

# A roadmap for financing hydrogen refueling networks – Creating prerequisites for H<sub>2</sub>-based mobility

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**Roland Berger**  
Strategy Consultants

A study for the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)  
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Roland Berger Strategy Consultants GmbH  
Mies-van-der-Rohe Straße 6  
80807 München

**Authors:**

Heiko Ammermann, Andre Martin, Caroline de Leeuw den Bouter,  
Christopher Schmitt

**Contact:**

Heiko Ammermann; [heiko.ammermann@rolandberger.com](mailto:heiko.ammermann@rolandberger.com)

## Table of Contents

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Introduction .....	5
<b>PART I: Key results and recommendations .....</b>	<b>8</b>
A. The business case for HRS rollout – a financing challenge .....	8
B. Options for involving public and private sector financiers in the HRS rollout .....	12
C. Devising an appropriate organizational setup and risk mitigation concept for the HRS rollout.....	16
D. Jump-starting the HRS rollout – Striking the right balance between governmental support and strategic investors' contribution.....	18
<b>PART II: Pathways to jump-start the HRS rollout.....</b>	<b>21</b>
E. Four pathways for jump-starting the HRS rollout in UK and Germany .....	21
F. What stakeholders need to do in the near future to secure medium- and long-term financing for the HRS rollout .....	43
G. Outlook and next steps – Advancing the discussion with European governments .....	45
<b>PART III: Detailed analysis .....</b>	<b>47</b>
H. Policy framework for the HRS rollout in the EU .....	47
I. Approach and methodology .....	49
J. Business case for the HRS rollout – Detailed analysis.....	58
K. Corporate finance or project finance? .....	66
L. Potential for minimizing project risks .....	71
M. Different types of financiers may be interested in financing the HRS rollout – Profiles of investors and lenders .....	82
N. Strategic perspectives and financing options for private-sector participation in financing the HRS rollout.....	90
Annex.....	100
Sources.....	102

## Table of Illustrations

---

<b>Fig. 1:</b> Main challenges of the HRS rollout business case.....	9
<b>Fig. 2:</b> FCEV ramp-up risk for the HRS rollout – Sensitivity analysis.....	9
<b>Fig. 3:</b> ADSCR analysis for the HRS rollout .....	11
<b>Fig. 4:</b> Options for involving public and private financiers in the HRS rollout.....	13
<b>Fig. 5:</b> Structure of an SPV for the HRS rollout .....	16
<b>Fig. 6:</b> Possible elements of an effective risk mitigation concept for the HRS rollout .....	17
<b>Fig. 7:</b> Roles of government and industry in the HRS rollout.....	20
<b>Fig. 8:</b> Roadmap for jump-starting the HRS rollout through a PFI .....	24
<b>Fig. 9:</b> Development of the availability payment over time (UK business case).....	26
<b>Fig. 10:</b> Organizational setup of the PFI for the HRS rollout reflecting risk absorption by strategic investors .....	27
<b>Fig. 11:</b> Roadmap for the HRS rollout supported by a loan with a conditionally repayable share from a public bank .....	30
<b>Fig. 12:</b> Example of a milestone plan for a loan with a conditionally repayable share .....	31
<b>Fig. 13:</b> Roadmap for the HRS rollout supported by the combined HRS / FCEV package.....	35
<b>Fig. 14:</b> Roadmap for the HRS rollout supported by a CAPEX grant combined with regulation .....	38
<b>Fig. 15:</b> Examples of milestones relating to the requirements of the CAPEX grant.....	38
<b>Fig. 16:</b> Effect of the four Pathways on the HRS rollout business case.....	41
<b>Fig. 17:</b> Comparing the Pathways from the government viewpoint – selected factors.....	42
<b>Fig. 18:</b> Government support schemes for renewable electricity generation .....	
<b>Fig. 19:</b> HRS and FCEV rollout in the UK and Germany .....	50
<b>Fig. 20:</b> Estimation of the initial HRS network required for Germany.....	51
<b>Fig. 21:</b> How the NPV assessment works .....	53
<b>Fig. 22:</b> Indicators most commonly used in bankability assessments.....	54
<b>Fig. 23:</b> Main drivers of the business case for the HRS rollout.....	58
<b>Fig. 24:</b> ADSCR analysis for the HRS rollout in UK and Germany .....	59
<b>Fig. 25:</b> NPV analysis for the HRS rollout (UK and Germany).....	61
<b>Fig. 26:</b> Overview of risks in the HRS rollout.....	62
<b>Fig. 27:</b> Sensitivity analyses .....	64
<b>Fig. 28:</b> Illustrative options for organizational setups of the HRS rollout.....	68
<b>Fig. 29:</b> Categories of mitigants and their effect on the bankability of the HRS rollout .....	72
<b>Fig. 30:</b> Requirements for risk mitigants in different project stages .....	73
<b>Fig. 31:</b> Evaluation of individual risk mitigants from the perspective of financiers .....	77
<b>Fig. 32:</b> Effectiveness of different types of risk mitigants for the HRS rollout and their impact on the availability of project finance.....	78
<b>Fig. 33:</b> Functioning of an H <sub>2</sub> purchase guarantee .....	79
<b>Fig. 34:</b> Different types of financiers' potential interest in financing the HRS rollout.....	83
<b>Fig. 35:</b> The strategic perspective influences the initial setup of the HRS rollout .....	90
<b>Fig. 36:</b> Strategic perspectives for the HRS rollout and possible financing options .....	92
<b>Fig. 37:</b> Financing options for the HRS rollout.....	93
<b>Fig. 38:</b> Conditions for accessing corporate finance for the HRS rollout .....	93
<b>Fig. 39:</b> Key project milestones for Financing Option 2 .....	95
<b>Fig. 40:</b> Key project milestones for Financing Option 3 .....	96
<b>Fig. 41:</b> Overview: EIB decision-making process on financing .....	97
<b>Fig. 42:</b> Evaluation of financing options for the HRS rollout .....	99

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# Introduction

## ► Objective of this study: Finding ways to involve private financiers in the creation of a hydrogen refueling infrastructure

Fuel cell electric vehicles (FCEVs) are zero tailpipe emission vehicles. Their large-scale deployment is expected to play a major role in the de-carbonization of transportation in the European Union (EU), and is therefore an important policy element at EU and Member State level (see Chapter III.G).

For FCEVs to be introduced to the market, a network of hydrogen refueling stations (HRS) first has to exist. From a technological point of view, FCEVs are ready for serial production already: Hyundai and Toyota plan to introduce FCEVs into key markets from 2015, and Daimler, Ford and Nissan plan to launch mass-market FCEVs in 2017.

At the moment, raising funds for building the hydrogen refueling infrastructure appears to be challenging. The business case is unattractive, which makes industry stakeholders hesitate to provide funds, and public and private financiers are reluctant to get involved. However, mobilizing private-sector financing for the rollout of the hydrogen refueling infrastructure – "the HRS rollout" – under market conditions is crucial, for a number of reasons:

- It enables investments from strategic investors and public funds to be leveraged
- It ensures that the HRS infrastructure is market-oriented, avoiding giving the impression that subsidies will be permanently required
- It proves the "bankability" of the HRS rollout in certain countries, and thus serves as a blueprint for a market-based rollout across the EU-28

This study explores options for financing the HRS rollout which facilitate the involvement of private lenders and investors. We present a number of different financing options, involving public-sector bank loans, funding from private-sector strategic equity investors, commercial bank loans, private equity, and funding from infrastructure investors. The options outline the various requirements for accessing these sources of funding with regard to project structure, incentives and risk mitigation. The financing options were developed on the basis of discussions with stakeholders in the HRS rollout from industry and with financiers.

## ► Starting the HRS rollout is critical – Public-sector support will be needed

The various financing options presented in this study are only possible if the HRS rollout is effectively "jump-started". Our analysis shows that the HRS rollout will not attract financing in the initial years due to its unattractive business case. Even strategic investors are not willing to fully absorb the project risks and financial losses of the first years of the project. As a result, financial support from governments will be needed to jump-start the HRS rollout.

Therefore, in this study we present four pathways for jump-starting the HRS rollout with the support of governments (see Part II). These pathways are intended as food for thought – a starting point for discussions between government and industry. They are not finalized approaches and they have not been discussed with industry stakeholders or policy officials or financiers within the framework of this study.

### ► Sponsor of the study

This study was sponsored by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a public/private partnership between the European Commission, the fuel cell and hydrogen industry and a number of research bodies. The FCH JU supports research, technological development and demonstration activities in the field of fuel cell and hydrogen energy technologies in Europe.

### ► Participants in the study

This study takes Germany and the UK as case studies, as the development of the FCEV market, driven by national coalitions, is the most advanced in these two countries. The study's Steering Committee, to which results were regularly presented, included representatives from FCH JU and from the national coalitions in Germany and the UK. The Stakeholders represented in the Steering Committees were:

From the UK coalition:

- The Office for Low Emission Vehicles of the UK Government
- Nissan
- Intelligent Energy
- ITM Power

From the German coalition:

- Daimler
- Shell
- Air Liquide
- Linde

The European Investment Bank (EIB) was involved in developing this study in its role as an advisor to the FCH JU. It participated in Steering Committee meetings and provided ongoing support to the authors of the study, serving as a sounding board for financing options. The EIB also provided advice on the use of joint financial instruments for the HRS rollout in Europe. However, it did not independently review or analyze the business case or financial data pertaining to the HRS rollout, and its support was provided on a non-committal basis.

The proposed funding structures and risk-sharing approaches for the HRS rollout developed in this study were discussed directly with stakeholders from the capital markets. These players acted as independent sparring partners to the authors of the study on a non-committal basis. Workshops were held with representatives of public and commercial banks, and of private financiers (private equity and infrastructure investors) including:

- Allianz Capital Partners GmbH
- Clean Infra Partners LLP
- IKB Deutsche Industriebank AG
- Infrastructure Development Partnership (IDP)
- Macquarie Capital (Europe) Limited

## ► Structure of the study

This study consists of three parts:

**Part I: Key results and recommendations** summarizes the main findings of the study on how to finance the HRS rollout. This part provides an overview of the challenges facing the business case for the HRS rollout (Chapter A), the three financing options identified for the rollout (Chapter B) and a sample organizational setup and risk mitigation concept (Chapter C). Finally, we identify the levers that governments can use to "jump-start" the HRS rollout. We show how governmental support should be provided at the start and progressively phased out over the course of the rollout (Chapter D)

**Part II: Pathways for jump-starting the HRS rollout** provides four concrete approaches for how to kick-start the HRS rollout through investment by strategic investors and government support in the UK and Germany (Chapter E). Chapter F outlines what stakeholders – including strategic investors and governments – should do in the near future to secure financing for the HRS rollout

**Part III: Detailed analysis** presents the results of the analysis that form the basis for Parts I and II of this study. Part III reviews the current policy framework for the HRS rollout in the EU (Chapter G), provides short explanations of the concepts used in the study (cash flow, NPV, ADSCR, project risks and risk assessment) and explains the chosen approach and methodology (Chapter H). It provides a detailed analysis of the business case for the HRS rollout (Chapter I). Chapter J describes the impact of the choice of corporate or project finance on risk allocation and the financing of the HRS rollout. Chapter K outlines how to build an effective risk mitigation concept, including an evaluation by financiers of different factors mitigating risk ("mitigants"). Chapter L provides an overview of the different types of potential financiers for the HRS rollout and what requirements the project would have to meet in order to access these sources of financing. Finally, Chapter M gives more detail on the three financing options identified for the HRS rollout summarized in Part I, Chapter B.

# PART I:

## Key results and recommendations

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### A. The business case for HRS rollout – a financing challenge

#### ► **Establishing an initial H<sub>2</sub> refueling network – A fundamental precondition for the market introduction of FCEVs**

According to plans, the market rollout of fuel cell electric vehicles (FCEVs) will begin in 2015: Hyundai and Toyota plan to introduce FCEVs into key markets from 2015, and Daimler, Ford and Nissan plan to launch mass-market FCEVs in 2017. From a policy point of view, large-scale deployment of FCEVs is expected to play a major role in the decarbonization of transport. For this reason, it is supported by policy makers at EU level and in various Member States.

The successful market introduction of FCEVs is entirely contingent upon the availability of a sufficient refueling network. A hydrogen refueling station (HRS) network that provides enough refueling opportunities to make FCEVs interesting to potential buyers needs to be established just before the introduction of FCEVs.

#### ► **The HRS rollout is a difficult business case for investors**

From a commercial perspective, the HRS rollout business case faces four key challenges:

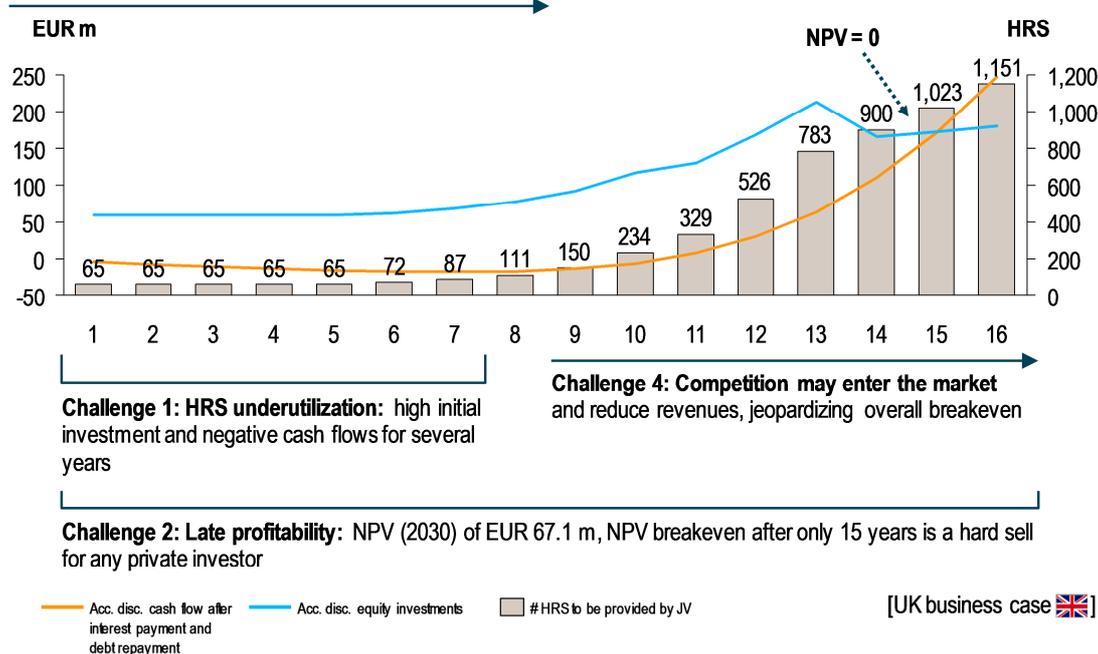
**Challenge 1: High initial investment needs and underutilization** – An HRS network with reasonable geographical coverage<sup>1</sup> needs to be available when FCEVs are launched on the market to make FCEVs interesting for potential buyers. The number of FCEVs on the road will increase only gradually. As a consequence, the initial HRS network will be underutilized in the first years. This means high initial investments combined with negative operating cash flows in the first years of the project.

**Challenge 2: Late NPV breakeven** – Developing a commercial scale market for FCEVs will take several years and revenues will only start to grow when vehicle sales pick up. As a result, the HRS rollout is expected to reach profitability late. For the UK, we estimated an NPV breakeven point after 15 years.

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<sup>1</sup> See **Part III.H Approach and Methodology** for derivation and calculation of initial area-covering HRS network

**Challenge 3: High FCEV ramp-up risk:** Revenues depend on FCEV uptake, not controllable within the project



**Fig. 1:** Main challenges of the HRS rollout business case<sup>2</sup>

**Challenge 3: FCEV ramp-up risk** – The HRS rollout is subject to a significant market risk, the FCEV ramp-up risk. This risk will be realized if FCEV sales are lower than expected or the market introduction of FCEVs is delayed. If the number of FCEVs on the road falls below the projections in the ramp-up plan, H<sub>2</sub> sales and the resulting revenues for the HRS rollout JV will be affected. This risk is particularly challenging as the infrastructure investor and / or operator can do nothing about it. Vehicle manufacturers and the public sector exert the greatest impact on the number of FCEVs on the road. The FCEV ramp-up risk decreases in significance over the period of the HRS rollout.

<b>RISK:</b>	<b>Variation</b>	<b>NPV [EUR m]</b>	<b>ADSCR at start of Bankable Phase</b>
FCEV sales lower than expected – insufficient H <sub>2</sub> demand	Baseline: 1.59 m FCEVs in 2030	+67.1	6.51
	-15%: 1.35 m FCEVs in 2030	+13.7	5.43
<b>&amp;</b> Delayed FCEV rollout – H <sub>2</sub> demand grows more slowly than forecast	-30%: 1.11 m FCEVs in 2030	-40.0	4.35
	-1 year: 1.26 m FCEVs in 2030	-36.5	4.76
	-3 years: 0.69 m FCEVs in 2030	-192.9	1.03

**Fig. 2:** FCEV ramp-up risk for the HRS rollout – Sensitivity analysis<sup>3</sup>

<sup>2</sup> These challenges apply equally to the German business case. See **Part III.H** for an explanation of the figure (NPV analysis) and **Part III.I** for details of the underlying analysis

<sup>3</sup> Similar findings apply to the German business case. See **Part III.I** for a detailed risk analysis of the HRS rollout

**Challenge 4: Competition in the late rollout phase** – Once there are enough FCEVs on the road to ensure the profitability of HRS, competitors are likely to enter the market and capture part of the revenues from H<sub>2</sub> sales. This may lower the project's revenues and jeopardize the overall breakeven point. The impact will be the same if the competition reduces the H<sub>2</sub> sales margin.

These four key challenges make creating the necessary infrastructure a critical issue in the discussion about the market introduction of FCEVs.

► **The HRS rollout will not be bankable in the initial years – Debt may become available gradually**

During the preparation of the study, it has become clear that no single industry player is willing to absorb the risks and losses associated with the project in the early years and that third party financing is seen as a potential solution.

Private sector financiers are, however, unwilling to absorb the project's risks and losses in the early years based on the business case as it stands. Private sector financiers would require that strategic investors or the state absorb losses and the main project risks. They would also require that the HRS rollout generates sufficient operating cash flows to service debt and make interest payments or an attractive return on investment on a guaranteed, or at least reasonably secure level.

Public or development banks may be in a position to assume a larger share of risk, but they too are unable to absorb losses of the initial years and the main project risks.

A rough bankability analysis focusing on the development of the Annual Debt Service Coverage Ratio (ADSCR) and project risks shows that the HRS rollout can be split into three phases:

- **Pre-bankable Phase (Phase 1):** Cash flows from operating the HRS network are too low to meet the debt service obligations. The development of H<sub>2</sub> revenues is still very insecure, as mass-market deployment of FCEVs has only just begun. Financing from public and private lenders is not available for the HRS rollout in this phase
- **Transition Phase (Phase 2):** H<sub>2</sub> sales generate sufficient positive operating cash flows to allow for debt repayments and interest payments. However, the project is still subject to a significant market risk – the FCEV market and associated H<sub>2</sub> demand is still developing. Financing by private lenders is still unavailable. However, this phase could see the start of partial debt financing through public bank facilities with a capacity to absorb higher risks
- **Bankable Phase (Phase 3):** Basic H<sub>2</sub> demand is established and utilization of HRS is high enough to generate sufficient operating cash flows for servicing debt, including a buffer. The H<sub>2</sub> demand risk is still present, but to a much lower extent. A sufficiently large FCEV stock is on the road for H<sub>2</sub> sales to be a straight forward retail business. Commercial bank debt becomes available in this phase

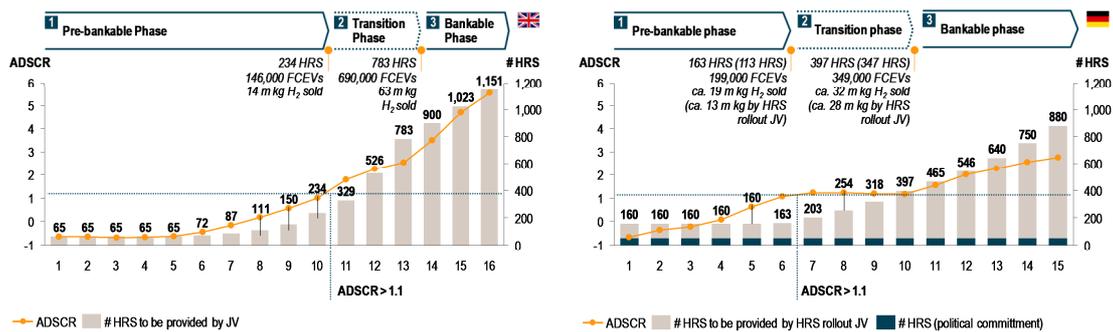


Fig. 3: ADSCR analysis for the HRS rollout<sup>4</sup>

## BOX 1: Potential types of investors in the HRS rollout

### Strategic investors

Strategic investors are industry stakeholders who need a successful HRS rollout in order to bring their core business products to the market. As building the infrastructure has significant strategic value for their core business activities, they are expected to provide financing for the HRS rollout not only for its potential short-term returns, but also for its strategic value and long term portfolio benefits. They can be expected to provide financing for the project right from the start. Strategic investors include:

- Car manufacturers aiming to bring FCEVs to the market
- Refueling station operators (mostly oil and gas companies) seeking to carry their business model into the future
- HRS suppliers aiming to move beyond customized/small batch HRS production
- H<sub>2</sub> suppliers seeking to support the establishment of the H<sub>2</sub> market

### Private sector financiers

Private sector financiers may provide financing in the later stages of the project. The timing of their involvement in the HRS rollout and the role they play in providing financing varies significantly, depending on their business model, risk appetite and investment horizon. Private sector financiers include:

- Commercial banks
- Private equity investors
- Infrastructure funds

### Public/development banks

Public banks (e.g. the European Investment Bank or Germany's KfW) can provide financing for the HRS rollout provided that the project complies with their mandate and lending objectives, which reflect certain policy priorities. Depending on the specific instrument in question, they may have a higher risk appetite than commercial banks and funding could become available in earlier project stages of the HRS rollout than funding from commercial banks.

<sup>4</sup> See **Chapter III.H** for an explanation of the figure and **Chapter III.I** for details of the analysis

## B. Options for involving public and private sector financiers in the HRS rollout

### ► **Financiers will not absorb the main project risks**

To explore different options for financing the HRS rollout, we held workshops with different types of financiers. They included:

- Public / development banks
- Commercial banks
- Private equity investors
- Infrastructure investors

All four types of investors drew attention to a key precondition for them funding the HRS rollout: main project risks, especially the FCEV ramp-up risk, would have to be fully controlled or absorbed by other stakeholders, i.e. strategic investors or the state. The underlying reason for this is that none of these financiers, including public / development banks, can include a fundamental risk in a financing agreement, where the debtor has no leverage over the risk – and, in case of the HRS rollout, the HRS network operator is not in a position to control the number of FCEVs on the roads.

The financing options presented below therefore depend on the successful mitigation or absorption of the main project risks by strategic investors and / or governments.

### ► **Three basic options for involving financiers in the HRS rollout**

The following options for involving financiers in the HRS rollout are based on the business case presented in Chapter I.B and do not assume any public sector support.

The involvement of the EIB is included in every financing option for the HRS rollout. In general, it can be very helpful for the HRS rollout joint venture to initiate a dialogue with the EIB early on to obtain a commitment for funding based on certain conditions. While working on the conditions, the consortium can use the conditional commitment from the EIB to show that the basic financials have been checked and approved through an EIB due diligence process.

Three basic options exist for the involvement of private financiers (see Chapter III.M for details of financing options):

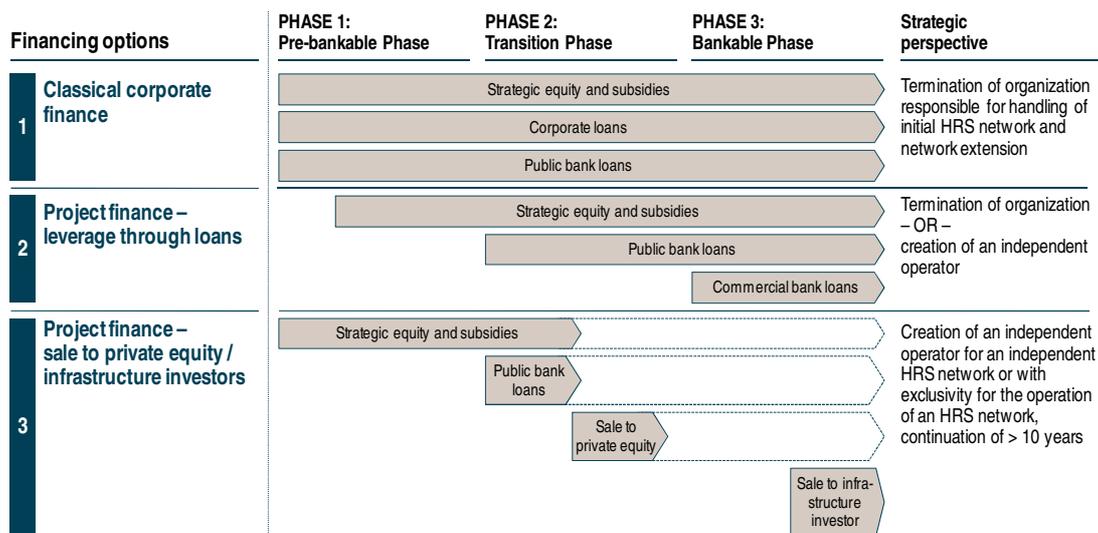


Fig. 4: Options for involving public and private financiers in the HRS rollout

### ► Option 1: Classical corporate finance

In option 1, each strategic investor finances a number of HRS. They finance the HRS in the same way as they would any other investment through a mix of equity and loans. The loans are secured via the assets and cash flows of strategic investors' balance sheets, so leverage can in principle be achieved from the start of the project, i.e. in Phase 1.

To access corporate finance, strategic investors need to offer sufficient security via their balance sheets. To what extent their equity can be leveraged depends on the individual creditworthiness and their preferences with regard to leveraging their business.

Loans from commercial banks can be complemented with loans from public and development banks, which may be available at favorable conditions (reduced rates of interest, long maturity) if the HRS rollout corresponds to the policy objectives of banks' programs (e.g. the EIB's RSFF, see **Box 5** or the KfW's "Umweltprogramm", see **Box 6**).

This financing setup is likely to require some form of coordination between the different stakeholders that participate in the roll-out (see Chapter III. J for more details). In the long term, the organizational structure created to coordinate the installation and operation of the initial HRS network between different strategic investors is shut down and the assets sold or integrated into the strategic investors' businesses.

### ► Option 2: Project finance – Leverage via loans

In option 2, strategic equity investors form a consortium and set up an SPV responsible for handling the HRS rollout. They seek financing on a project finance basis.

In Phase 1, the HRS rollout has to rely on strategic equity and potentially public sector support.

In Phase 2, the project's cash flows are just sufficient for debt repayment and interest payments, but the risk level is still high. Debt financing from certain public / development banks (e.g. the EIB's RSFF, see **Box 5**) becomes available. Main conditions to access debt financing in this phase include that the SPV and the HRS network have been operating smoothly for over three years, that the initial H<sub>2</sub> demand is established, that an effective risk mitigation concept is in place and the

existence of a solid business plan for further HRS network extension, as well as – of course – the successful undergoing of the EIB's due diligence and approval by its governing bodies.

In Phase 3, the SPV can access loans from commercial banks. Additional loan instruments from public banks (e.g. the KfW's "Umweltprogramm", see **Box 6**) also become available. Main conditions to access loans include that the H<sub>2</sub> demand corresponding to this phase is established, that a solid risk mitigation concept is in place, and that the SPV can provide a solid business plan for further network extension, all verified and approved through a satisfactory due diligence.

Option 2 leaves the long-term strategic perspective for the HRS network operator open. The SPV could be shut down, or alternatively it could be established as an independent operator of the HRS network.

### ► **Option 3: Project finance – Sale to private equity / infrastructure investors**

In option 3, strategic equity investors form a consortium to set up an SPV responsible for the HRS rollout. In Phase 1, the HRS rollout has to rely on strategic equity and potentially public sector support.

In Phase 2, the SPV may access financing from public banks (see Option 2 for conditions). Toward the end of Phase 2, a private equity investor may be interested in financing the HRS rollout. For this purpose, the HRS rollout should offer a growth story, in other words the prospect of a significant increase in the SPV's revenues. Elements of a growth story could include, for example, an exclusivity agreement with large refueling network operators or contracts with large fleet operators, combined with upcoming regulation stipulating that fleets must contain a certain share of zero-emission vehicles.

In Phase 3, an infrastructure investor may be interested in purchasing the HRS rollout SPV. Infrastructure investors would seek to operate the HRS rollout SPV after purchase for typically ten years or more. During this period, the SPV would be operated within the same strategic framework and would have to yield secure, if not guaranteed, returns. Secure returns could be achieved via long term contracts with large fleet operators including a minimum H<sub>2</sub> off-take, for example, or via exclusivity with refueling network operators for operating their HRS.

### ► **Evaluation of options**

All three financing options are viable alternatives for the HRS rollout. Option 2 (project finance – leverage through loans) is the preferred option to aim for at the start of the HRS rollout for three reasons:

- It does not require any decision about the project's long-term strategic perspective (creation of an independent HRS operator or shutting down of the SPV) at the outset: It can be started with a "coalition of the willing" and then developed over time
- It creates an entity that can control the HRS rollout and align it with the vehicle rollout. It is also more independent of individual shareholder interests and avoids a situation of permanent negotiation with various independent stakeholders that, in an extreme case, each own and operate a couple of HRS
- It creates a legal structure that can receive benefits in the early years, can enter into loan agreements in Phases 1 and 2 and potentially can collect returns in Phase 3, rewarding the shareholders that set it up. It also creates a legal counterpart for the government to commit to milestones in return for funding

If financing option 2 is pursued by the HRS rollout SPV, it may still be possible to decide to involve private equity and infrastructure investors (financing option 3) in the medium term. It will, however, be more challenging to create the conditions for the involvement of these investors at that stage than from the outset of the HRS rollout.

► **Involving public and private financiers is only possible if the Pre-bankable Phase is successfully managed**

Successfully managing the Pre-bankable Phase will require joint action by governments and strategic investors. These are the only parties that are in a position to resolve the fundamental risk of the FCEV market developing too slowly and deal with the inherent first-mover disadvantage. Vehicle manufacturers are in a position to mitigate the FCEV ramp-up risk, but governments can overcome the current stalemate in strategic investors' discussions by jump-starting the roll-out and creating a first-mover advantage.

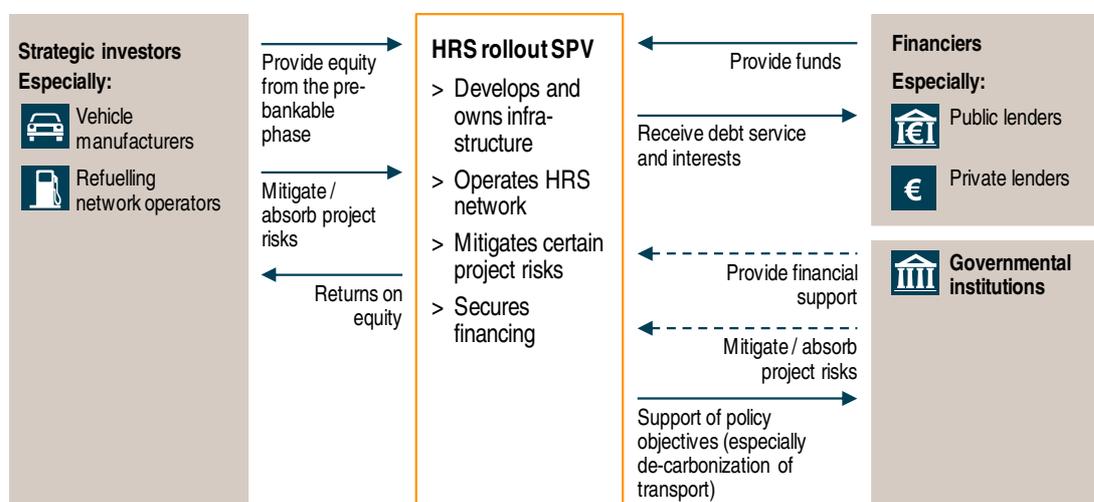
## C. Devising an appropriate organizational setup and risk mitigation concept for the HRS rollout

### ► A legally independent entity to steer the HRS rollout

The HRS rollout should be steered by a legally independent entity, that is to say a "special purpose vehicle" or SPV. Creating an SPV facilitates coordination of the HRS rollout and the contractual relationships comparatively independently of the interests of individual strategic investors. It also opens up more financing options and makes an exit easier for strategic investors (see also Chapter III.J).

Strategic investors are expected to provide equity from the start of the project and to mitigate and absorb the project risks. Vehicle manufacturers and refueling network operators should ideally be among the sponsors of the project, as they are best positioned to address the FCEV ramp-up risk and ensure access to refueling stations. Suppliers of HRS, providers of HRS maintenance and H<sub>2</sub> suppliers are also important partners in the HRS rollout, especially with regard to developing the HRS in a price segment that supports its further extension. However, these stakeholders do not necessarily need to be involved in the HRS rollout as shareholders. For example, they could be involved in the framework of a development partnership.

Financial support and risk mitigation/absorption can also potentially be provided by the public sector (see Chapter I.D).



**Fig. 5:** Structure of an SPV for the HRS rollout

The SPV for the HRS rollout should leverage funds through project finance, especially from public and private lenders (Financing Option 2, Leverage through loans – see Chapters I.B and III.M).

► **Risk mitigation concept for the SPV for the HRS rollout**

If an SPV is set up and funds are leveraged via project finance, the project risks will be automatically concentrated in the SPV and not absorbed via the assets and cash flows of the project's strategic equity investors. Therefore, a comprehensive risk mitigation concept needs to be established to control these risks and, where appropriate, reallocate them to the parties that are best positioned to address them – including the SPV, its shareholders and the state.

Figure 6 presents a possible risk mitigation concept for the SPV for the HRS rollout. This concept covers the project risks of the HRS rollout and draws mostly on those risk mitigants that were evaluated by financiers as the most effective (see Chapter III.K). The mitigants allocate project risks to the parties best positioned to address them.

What are the risks?	Who is responsible?	What needs to be done?
1 <b>FCEV ramp-up too low/delayed</b> <b>MAIN PROJECT RISK</b>	  	<ul style="list-style-type: none"> <li>&gt; Contracts with fleet operators incl. min. H<sub>2</sub> offtake</li> <li>&gt; Pre-purchase of H<sub>2</sub>/ contingent equity for H<sub>2</sub> sales forecast not covered by fleet offtake</li> <li>&gt; Regulation supporting FCEVs in fleets</li> </ul>
2 <b>HRS deployment delayed</b>		> Commitment from refuelling station operator to offer H <sub>2</sub> at stations corresponding to initial network
3 <b>Change in H<sub>2</sub> taxation</b>		> National law setting preferential H <sub>2</sub> taxation
4 <b>Cost of HRS above forecast</b>		> HRS purchase tendered, price and cost development fixed incl. incentives for further price reductions
5 <b>H<sub>2</sub> price lower than forecast</b>	  + other strategic investors	> Contingent equity
6 <b>OPEX exceed forecast</b>		> Fixed price maintenance agreements
7 <b>Cost to run the project exceeds forecast</b>		> Third party validation of planning

Legend:  Vehicle manufacturer     Refuelling network operator     Governmental institutions

**Fig. 6:** Possible elements of an effective risk mitigation concept for the HRS rollout

## D. Jump-starting the HRS rollout – Striking the right balance between governmental support and strategic investors' contribution

### ► Governmental funding has an important part to play

In the long run, the aim is for hydrogen refueling to become a competitive retail market, and the installation and operation of HRS to be purely driven by the private sector. It is therefore crucial that the HRS rollout is shaped by industry, or has strong industry involvement, from the outset.

In recent years, industry coalitions involving various stakeholders in the value chain of the HRS network – vehicle and HRS manufacturers, HRS maintenance providers, H<sub>2</sub> producers, fuel retailers – have been working on concepts to build and operate the HRS infrastructure. However, there has been little visible progress. Several reasons exist for this:

- The business case for the HRS rollout contains major challenges for private investors, including strategic investors (see Part I.A). The HRS rollout thus has a potential first-mover disadvantage
- Due to the variety of interests and the reluctance of stakeholders to be the first to make financial commitments – i.e. before other potential strategic investors have made their commitments – coordination between stakeholders turns out to be complex and time consuming

As a consequence, government funding has an important part to play. Support from governments will be needed to jump-start the HRS rollout by improving the HRS rollout business case and to overcome negotiating stalemates between strategic investors. Government support is well justified, as the HRS rollout complies with strategic policy targets and the initial HRS network can be seen as essential infrastructure that will lead to broader benefits, e.g. the reduction of tail pipe emissions of vehicles.

### ► Governments can create a first-mover advantage

Strategic investors are expected to be the main investors in the HRS rollout SPV, becoming involved in the project as early as the Pre-bankable Phase. Their main motivation will be to lay the foundations for their later business. However, it will be easier to get strategic investors to commit if the business case promises a good return on investment if everything goes as planned. Such conditions can be created by governments.

Governments should combine five levers:

- Create a first-mover advantage: Governments can give first movers a financial advantage over players who only enter the market when the HRS network is already profitable. For example, the government can limit access to financial support to first movers. This financial support should slightly exceed any losses generated in the initial years that are not expected to be recovered later on when the HRS network is profitable
- Encourage swift action by setting a limited time period during which the first-mover advantage is available: Governments can create a tender for a concession that forces industry stakeholders to align and submit a concrete proposal (e.g. setup of the consortium, roles within the consortium, a tested business case, pricing)

- Help to mitigate the FCEV ramp-up risk: Governments can provide regulations and incentives that stimulate the market uptake of FCEVs (e.g. a regulation requiring a minimum share of zero-emission vehicles in large fleets and accompanying incentives to support market pick-up)
- Help push down financing costs: Governments can issue guarantees for public bank loans or make public bank products available
- Increase the strategic value of the HRS rollout: Regulations can make the need for the HRS network more urgent from the point of view of strategic investors. For example, implementing the EU "Cars regulation"<sup>5</sup>, which sets a limit for the CO<sub>2</sub> emissions of vehicle manufacturers' fleets (currently being amended), significantly increases the strategic value of the HRS rollout for vehicle manufacturers. To avoid funding a permanently underutilized infrastructure, HRS rollout has to be in line with FCEV rollout plans by car makers. The timeline for the HRS rollout should be adapted based on the amended "Cars regulation" to reflect CO<sub>2</sub> regulation-induced pressure on car manufacturers and a realistic reflection of their plans for FCEV market introduction

The right balance of those levers is a matter of decision-taking by governments, and of negotiations between governments and industry.

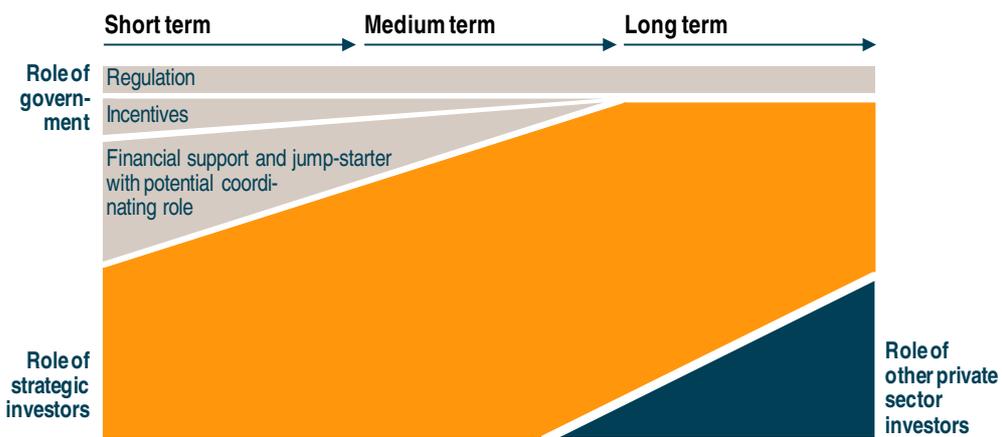
#### ► **Limit government support to the initial build-up of infrastructure**

In the long run, the HRS network is expected to be a profitable business. While strategic investors are expected to be the main investors and operators of the initial HRS network, competition may enter the market in the medium and long term. H<sub>2</sub> sales will be a competitive retail market.

The role of governments should be reduced progressively after successfully jump-starting the HRS rollout. In the short and medium terms, governments may have to provide financial support for the HRS rollout and take the role of a jump-starter with a potential coordinating role. Incentives (e.g. tax benefits, financial premium for FCEV purchase) can be used to push the initial market pick-up of FCEVs. Regulation (e.g. requirement of a minimum share of zero-emission vehicles in fleets) can continue to play a role and support further market penetration of zero-emission vehicles in the long term.

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<sup>5</sup> The "Cars Regulation" (EC No 443/2009) aims to achieve a fleet average of 95g CO<sub>2</sub> / 100 km by all new cars. The regulation is currently being amended. On 29 November 2013, the Permanent Representatives Committee of the Council of the EU reached an agreement with the European Parliament, and the regulation is expected to be adopted in 2014. See also: Council of the European Union, Informal agreement on car CO<sub>2</sub> emissions reduction, 29 November 2013, [http://www.consilium.europa.eu/uedocs/cms\\_data/docs/pressdata/en/envir/139786.pdf](http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/envir/139786.pdf)



**Fig. 7:** Roles of government and industry in the HRS rollout

# PART II:

## Pathways to jump-start the HRS rollout

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### E. Four pathways for jump-starting the HRS rollout in UK and Germany

#### ► Governments and strategic investors should jump-start the HRS rollout

In Part II, we suggest four approaches involving governments and strategic investors tackling the Pre-bankable Phase and absorbing main project risks, especially the FCEV ramp-up risk.

While the financing options outlined above are based on the results of workshops with financiers and have been discussed with industry stakeholders at the Steering Committee meetings, the pathways described below were developed by our team and have not been discussed with financiers and industry stakeholders.

As a result, they are intended purely as food for thought, the starting-point for a discussion between government and industry in the specific political and economic environment of Germany and the UK.

#### ► Four pathways for financing the HRS rollout

We have designed four concrete pathways for financing the HRS rollout. They draw on instruments of public-sector support that have been tried and tested in the UK and Germany. These instruments can be quickly adapted to the HRS rollout. Public-sector stakeholders also already have experience with regard to success factors when using these instruments.

The four pathways are as follows:

**Pathway 1 – Private financing initiative (PFI):** A PFI establishes a legal structure and commercial framework that can create a first-mover advantage for those who take responsibility for setting up the initial HRS network. The government provides payments for making the infrastructure available, thus facilitating access to debt financing and covering the initial losses relating to underutilization. The concession-holder takes on the risk of not complying with the agreed HRS rollout and the market development upside/downside (above or below expectations). By starting the tender on a PFI concession the government can kick-start the HRS rollout process and motivate the alignment of private stakeholders.

**Pathway 2 – Loan with a conditionally repayable share:** The government provides a guarantee for a loan covering part of the CAPEX for the construction and expansion of the initial HRS network. At the same time, the government and strategic investors in the HRS rollout agree on conditions that will influence market success. These conditions are reflected in a detailed milestone plan. The milestone plan includes commitments from strategic investors on the HRS network installation schedule and quality, as well as an FCEV market introduction schedule. Meeting these milestones is necessary in order to realize two key benefits of the loan program:

First, the disbursement of the different loan tranches in the course of the rollout is contingent upon the strategic investors complying with the milestone plan. If private investors fail to meet their commitments, then loan tranches may be reduced or not disbursed at all. Strategic investors responsible for failing to meet the milestones would have to provide contingent equity to cover the resulting costs.

Second, the loan program includes an advance, which does not have to be repaid if H<sub>2</sub> sales are not sufficient to cover debt repayment and interest payments. In this case, the government covers the debt service for the public bank, that issued the loan. However, this potential debt relief applies only if H<sub>2</sub> sales are below forecast and the SPV met all of the milestones. If milestones have not been fulfilled, the SPV's shareholders have to cover debt repayment and interest payments to the public bank with contingent equity.

**Pathway 3 – Combined HRS / FCEV package:** The government provides grants to support market introduction of FCEVs by car manufacturers targeting commercial user fleets with very high annual mileage. To be eligible for the grants, applicants have to ensure that an HRS is installed and operated at or nearby the site of the fleet, potentially also open for other users. Targeting commercial fleets supports both FCEV market introduction and a good HRS utilization from the start. Launching the tender process allows the government to kick-start the commercial-scale development of FCEVs and of HRS, and at the same time introduce zero-emission vehicles into previously unreachable car segments.

**Pathway 4 – CAPEX grant:** Government funds are provided as a one-time payment for installing the initial HRS network. This reduces the investment requirement from private stakeholders. The grant can be made conditional on meeting a milestone plan for the HRS rollout.

All four proposals include a number of elements that our detailed analysis shows to be essential:

- An industry consortium forms a legally independent entity – i.e. the special purpose vehicle, SPV – with the sole purpose of building and operating the HRS network (see Chapter I.C and Chapter III.J)
- Car manufacturers participate in the HRS rollout and hold a large part of equity shares of the SPV. Car manufacturers are reluctant to invest in the HRS rollout, because it is not part of their core business. However, they are the only stakeholder in a position to address the FCEV ramp-up risk and they play a vital role in making the HRS rollout commercially viable. Therefore financiers insist on the participation of car manufacturers in the HRS rollout as a condition to provide financing. If equity from car manufacturers is not available, or if their equity covers only a small share of the SPV in comparison to the FCEV ramp-up risk, other stakeholders have to provide the equity that can absorb losses in case of a delayed market pick-up of FCEVs. Agreements with car manufacturers that commit a certain number of FCEVs on the street could be used to mitigate this risk
- The SPV seeks to leverage funds on the basis of project finance (see Chapter I.B and Chapter III.J).

- Strategic investors focus on establishing an open H<sub>2</sub> refueling market. It is not decided in advance what will happen with the SPV when a functioning H<sub>2</sub> refueling market has been created: The decision is taken by strategic investors depending upon how the HRS rollout develops (see Chapter III.M)
- As project finance and an open long-term strategic perspective have been chosen, the best option for the SPV for the HRS rollout is to leverage funds via loans from public and commercial banks (see Chapter I.B and Chapter III.M)
- The SPV for the HRS rollout has the perspective to access lending under the Risk Sharing Finance Facility (RSFF) of the EIB (see **Box 5**). This financing can become available for the HRS rollout before financing from commercial banks, after a satisfactory due diligence and approval by the EIB's governing bodies. When preparing for the required due diligence with EIB to apply for RSFF funding, the SPV benefits from the support from the EIB Research Development & Innovation (RDI) Advisory team
- The public sector introduces regulations supporting the development of FCEVs and the HRS rollout. For example, such regulations could promote the introduction of zero-emission vehicles in large corporate fleets. Additionally, governments can create financial incentives to support the HRS rollout and spur FCEV market pick-up (see Chapter III.K)

The proposals differ with regard to the level of public-sector support assumed. Strong involvement by government in the HRS rollout, including financial, regulatory and coordination support, is expected to have a positive impact on access to financing. Depending on the level of government engagement, the duration of the Pre-bankable and Transition Phases of the financing of the HRS rollout can be significantly reduced.

Below, unless otherwise stated, business case calculations are based on the assumptions presented in **Chapters III.H and I** and summarized in the **Annex**.

### ► **Pathway 1: Private financing initiative created by the government to jump-start the HRS rollout**

#### **PFI as a "jump-starter" for the HRS rollout**

A private financing initiative (PFI) is typically used to raise private capital for infrastructure projects and to increase the efficiency and service level of construction, maintenance and operation through private-sector involvement. PFIs are a well-established tool for infrastructure provision and public procurement in the UK and are frequently used in transportation and healthcare infrastructure projects, for example.

The government can use the PFI as a tool to jump-start the HRS rollout and serve as a contractual and organizational framework for risk-sharing between itself and strategic investors. While the approach is based on the typical setup of a PFI, some of its aspects are adapted to conform to the specific requirements of the HRS rollout:

- The SPV absorbs a substantial share of the market risk. Public payments are reduced over time
- After the first few years of the HRS rollout, the stations operated under the scheme may and should co-exist with competition from new entries
- The assets are not transferred to the government at the end of the concession period, but remain with the SPV

In this approach, the disbursement of public funds is certain and funds have to be set aside in the budget, as availability payments must be made to the SPV from Day 1 of the rollout. These funds are intended to provide the H<sub>2</sub> refueling infrastructure at an agreed-upon service level, regardless of the level of use.

### Roadmap for jump-starting the HRS rollout through a PFI

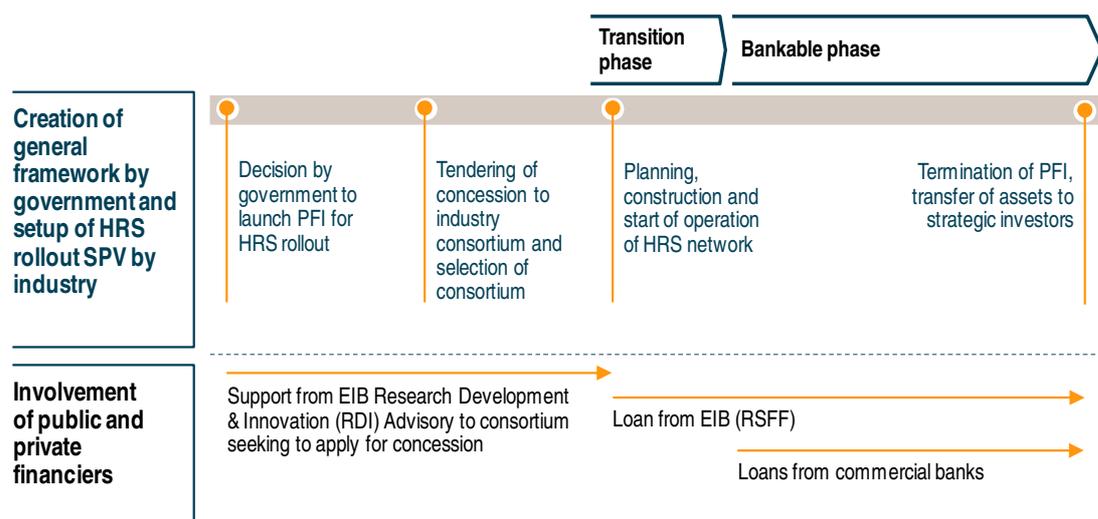
The PFI approach could be applied in the UK as well as in Germany. Given the important role of PFIs in public infrastructure procurement in the UK in recent years, the business case for the UK is used as an example to illustrate the mechanics of the PFI for the HRS rollout.

In this approach, the government tenders a concession for planning, financing, building, maintaining and operating the initial HRS network (65 HRS in the UK). The government provides annual availability payments for provision of the HRS over the entire concession period, contingent upon the timely installation and effective operation of the HRS network. The duration of the concession is 16 years.

Subsequent installation of additional HRS to expand the initial network takes place on a purely market-driven basis, either through the SPV or through new competitors entering the market, or a combination of both. There is no financial support or involvement from government beyond the availability payment for the initial network. This creates a strong first-mover advantage. Strategic investors apply for the concession and establish an SPV to install and operate the network.

The SPV for the HRS rollout seeks to leverage funds using project finance. Based upon the availability payments guaranteed under certain conditions by the government, the SPV can skip the Pre-bankable Phase. The SPV could examine the possibility to access a loan under the EIB's RSFF. The SPV may access additional loans from commercial lenders at later stages, as the project becomes bankable.

After 16 years, the concession period ends and the SPV is closed down. The HRS network's assets are handed over to the strategic investors.



**Fig. 8:** Roadmap for jump-starting the HRS rollout through a PFI

## Creating a first-mover advantage for strategic investors

The purpose of the PFI is to trigger investment and kick-start the HRS rollout by creating a first-mover advantage for the SPV. It does this by guaranteeing availability payments during the concession period. The availability payments must meet two key requirements:

- They must facilitate leverage through access to debt financing from Day 1
- They must address the issue of underutilization in the initial years of the HRS rollout and compensate equity investors for the resulting losses during this phase

While the amount of availability payments is usually set through a competitive tender procedure, it makes sense to assess the dimension of costs that have to be covered by those payments in order to create a first-mover advantage. The results of this assessment reveal that two components have to be covered by the availability payments:

- **Debt service component:** Debt financing for the SPV from public and commercial lenders requires predictable, secure revenues that can be used for debt service (interest payments and debt repayment). The PFI scheme therefore provides contractually guaranteed availability payments that cover debt service over the entire concession period. The payments are designed to meet debt service obligations for a loan covering 50% of the CAPEX investment required to build the initial HRS network. The remaining 50% of the CAPEX for the initial HRS network must be financed through equity from strategic investors. The amount of the availability payment for debt service is gradually reduced over the course of the project, as the burden from debt service decreases over time
- **Underutilization buffer component:** In the existing FCEV rollout scenario, the HRS network will be underutilized in the first five years of the rollout in the UK. In this phase, the HRS network generates negative cash flows from operations, as the projected revenues from H<sub>2</sub> sales are insufficient to cover the costs of running the HRS. To address this challenge, which is inherent to the business case, the availability payments in this phase not only cover debt service but also cover the inevitable gap in cash flows resulting from underutilization even when FCEV sales are fully in line with the FCEV ramp-up plan. Starting from Year 6, which is when the FCEV ramp-up plan foresees sufficient FCEVs to cover operating costs, the underutilization buffer is reduced to zero and the availability payments only cover debt service, as described above. The availability payment thus absorbs the losses from underutilization that will be incurred inevitably in the initial years in line with the FCEV ramp-up plan. If, however, the actual FCEV ramp-up falls short of the level foreseen in the ramp-up plan, the resulting losses are borne exclusively by strategic investors (through equity)

To summarize, the PFI scheme creates a considerable first-mover advantage by absorbing the initial losses from underutilization and covering 50% of the CAPEX associated with the installation of the initial network by means of annual availability payments.

## Estimating the required availability payments

Based on our preliminary business case computations for the UK, the required availability payment each year begins at around EUR 7.9 m in the first year of the rollout, comprising EUR 3.9 m for debt service and EUR 4.0 m for absorbing negative cash flows from operations due to underutilization.

As the number of FCEVs foreseen in the ramp-up plan increases, the underutilization buffer component is gradually reduced to EUR 0.5 m in Year 5, and completely eliminated in Year 6. Starting from Year 6, the availability payments to the SPV consist of just the debt service

component. Availability payments decrease over time to approximately EUR 2.0 m in the last year of the HRS rollout concession period, reflecting the gradual decrease in interest payments as the outstanding debt is reduced year by year.

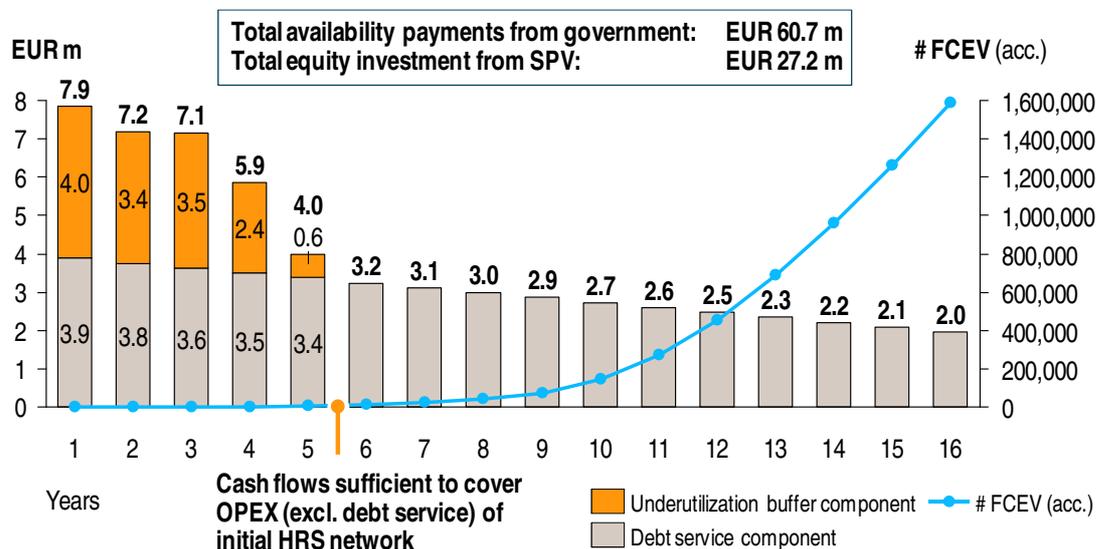


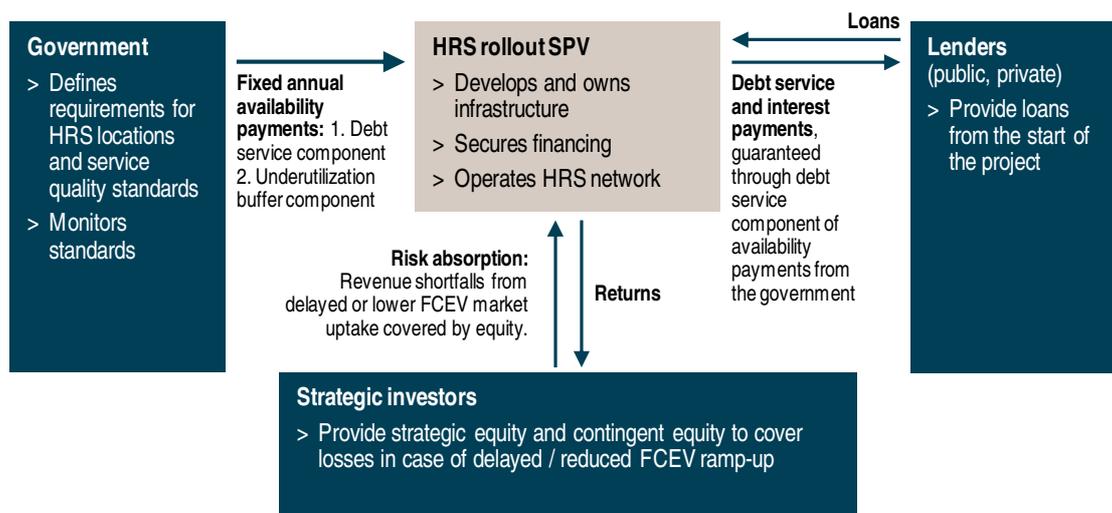
Fig. 9: Development of the availability payment over time (UK business case)

### Risk mitigation

Tendering a PFI allows the government to allocate risks to those strategic investors who are best positioned to address them.

The FCEV ramp-up risk is effectively transferred to the SPV. Revenue shortfalls from delayed or lower-than-expected FCEV market uptake translate into losses for the strategic investors, which have to be covered by equity. Since the SPV's strategic investors bear the market risk if the FCEV market is not developed in line with the FCEV ramp-up plan, it is crucial that car manufacturers are included in the SPV.

In addition, the SPV is held accountable for rolling out the HRS on time and in compliance with certain service quality standards defined in the tender (e.g. closure of HRS for maintenance or repairs). If these benchmarks are not met, the availability payments for the year in question are reduced as a contractual penalty.



**Fig. 10:** Organizational setup of the PFI for the HRS rollout reflecting risk absorption by strategic investors

### Structure of the SPV

A key success factor for the PFI is the participation of car manufacturers, who are best positioned to address the FCEV ramp-up risk and thus will play a deciding role in making the PFI commercially viable, and refueling network operators, who are best placed to address the risk of a delayed or inadequate HRS rollout. The fact that the industry players have equity in the SPV creates a financial incentive to control the most relevant risks, and serves to absorb losses if these risks materialize. In an ideal world, equity shares of individual industry stakeholders would reflect the importance of the risks which they can control – for example:

- Car manufacturers: 50%
- Refuelling network operators: 20%
- Other strategic investors (e.g. HRS, HRS maintenance, H<sub>2</sub> suppliers): 30%

### Involvement of public and private lenders

The SPV for the HRS rollout could benefit from the support of the EIB's RDI Advisory team even before the concession for the PFI is awarded. The SPV could already undergo the due diligence with the EIB in this stage. The SPV could in principle be subject to satisfactory due diligence and access funding from the EIB under the RSFF. The EIB has the possibility to offer a general commitment to provide a loan at a later stage, subject to the SPV meeting a set of pre-defined milestones.

Once the concession has been awarded to the SPV, the HRS rollout project can be expected to have access to lending from the start of the project based on the contractually guaranteed availability payments for debt service for the entire concession period. The secure availability payments are sufficient to cover debt service for 50% of the CAPEX for the 65 HRS in the initial network. Beyond this, the SPV has no access to debt financing. The remaining 50% of the initial investment in the HRS network must be provided by strategic investors in the form of equity.

There will be a short Transition Phase at the start of the HRS rollout. It can be expected that commercial lenders will be hesitant to provide financing to the SPV in spite of the availability of secure revenues. Commercial lenders may be reluctant due to the novelty of the technology and the lack of a track-record of commercial scale, day-to-day deployment of HRS. At first, financing

could be provided by the EIB's RSFF after satisfactory due diligence and approval by the EIB's governing bodies. The EIB could serve as an anchor investor with a catalytic effect in terms of attracting other lenders. After the feasibility of running HRS has been demonstrated in practice, the SPV will be able to gradually involve private lenders, which marks the beginning of the Bankable Phase.

In later project stages, the SPV may be able to leverage the investment beyond the 50% of CAPEX covered by secured availability payments through additional loans. This will require a solid track-record of successful FCEV market uptake and corresponding H<sub>2</sub> demand roughly in line with original forecasts.

### **Impact of Pathway 1 on the business case for the HRS rollout**

On the basis of the availability payment outlined above, the planned FCEV ramp-up curve and other assumptions for the business case (see **Annex**), we have calculated the impact of the PFI on the business case for the initial HRS network in the UK (65 HRS over 16 years). As the PFI would be tendered and the level of the availability payment might be an element of the tendering procedure, the business case calculated here is purely an example of what the impact of the PFI might be from the investors' point of view.

Our calculation reflects the rationale of the PFI for the HRS rollout: While the availability payment absorbs the losses from the initial ramp-up years and provides relief in terms of financing costs by covering 50% of the CAPEX required to install the network, industry stakeholders, in particular car manufacturers, are not released from their responsibility to mitigate and absorb project risks.

If the actual number of FCEVs develops in line with the FCEV ramp-up plan, the business case for the HRS rollout PFI yields a positive NPV of approximately EUR 39.4 m. Equity investors thus receive a return well above their required rate of return, benefitting from the first-mover advantage afforded by the PFI scheme.

If, however, the FCEV ramp-up is delayed or less than expected, the SPV's strategic investors may incur losses. A delay to the FCEV rollout of one year reduces the NPV down to EUR 8.5 m. A delay of two years yields a negative NPV of EUR -12.5 m. Reducing the FCEV sales volume by 20% decreases the NPV to EUR 23 m, while a shortfall in FCEV sales of 50% yields a negative NPV of approximately

EUR -2 m.

Applying the PFI approach to the German business case shows that the share of CAPEX covered by the debt service component of the availability payments would have to be increased to 60% (compared to 50% in the UK) to yield a positive NPV of approximately EUR 2.8 m.

### **Challenges for Pathway 1**

Effective risk mitigation requires that the consortium includes vehicle manufacturers as strategic investors or finds some binding agreement on vehicle roll-out planning. Given the limited number of vehicle manufacturers that could potentially join bidding consortia, the number of eligible consortia competing in the tendering procedure may turn out to be small. The resulting lack of effective competition may put the government in a weak negotiating position which could result in costly agreements and a heavy burden on public budgets.

## ► Pathway 2: Loan with a conditionally repayable share

### **A loan with a conditionally repayable share to jump-start the HRS rollout**

In this pathway, the government issues a sovereign guarantee for a loan program for the establishment and expansion of the initial HRS network. This sovereign guarantee applies to loan tranches provided by a national public bank, such as for example the KfW in Germany. Based on the sovereign guarantee, the public bank can issue a loan at favorable conditions right at the start of the HRS rollout.

Part of the loan can take the form of a reimbursable advance, which absorbs part of the market risk. The SPV can repay this part of the loan depending on how H<sub>2</sub> sales develop and its resulting ability to cover debt service and interest payments. If H<sub>2</sub> sales are below forecast, the state covers the debt service to the public bank. This potential debt relief, however, applies only if the HRS rollout SPV complies with a milestone plan agreed upon between the strategic SPV investors, the government and the public bank. This milestone plan reflects the strategic investors' commitments to develop the FCEV market: the quality and pricing of vehicles must be based on a jointly developed market study, and the HRS rollout must be in line with the requirements of the initial HRS network.

Additionally, the successive disbursement of the loan tranches is made contingent upon the fulfillment of the milestone plan by the SPV and its strategic investors.

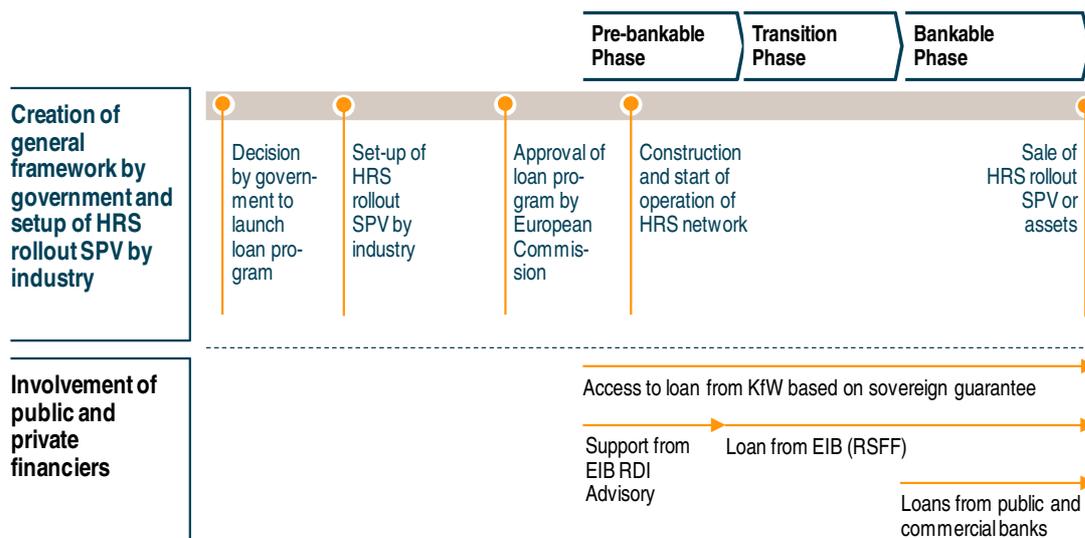
In this approach, there is no direct or automatic disbursement of public funds, as the financial support is provided in the form of a loan secured by a government guarantee. However, if the guarantee has to be activated due to lower-than-expected H<sub>2</sub> sales in spite of the HRS rollout SPV's (and its shareholders') full compliance with the milestone plan, public budgets will have to bear the costs of the shortfall in debt service for the reimbursable advance.

### **Roadmap for the HRS rollout supported by a loan with a conditionally repayable share**

At the moment, a loan with a conditionally repayable share is not applicable in the UK due to the absence of a national public bank that could handle the loan program. Therefore, the following description refers to the business case for Germany.

The government issues a sovereign guarantee for the loan program for the HRS rollout, covering part of the CAPEX required. As the loan includes a reimbursable advance (i.e. state aid), approval by the European Commission may be necessary.

The loan with a conditionally repayable share from the public bank is available for the SPV at the outset of the project. As the sovereign guarantee covers only the loan from the national public bank, no additional loans are available to the SPV at this stage. For other lenders, the Pre-bankable and Transition Phases remain applicable. In the Transition Phase, the SPV could further leverage investments through access to RSFF lending from the EIB, subject to a satisfactory due diligence process and approval by EIB governing bodies. In the Bankable Phase, loans from commercial banks become available.



**Fig. 11:** Roadmap for the HRS rollout supported by a loan with a conditionally repayable share from a public bank

### Design of the loan with a conditionally repayable share and creation of a first mover advantage

The loan from the public bank has a number of conditions that make it preferable to loans from commercial banks:

- The loan covers 50% of the CAPEX investments required for the HRS rollout in the Pre-bankable and Transition Phases (i.e. until Year 10 of the HRS rollout in Germany in the business case calculations used in this study). Of that 50%, 15% is an unconditionally repayable share at market conditions (with an interest rate of 7%). The remaining 35% is a reimbursable advance at a lower interest rate (2%), repayable depending on the actual development of H<sub>2</sub> sales and the resulting capacity of the SPV to cover debt service and interest payments. Based on the HRS rollout plan, the loan will be disbursed in six tranches over ten years (for the installation of the first 110 HRS and five subsequent expansions of the network to a total of 347 HRS)
- The SPV benefits from a grace period for the entire public bank loan. Debt service starts only in Year 7 of the HRS rollout, when positive operating cash flows are expected to be sufficient to cover debt service based on the HRS rollout planning and the FCEV ramp-up forecasts

Access to this loan program is restricted to a limited time window. Only industry consortia that apply for the loan within this time window and commit to starting the HRS rollout within a certain period have access to the loan. As a consequence, industry stakeholders are incentivized to start the HRS rollout. Additionally, only first movers will benefit from the financing conditions offered by the loan.

### Effective risk mitigation concept

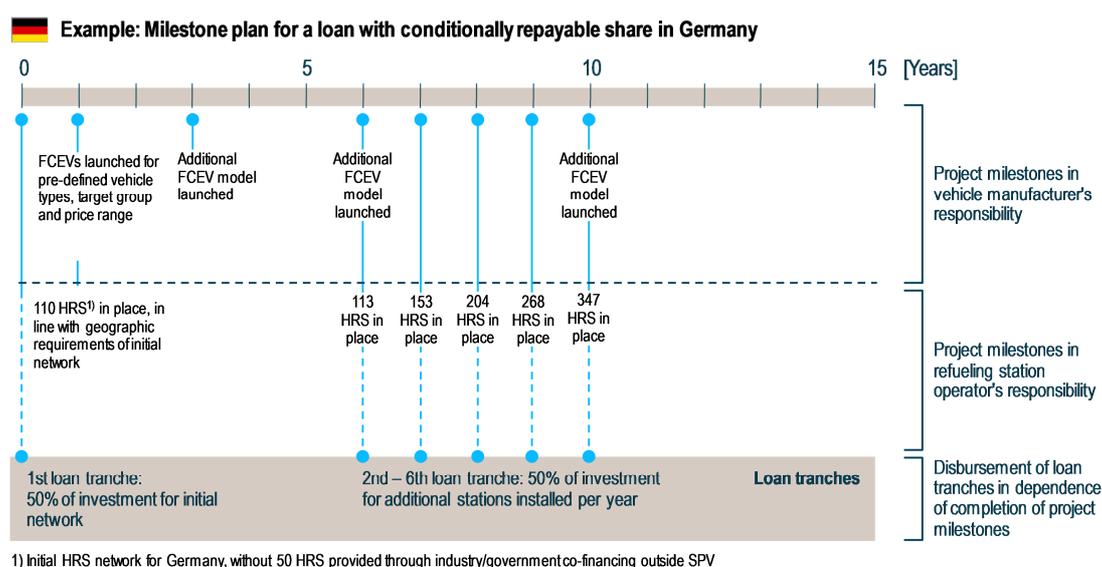
For effective risk control, the loan is split into six tranches. Disbursement of the loan tranches is dependent on meeting predefined project milestones. These milestones relate to the vehicle manufacturers' schedule for introducing FCEVs into the market (launch date, vehicle type, target group, price range) and to building the HRS network on schedule and in line with the requirements of the initial network for basic coverage. To make sure that an interruption of loan disbursements

does not have a negative effect on the HRS rollout, strategic investors must provide contingent equity that can be used if necessary to replace loan tranches that are held back.

Additionally, debt relief of the reimbursable advance in the case of a shortfall of H<sub>2</sub> sales only applies if the SPV was in full compliance with the milestones. If milestones are not met and H<sub>2</sub> sales fall short of the planned levels, the SPV's strategic investor responsible for the milestone in question has to cover debt service obligations through contingent equity.

Using the milestone plan and an independent market study, it is possible to forecast the H<sub>2</sub> sales that result from the FCEV ramp-up curve for different vehicle models and the driving range of the different target groups. This forecast, in turn, allows us to test whether the predefined project milestones are sufficient to mitigate the FCEV ramp-up risk.

Compliance with this agreed milestone plan is monitored by an independent third party. If one of the project milestones is not met on schedule, the disbursement of the upcoming loan tranche is deferred or cancelled and to be replaced by contingent equity from strategic investors, and also the sovereign guarantee has to be partially replaced by contingent equity from strategic investors. Failure to comply with the predefined project milestones thus results in the stakeholders responsible for the failure compensating for the loans.



**Fig. 12:** Example of a milestone plan for a loan with a conditionally repayable share

### The consortium

The industry stakeholders best positioned to address the FCEV ramp-up risk (vehicle manufacturers) and the risk of a delayed or inconsistent rollout of the HRS network (refueling network operators) should ideally hold a significant share in the HRS rollout SPV – for example:

- Vehicle manufacturers: 50%
- Refueling network operators: 20%
- Other strategic investors: 30%

## **Gradual involvement of other public and private lenders in the Transition and Bankable Phases**

In the Pre-bankable Phase (Phase 1), financing other than the loan based on the sovereign guarantee is not available. The financing of CAPEX investments thus consists of 50% debt in the form of the loan with a conditionally repayable share and 50% equity provided by the strategic investors in the SPV.

In the Pre-bankable Phase, support from the EIB RDI Advisory team might be available to help the SPV prepare for the EIB's due diligence. The SPV could already go through the due diligence in this phase. The EIB has the possibility to make a general commitment to provide a loan for a certain period of time, which then can be accessed by the SPV subject to the SPV meeting certain milestones and conditions within this period.

In the Transition Phase, the SPV can complement the loan with a conditionally repayable share with lending under the EIB's RSFF. Potential conditions might include the following, however, these are only indicative in nature and need to be established by EIB lending teams in due course:

- The Transition Phase must have started (in Germany: 153 HRS must be installed by the SPV, approximately 230,000 FCEVs on the road, ADSCR > 1.1, and project risks mitigated or absorbed)
- The initial H<sub>2</sub> demand must be established and roughly in line with forecasts
- An effective risk mitigation concept must be in place, addressing the FCEV ramp-up risk in particular
- A business plan for extending the HRS network further must be in place, based on in-depth market research and carmakers' plans for further FCEV market introduction
- The SPV/project organization must have been operating smoothly over several years despite diverse shareholder interests
- The HRS network must have been operating smoothly over several years, including H<sub>2</sub> supply and storage and HRS maintenance

Lending from the EIB's RSFF will help the SPV build up a credit history and access loans from commercial lenders in the Bankable Phase (Phase 3). The SPV can be expected to access loans from commercial lenders when it meets the following main conditions:

- The Bankable Phase must have started (in Germany: 415 HRS must be installed by the SPV, approximately 400,000 FCEVs on the road, ADSCR > 1.1 including a buffer, and project risks mitigated or absorbed)
- Initial H<sub>2</sub> demand must be established roughly in line with forecasts
- An effective risk mitigation concept must be in place, addressing the FCEV ramp-up risk in particular
- A business plan for extending the HRS network further must be in place, based on in-depth market research and vehicle manufacturers' plans for further FCEV market introduction

## **Impact of Pathway 2 on the business case for the HRS rollout**

Our indicative business case assessment shows a slightly negative NPV of EUR -6.6 m after 15 years for the HRS network that is financed by the loan with a conditionally repayable share, i.e. the network that is in place by the end of Year 10, when the beginning of the Bankable Phase marks the end of new tranches of this loan. The project is thus very close to reaching NPV breakeven. Given that strategic investors are not primarily driven by the potential returns of the HRS rollout as a financial investment, this outcome may be sufficient to induce investment from them.

Complementing the loan instrument with a partial grant to cover 15% of the CAPEX required to install the first round of HRS in Year 1 further improves the business case, yielding a positive NPV of EUR 1.4 m.

### **Conditions and challenges for Pathway 2**

This pathway requires the involvement of a public bank that can handle a loan with a conditionally repayable share based on a sovereign guarantee. It also requires the presence of a car manufacturer and a refueling station operator in the consortium forming the SPV.

In relation to the cost of the HRS rollout, the legal structure that has to be set up for the loan with a conditionally repayable share is complex. The loan requires an in-depth analysis to establish the baseline for the FCEV ramp-up and related milestones. It also requires a highly detailed agreement between the government and the SPV about the planned and committed market introduction activities, plus monitoring by a third party.

### **► Pathway 3: Combined HRS / FCEV package**

#### **Leveraging corporate fleets to promote FCEV market uptake and jump-start the HRS rollout**

In this pathway, the government sets up a financial support program to promote FCEV procurement by corporate fleets. The program helps vehicle manufacturers put FCEVs on the road by making an attractive offer to fleet customers, supported with incentives. Targeting mileage-heavy users ensures that the initial FCEV fleet generates good utilization of the basic HRS network within a relatively short time span. Financial incentives have a particularly strong effect in the context of corporate fleet procurement, which is mostly driven by value-for-money considerations, as can be seen from the prevalence of bulk deals with significant discounts. One option could be to target taxi fleets, which have a very high annual mileage per vehicle.

Additionally, this approach aligns the development of FCEVs and the HRS rollout. To be eligible for the grants, applicants have to ensure that an HRS is installed and operated at or nearby the site of the fleet, potentially also open for other users. This pathway leads to an FCEV stock sufficient to financially sustain the initial HRS network. The SPV operating the HRS network can benefit from minimum H<sub>2</sub> purchasing commitments by fleet operators, which provide secure returns for the HRS network and, as a result, access to lending from the very start of the project.

The program requires public funds to pay the financial incentives to eligible companies at the beginning of the HRS rollout.

#### **Roadmap for the HRS rollout supported by a combined HRS / FCEV package**

The approach of the HRS / FCEV package could be applied in Germany as well as in the UK. For illustration purposes, the following sections use the German business case calculation as an example, unless otherwise stated.

The government tenders a grant program for FCEV procurement by corporate fleets with high annual mileage (for example taxi firms, telecommunications firms, utilities, homecare service providers). The goal is to establish zero-emission vehicles in those markets, where currently available zero-emission technologies are not applicable. Tendering a program that targets users with high mileage and using the required incentive per gram of CO<sub>2</sub> make it possible to adhere to technology neutrality in public tenders. At the same time, it overcomes the focus on inner-city mobility that currently predominates in most programs featuring battery electric vehicles. The FCEV

procurement grant is tendered in several tranches to facilitate the participation of different car manufacturers.

To apply for the grant, car manufacturers and commercial fleet operators must join together to form bidding consortia. They submit proposals which specify the number of cars that each commercial fleet operator involved would be willing to purchase from the car manufacturer, along with a request for a specific amount as a public incentive payment to bridge the price gap between conventionally-fuelled vehicles and comparable FCEVs. The application must also include a concept for the installation and the operation of HRS for a minimum time span, for example the provision and operation by an SPV handling the HRS rollout.

As several car manufacturers compete for the available grants, there is a strong incentive for car manufacturers to provide implicit "match funding" when it comes to determining the amount requested as a procurement grant. This competitive mechanism helps ensure that car manufacturers make a financial contribution to facilitating the market launch of FCEVs and the price gap is not fully borne by the public sector.

The grant is tendered according to clearly specified quality criteria, including good value for money, convincing targeting of use-cases, overall emission-free mileage achieved, favorable geographic location of proposed HRS sites, and so on. The size of the program – in other words, the maximum number of FCEVs that may receive funding – is derived from the number of FCEVs needed to sustain a basic HRS network financially.

To ensure the installation and the operation of the HRS, car manufacturers are expected to set up an SPV for the HRS rollout with other relevant industry stakeholders. This can either be done individually by each car manufacturer that receives funding from the tender, or through a joint SPV. This joint entity could manage the entire network's HRS on behalf of a consortium consisting of different car manufacturers.

Two types of fleets would be targeted through the program:

- Big fleets that operate on the basis of back-to-base refuelling, i.e. cars that are used only within a limited geographical area (a city or metropolitan area) and return to a corporate site or depot on a daily basis. HRS can then be installed close to or even right on the corporate base site. Targeting these fleet operators provides a simple mechanism for choosing the right sites for the HRS and requires relatively little coordination
- Car fleets that operate on a decentralized basis (e.g. regular company cars) which are spread across the entire country and typically use public stations for refueling. Incorporating these cars requires significant coordination

In practice, carmakers will most likely use back-to-base refueling fleets as the basis for forming bidding consortia, and will try to incorporate decentralized fleets in addition to that.

Fleet operators in the grant program could provide a contractual commitment to a minimum H<sub>2</sub> offtake with the HRS rollout SPV. This would ensure that the H<sub>2</sub> demand which stems from the FCEVs procured under the scheme creates predictable revenues for the initial HRS operated by the car manufacturer. Such a commitment could be an element of the tender.

When the tender process is complete, the program is launched. HRS are installed at the agreed sites, procurement support grants are disbursed, and FCEVs are procured and deployed by the fleet operators as specified in the grant procedure. The minimum purchasing agreements with corporate fleets generate guaranteed revenues, which enable the SPV to skip the Pre-bankable Phase and gain access to debt financing right from the start of the project.

When general FCEV sales increase and create more demand for hydrogen fuel, the initial network may be expanded, either through the initial SPV or external competitors entering the market. This potential expansion of the network would take place outside of the support scheme on a purely market-driven basis.

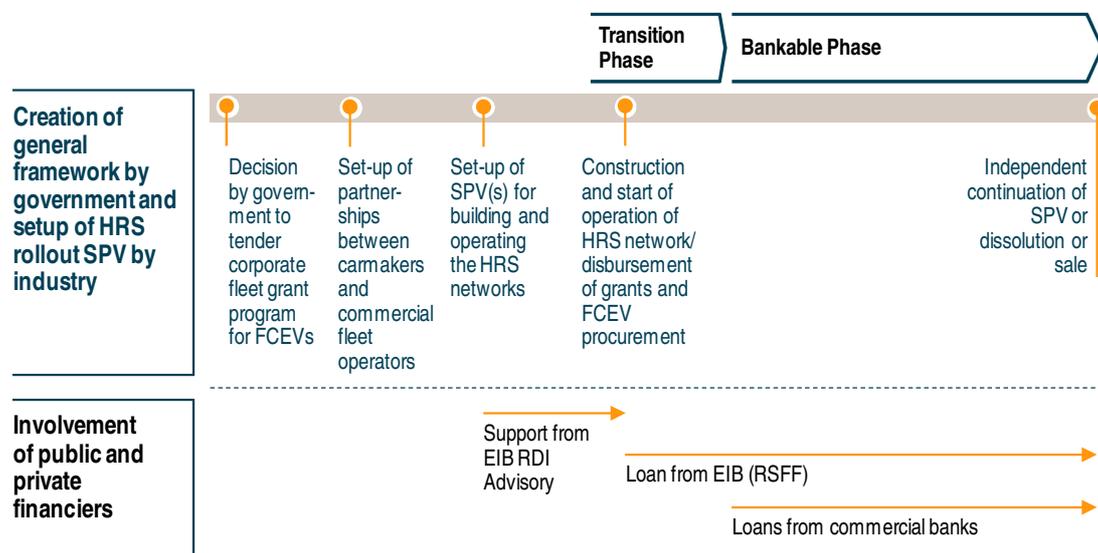


Fig. 13: Roadmap for the HRS rollout supported by the combined HRS / FCEV package

### Determining the correct scope for the program

To trigger investment in the station network and make the overall HRS / FCEV package scheme attractive for carmakers as strategic investors, the number of FCEVs put on the road with the help of the program needs to be sufficient to profitably run the HRS. According to our calculations, we estimate that in Germany a stock of approximately 38,000 FCEVs with an annual mileage of 50,000 km would have to be procured by corporate fleets in order to sustain the initial network (110 HRS) financially. This number of vehicles, held constant over the project's lifetime, would cover the operating costs and ensure the ability to service debt from the beginning of the rollout.

To create an effective incentive for fleet operators to purchase FCEVs, FCEVs procured under the program must yield a financial advantage vis-à-vis conventionally fuelled vehicles on a total cost of ownership basis (TCO). For illustration purposes, we assume an indicative TCO gap of EUR 8,000<sup>6</sup> between conventional diesel cars and FCEVs over a vehicle's lifetime for corporate fleets with high annual mileage. For the initial FCEV fleet of 38,000 cars, this assumption yields a total funding amount of approximately EUR 304 m which would have to be put up between the German government and the private sector partners to bridge the TCO gap. To provide a real financial incentive, the support would have to go beyond TCO break-even and offer an additional incentive. Assuming an incentive of EUR 1,000 per vehicle would then yield a total amount of approximately EUR 342 m. This could be reduced by fine-tuning the targeting of users – the more mileage is

<sup>6</sup> This assumption is based on discussions with independent industry experts and is meant for illustration purposes only. It does not represent a forecast of the actual TCO gap at FCEV market launch. The assumption was not reviewed and confirmed by industry representatives.

achieved, the lower the number of subsidized cars needed. This can be used as one of the criteria in the tender process.

### **Effective risk mitigation concept**

This proposal addresses the FCEV ramp-up risk by aligning the ramp-up of FCEVs with the rollout of the HRS network. Especially a minimum H<sub>2</sub> purchasing commitment by fleet operators could provide a basic guaranteed level of overall H<sub>2</sub> demand, and the SPV for the HRS rollout would benefit from predictable revenues over several years.

Additionally, the scheme supports an HRS rollout that is both on schedule and in line with the geographical requirements of an initial HRS network for basic coverage. The criteria for accessing funds from the combined HRS / FCEV package can include a time window in which HRS need to be set up, as well as the installation of HRS at sites that are relevant for the initial HRS network. Moreover, the SPV has a strong interest in ensuring that highly frequented and visible HRS sites are chosen so as to provide a customer-friendly, accessible basic network. This also promotes FCEV uptake from private customers and the general market beyond the scope of the financial support scheme.

### **Involvement of public and private lenders**

Debt financing will be available for the number of HRS that can be financially sustained from the H<sub>2</sub> sales guaranteed by contracts with corporate fleet operators. If contracts are concluded progressively, debt financing will also become available progressively. While additional FCEV sales that may take place outside of the scheme could provide extra revenues for the HRS network, the financing approach refers exclusively to the FCEVs for which H<sub>2</sub> purchasing commitments are concluded under the support program.

Support from EIB Research Development & Innovation (RDI) Advisory can already become available for the SPV as soon as it is setup. The team can help the SPV prepare for its due diligence with the EIB. This due diligence would take place at the beginning of the rollout, when the first stations need to be financed. The EIB has the possibility to make a general commitment to providing a loan for a certain period, during which the final contract can be concluded between EIB and the SPV. The SPV can access the loan once pre-defined criteria have been met, most importantly revenue guarantees based on the conclusion of contracts with fleet operators.

Given the novelty of the technology and the lack of a track-record regarding HRS deployment on a commercial scale day-to-day, commercial banks will initially be hesitant to provide financing to the SPV, despite the secure revenues. The initial HRS in the Transition Phase could be financed through the EIB's RSFF after satisfactory due diligence and approval by the EIB's governing bodies. Once the feasibility of running HRS has been demonstrated by the first stations, financed by the EIB in the short Transition Phase, the SPV will be able to attract financing from private lenders. This marks the beginning of the fully-fledged Bankable Phase for the HRS rollout.

### **Impact of Pathway 3 on the business case for the HRS rollout**

With a financial support scheme facilitating a stock of approximately 38,000 FCEVs in corporate fleets and corresponding contractual H<sub>2</sub> purchasing commitments in place, the HRS network operated by the SPV yields a sufficient financial return for investors. For the German business case, we calculate a positive NPV of approximately EUR 3.1 m for the SPV operating the initial network (110 HRS) over 15 years. This is based on the assumption that the SPV manages to at least maintain the level of H<sub>2</sub> sales guaranteed by the contractual purchasing agreements for the first generation of vehicles over the project's lifetime of 15 years (see the Annex for underlying

assumptions). Applying the HRS / FCEV package approach to the UK business case shows that a stock of 16,000 FCEVs deployed under the scheme would yield a positive NPV of approximately EUR 6.7 m for the initial network of 65 HRS.

### **Conditions and challenges for Pathway 3**

Pathway 3 requires that the government and private-sector partners commit funding for the program (approximately EUR 342 m in Germany, based on our rough estimate). This amount exceeds the funds required to install the initial HRS network (CAPEX of just approximately EUR 100 m for 110 HRS).

However, this can be justified by the much broader perspective of this approach. It not only provides HRS, but also kick-starts the market introduction of FCEVs into car segments that have so far not been targeted by zero-emission offerings. This approach therefore directly supports additional policy objectives, such as reducing the CO<sub>2</sub> emissions of large fleets and impacting congested areas within a short time period).

On the flip side, this pathway also reduces the pressure on car manufacturers to promote FCEV market uptake through attractive pricing, marketing efforts, effective sales channels, and such like. The government funds used to bridge the price gap between conventionally-fuelled cars and FCEVs may result in "deadweight effects" that inhibit competitive FCEV pricing in the medium term.

### **► Pathway 4: CAPEX grant for the initial HRS network**

#### **Using a CAPEX grant to jump-start the initial HRS rollout**

The large initial CAPEX investment required for the initial HRS network represents a significant financial burden for the HRS rollout. Accordingly, in this pathway the government provides a CAPEX grant which covers a substantial share of the initial investment. This approach is built around an upfront, non-repayable grant. The public sector incurs the associated costs and the funds need to be allocated in the national budget.

#### **Roadmap for the HRS rollout supported by a CAPEX grant combined with regulation**

The CAPEX grant could be applied in Germany as well as in the UK. For illustration purposes, the following sections use the German business case as an example, unless otherwise stated.

In this approach, the government put to tender a grant covering 70% of the CAPEX required for the initial HRS network (110 HRS in Germany). The beneficiary is required to operate the network for 15 years. The subsequent expansion of the network takes place on a purely market-driven basis. No additional CAPEX grants are available. To apply for the CAPEX grant, strategic equity investors form an SPV to plan, finance, build and operate the initial HRS network. The grant is made available to the SPV prior to the start of the HRS rollout in the form of a one-time lump sum.

The remaining 30% of the required investment that is not covered by the grant needs to be financed exclusively through equity from strategic investors in the Pre-bankable Phase. Debt financing is not accessible as there are no secured revenues available to cover debt service. In the Transition Phase, the SPV can start leveraging the equity investments through the EIB's RSFF after satisfactory due diligence and approval by the EIB's governing bodies. In the subsequent Bankable Phase, loans from commercial banks gradually become available.

After 15 years, when the obligatory period for operating the network ends, the shareholders of the SPV can choose to dismantle the SPV or continue it as an independent operator.

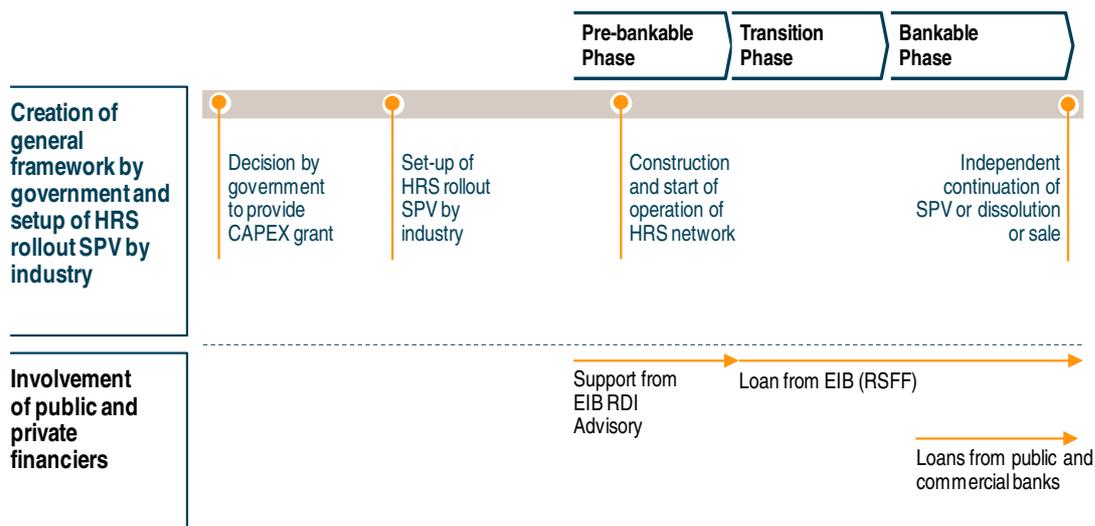
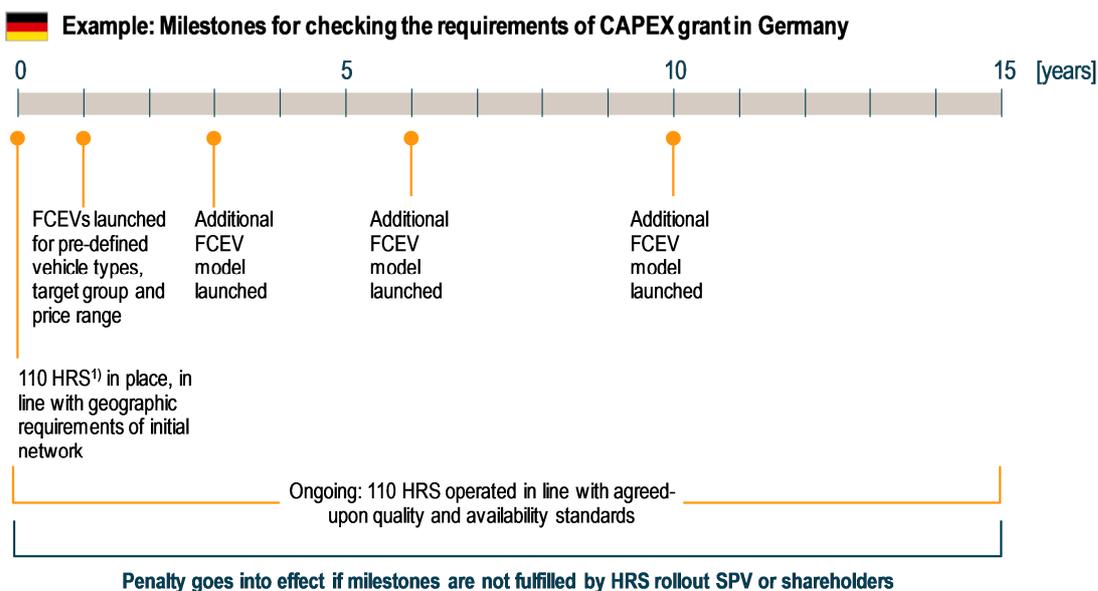


Fig. 14: Roadmap for the HRS rollout supported by a CAPEX grant combined with regulation

### Risk mitigation

To ensure that strategic investors help control the project risks, the government disburses the CAPEX grant on condition that certain project milestones are met by the SPV and its shareholders in the following years. If these milestones are not met, the beneficiaries of the grant have to pay a penalty – in other words, to repay a share of the grant. The milestones in the grant agreement include obligations of car manufacturers to promote FCEV market uptake, as well as certain quality standards for the availability and service level of the HRS operated by the SPV. Strategic investors are directly liable for any penalties for missed milestones for which they are responsible, and they need to provide contingent equity to cover these potential penalties.



1) Initial HRS network for Germany, without 50 HRS provided through industry/government co-financing outside SPV

Fig. 15: Examples of milestones relating to the requirements of the CAPEX grant

## **The consortium**

As for the other Pathways, it is equally important for the CAPEX grant that the ability to meet the project milestones is aligned with a financial interest in the HRS rollout. Ideally, the industry stakeholders best positioned to address the FCEV ramp-up risk (vehicle manufacturers) and the risk of a delayed or inconsistent rollout of the HRS network (refueling network operators) should hold a significant share in the HRS rollout SPV. For example, the shares could be distributed as follows:

- Vehicle manufacturers: 50%
- Refueling network operators: 20%
- Other strategic investors: 30%

## **Involvement of public and private lenders**

The CAPEX grant does not change the fundamental setup of a business case split into three phases (i.e. Pre-bankable, Transition and Bankable Phase). However, the grant shortens the Pre-bankable and Transition Phases.

In the Pre-bankable Phase, debt financing is not available. The remainder of the CAPEX, i.e. 30%, has to be provided exclusively through equity from the strategic investors. Support from the EIB RDI Advisory team is however already available in the Pre-bankable Phase. The team helps the SPV prepare for a due diligence with the EIB. The SPV can already undergo the due diligence with the EIB in the Pre-bankable Phase. The EIB has the possibility to make a general commitment to provide a loan for a certain period, which then can be accessed by the SPV on condition that the SPV meets certain criteria within this period.

In the Transition Phase, the SPV accesses a loan from the EIB's RSFF, on condition that predefined criteria are met. The EIB financing during the Transition Phase can help the SPV build a credit history, which can then be used to further leverage the investment by means of additional commercial bank loans in the Bankable Phase

## **Impact of Pathway 4 on the business case for the HRS rollout**

The CAPEX grant can shorten the Pre-bankable and Transition Phases. While the FCEV ramp-up risk is not addressed by the grant, it reduces the annual financial burden of debt service at the beginning of Phase 2 from around EUR 1.9 m to approximately EUR 580,000 by reducing the investment from approximately EUR 100 m to approximately EUR 30 m. As a consequence, an ADSCR > 1.1 can be achieved two years earlier in the case of Germany, and – contingent upon the development of the FCEV ramp-up – bankability will be reached two years earlier.

The CAPEX grant has a positive impact on the NPV of the HRS rollout. With the grant, the business case for the initial network operated by the SPV (110 HRS in Germany) yields a positive NPV of approximately EUR 2.45 m over 15 years.

However, the grant has no impact on controlling the FCEV ramp-up risk. The business case remains fully dependent on the realization of the forecast FCEV ramp-up. A delay in the FCEV rollout of one year causes the NPV to decrease to

EUR -14.2 m, while reducing the FCEV sales volume by 15% causes the NPV to decrease to EUR -8.5 m. On the other hand, accelerating the vehicle rollout by one year results in an NPV of EUR 22.1 m, while increasing sales volumes by 15% yields an NPV of EUR 13.1 m.

Applying the CAPEX grant scheme to the UK business case shows that a grant would have to cover 85% of the initial CAPEX (compared to 70% in Germany) to achieve a positive NPV of approximately EUR 0.17 m.

#### **Conditions and challenges for Pathway 4**

The FCEV ramp-up risk is not addressed by the CAPEX grant. While the grant can support the enforcement of project milestones relating to FCEV market introduction, it does not include any mechanism that would encourage sales of FCEVs or transfer the risk of actual sales numbers to the car manufacturers. Car manufacturers are only financially liable for the FCEV ramp-up risk, if they are members of the SPV consortium, and only in relation to their share in the SPV.

#### **► Comparison of the Pathways**

Each Pathway has a different impact on the HRS rollout business case. To get an idea of these impacts from the investor and government viewpoints, we carried out a rough assessment of business case effects. The business case calculations have to be understood as a rough, indicative estimate, since they are based on a number of assumptions of which not all were validated by industry stakeholders and / or governments.

All four Pathways make the HRS rollout business case interesting for strategic investors. The NPV of the business cases is positive in nearly every Pathway; only a loan with a conditionally repayable share (Pathway 2) needs an additional grant element to achieve a positive NPV.

The bankability of the HRS rollout changes depending on the Pathway:

- The PFI (Pathway 1) and the combined HRS / FCEV package (Pathway 3) allow the HRS rollout SPV to skip the Pre-bankable Phase
- The CAPEX grant (Pathway 4) shortens the Pre-bankable Phase
- The loan with a conditionally repayable share (Pathway 2) has no impact on the bankability of the project. Pathway 2 is based on a sovereign guarantee, which only applies to the specific public bank loan and does not impact the inclination of other lenders and investors to provide funds for the HRS rollout

	NPV [EUR m]	Impact on bankability
<b>1 Private financing initiative</b> (UK: 65 HRS; 50% debt GER: 110 HRS; 60% debt)	39.4 ✓ 2.8 ✓	
<b>2 Loan with conditionally repayable share</b> (347 HRS) <sup>1)</sup>	Only loan -6.6 Loan plus grant 1.4 (15% of CAPEX) ✓	
<b>3 Combined HRS / FCEV package</b> (UK: 65 HRS GER: 110 HRS)	6.7 ✓ 3.1 ✓	
<b>4 CAPEX grant</b> (UK: 65 HRS; grant 85% GER: 110 HRS; grant 70%)	0.17 ✓ 2.45 ✓	

1) Loan w. conditionally repayable share not applicable in the UK due to lack of national public bank that could handle the loan program

**Fig. 16:** Effect of the four Pathways on the HRS rollout business case

From the government point of view, all four Pathways fulfill key requirements:

- All Pathways create a first-mover advantage
- All Pathways encourage swift action by industry
- All Pathways include mechanisms to address the FCEV ramp-up risk by holding strategic investors responsible for controlling this risk

The Pathways differ with regards to the extent to which public funds are used:

- A loan with a conditionally repayable share (Pathway 2) backed by a sovereign guarantee is the only Pathway that does not assume a disbursement of public funds. The guarantee for a share of the loan comes into effect only if the SPV meets all defined project milestones (market introduction schedule for FCEVs and HRS installation schedule) and if revenues from H<sub>2</sub> are below forecast
- The HRS / FCEV package (Pathway 3) is estimated to be the most costly Pathway for governments – but it is also the only Pathway which not only mitigates, but which partially eliminates the FCEV ramp-up risk. The combined HRS / FCEV package is the only Pathway with a direct mechanism for spurring FCEV ramp-up, as it links the rollout of the HRS network with FCEV purchases by fleets. The flipside: potential deadweight effects for FCEV prices

A crucial success factor – and main challenge – for all four Pathways is the participation of a vehicle manufacturer in the consortium. This is needed to ensure the effectiveness of the risk mitigation concept built into each Pathway.

	Issue of guarantee (vs. direct disbursement of funds)	Required public funds [EUR m] <sup>1)</sup>	Creation of first mover advantage	Encouraging swift action by industry	Mitigation of FCEV ramp-up risk	Elimination of FCEV ramp-up risk
<b>1</b> Private financing initiative	X	 approx. 61  approx. 105	✓	✓	✓	X
<b>2</b> Loan with conditionally repayable share <sup>2)</sup>	✓	 approx. 15 – 115	✓	✓	✓	X
<b>3</b> Combined HRS / FCEV package	X	 approx. 144  approx. 342	✓	✓	✓	✓
<b>4</b> CAPEX grant	X	 approx. 50  approx. 69	✓	✓	✓	X

1) Numbers are to be understood as a rough, indicative estimate. They are based on various assumptions of which not all were validated with industry stakeholders and financiers

2) Loan w. conditionally repayable share not applicable in the UK due to lack of national public bank that could handle the loan program

**Fig. 17:** Comparing the Pathways from the government viewpoint – selected factors

Ultimately, strategic investors and governments will have to check the relevance of the Pathways for their countries, as the practical feasibility of the Pathways depends on the specific conditions in each country. Such conditions include the presence of a public development bank, the level of experience and expertise regarding public-private partnerships, the presence and structure of large fleets, and the structure of the national vehicle and filling stations market. Given the wide variety of these conditions, there will be no "one size fits all" solution for the EU.

## F. What stakeholders need to do in the near future to secure medium- and long-term financing for the HRS rollout

### ► Strategic investors should prepare a concrete proposal for governments

Despite their strong strategic interest in the implementation of the HRS rollout, strategic investors are hesitant to initiate the HRS rollout and to fully take on the challenges of the business case. They are especially reluctant to provide funds in the Pre-Bankable Phase of the HRS rollout, where they see a first-mover disadvantage for investors.

Strategic investors realize that governments also have a strategic interest in the HRS rollout: They need the hydrogen refueling infrastructure to support their policy goal of de-carbonizing transportation through the introduction of FCEVs. Accordingly, they expect the government to make the HRS rollout more attractive from a business perspective, and in particular to remove the first-mover disadvantage.

To obtain support from the government, strategic investors should formulate a concrete proposal for the public sector, including the following elements:

- Commitments from strategic investors to jump-starting the HRS rollout under certain conditions (a "coalition of the willing"): These commitments should be in the form of letters of intent, or, if possible, more enforceable formats. Ideally, strategic investors should include car manufacturers, who can address the FCEV ramp-up risk, and refueling network operators, who can ensure access to sites and on-schedule installation of HRS
- Outline of the intended organizational setup for the HRS rollout and a concrete proposal for a risk mitigation concept: Strategic investors should establish a legally independent entity for handling the HRS rollout. To leverage funds on a project finance basis, a firm risk mitigation concept is required. The concept must include risk mitigants addressing all the project risks. For each mitigant, the expected effect should be described and the stakeholder responsible for the implementation identified. Where appropriate, one of the stakeholders should be the state (see Chapter I.C)
- A reliable FCEV introduction plan from vehicle manufacturers: This is a key component of an effective HRS rollout plan and risk mitigation concept. It is also required as a basis for discussions with governments and potential financiers. The plan should include a schedule, vehicle types, target groups, sales channels and a marketing and sales strategy for FCEVs
- A concept for the support requested from the government: The proposal from strategic investors should serve as a basis for negotiations with the government. It should state what kind of support the strategic investors consider necessary, in terms of providing funds and absorbing the project risks of the HRS rollout (see Chapter I.D). Any request for financial support should be underpinned with transparent business case calculations. The proposal should clearly state what part of the financial challenge and risks the strategic investors are willing to shoulder in exchange for the government support they request
- A concept for involving public and private financiers: One financing option for the HRS rollout should be selected (see Chapter I.B). The concept should outline how strategic investors will meet the requirements for accessing the selected financing option, including risk mitigation and risk absorption by strategic investors and the state. It should also include a schedule that outlines when initial discussions with different types of financiers are planned, which institutions

will be contacted, and at what stage of the HRS rollout each financier is expected to show interest in the HRS rollout

### ► **Governments can jump-start the HRS rollout**

The HRS network should be in place in time for the planned mass-market introduction of FCEVs by major car manufacturers. Governments are in a position to jump-start the HRS rollout. To stimulate swift rollout, governments can follow one of the four pathways presented as food for thought in Part II. To help them decide which pathway to follow – and to adapt that pathway in line with their concrete policy priorities – governments should ask themselves the following questions:

- Which financial support instruments have produced good results for similar projects and could be adapted quickly and easily for the HRS rollout?
- What level of financial support would be necessary to jump-start the HRS rollout in the specific context of a country, compensating for losses in the Pre-Bankable Phase and creating a first-mover advantage? (This requires an in-depth assessment of the requirements for an initial HRS network, including a market study / consumer survey and validation of the business case based on this assessment)
- Would it be preferable to provide a guarantee than give financial support in the form of financial incentives or grants?
- To what extent are we ready to absorb the risks of the HRS rollout through financial support? Could financial support to some extent be replaced by stricter regulation, e.g. supporting FCEV sales by targeting large off-takers?

## G. Outlook and next steps – Advancing the discussion with European governments

Putting into place a basic HRS network through a joint public-private approach – planting the seed for a self-sustained, market-based HRS network – which involves strategic investors from industry and public sector stakeholders is a demanding task. Significant co-ordination and a well-managed negotiation process are required to successfully develop a viable financing model which can jump-start the commercial scale deployment of hydrogen based mobility.

Considering the diversity of vehicle and filling station markets across Europe, as well as the differences in national policies, it is evident that the financing approaches to be developed need to take into account the specific characteristics and requirements of individual national markets. Therefore, national governments and strategic investors with a strong presence in the respective national markets will be the key players in developing feasible financing frameworks for the deployment of initial HRS networks in national markets across the EU.

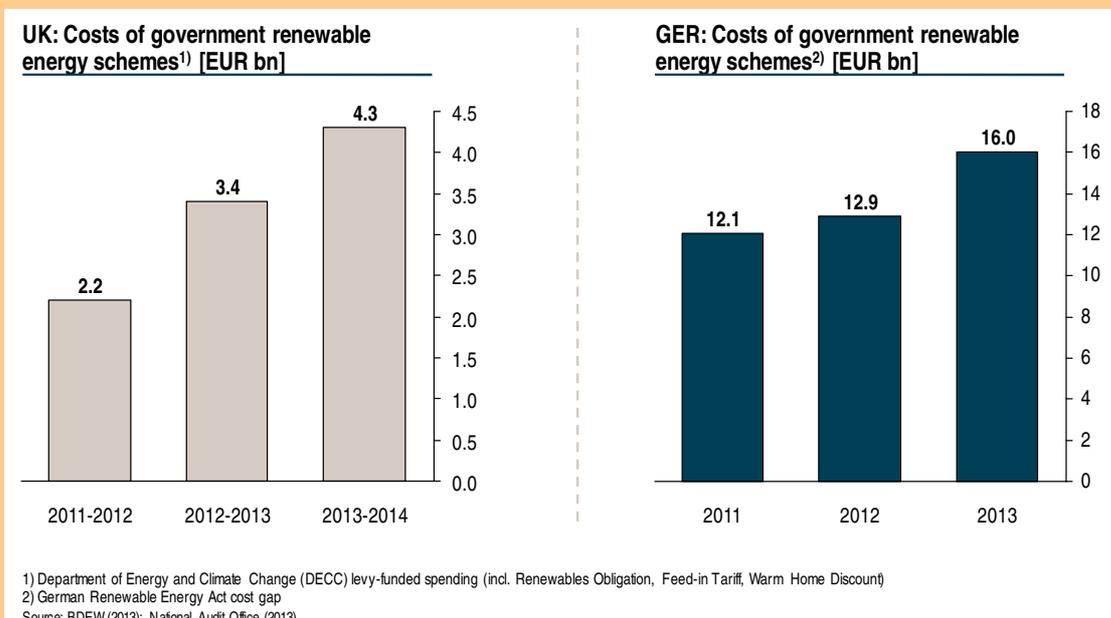
However, there is also an important role to play for the European level when it comes to coordinating and aligning activities across Europe, transferring knowledge and expertise between different EU countries and providing a platform for co-operation for different industry stakeholders that all hold stakes in their national markets and policy arrangements. Since its inception in 2008, the FCH JU has played a vital role in coordinating public and private stakeholder across Europe to promote and accelerate the mass-market-scale deployment of fuel cell and hydrogen technologies. Building on this experience, the FCH JU can make a beneficial contribution to the rollout of a basic European HRS network in the years ahead by:

- Bundling and sharing experiences, knowledge and good practices for HRS financing from different countries to support the swift adoption of viable financing approaches for basic HRS networks throughout the EU
- Using its unique position as a well-connected EU-level public private partnership to initiate and structure a constructive dialogue with national governments in order to facilitate the development and implementation of national HRS rollout plans
- Continuing to provide a link between HRS and FCEV commercialization activities and wider EU policy initiatives aimed at de-carbonizing transport. This holds in particular for developing a well-aligned policy approach across Europe which helps co-ordinate policy targets and measures in the fields of climate, transport, industrial and energy policy in a consistent way
- Exploring funding models that include its funding or other EU-level funds and providing a platform for industry to advance financing discussions in respective national HRS projects
- Supporting the definition of a consistent position with regards to the contribution of H<sub>2</sub>-based mobility towards reducing CO<sub>2</sub> emissions in the transport sector and the share of hydrogen based vehicles in car fleets and aligning this position with the Commissions' reflections on political and financial priorities for supporting a HRS roll-out

Comparing the required funding of the four pathways (compare Chapter E) with investments and other financial support that Germany's and the UK's governments have committed towards de-carbonizing the energy sector (compare **Box 2** below), one finds that in relation the required funding to kick off an initial HRS network seems feasible – if and when the timelines and political objectives of relevant stakeholders can be aligned.

**BOX 2: The level of government support necessary for initiating a hydrogen refueling infrastructure is modest when compared to existing support schemes for de-carbonizing energy and transport**

As discussed above, it is crucial to ensure that financial government support is granted on a strictly temporary basis and limited to the initial build-up of a basic HRS infrastructure. Furthermore, the financial involvement of the public sector needs to be made contingent upon firm and binding commitments from strategic investors. Keeping in mind these important principles, it should also be pointed out that governments both in the UK and in Germany have already been spending significant public funds on other technologies to de-carbonize their economies. While those countries' governments have taken very different approaches, both have committed significant financial resources. This holds in particular for support schemes for electricity generation from renewable sources (see below).



**Fig. 18:** Government support schemes for renewable electricity generation

In the transport sector, considerable public funds have been made available to support the development and market uptake of battery electric vehicles. In the UK, for example, GBP 30 m were spent on the installation of chargepoints within the framework of the so-called "Plugged-in Places" program. In early 2013, the the government announced an extra GBP 37 m to offset the cost of installing infrastructure for recharging electric vehicles. In Germany, more than EUR 1.5 bn were made available over the past years for R&D and demonstration projects for battery electric vehicles.

In comparison, the amounts of public support necessary to initiate the launch of a hydrogen refueling infrastructure would range from approximately 50 to 144 EUR m for the UK and from 15 to 342 EUR m for Germany, depending on the specific pathway chosen (compare section E).

# PART III: Detailed analysis

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## H. Policy framework for the HRS rollout in the EU

### ► **The climate protection policy goals of the EU require the introduction of alternative zero-emission vehicles**

The European Union has set ambitious climate protection policy goals. EU Member States plan to reduce Europe's greenhouse gas emissions by 80-95% by 2050 compared to 1990 levels (European Commission 2011). Greenhouse gas emissions in the transport sector will have to be cut by at least 60% by 2050 compared to their 1990 levels to achieve these targets (European Commission 2011a). Introducing alternative zero-emission and propulsion technologies is a key part of implementing this strategy.

### ► **Fuel cell electric vehicles – Possible contribution to the EU's climate protection policy goals**

Large-scale deployment of fuel cell electric vehicles (FCEVs) is expected to play a major role in achieving the EU's climate protection policy goals:

- FCEVs are zero tail-pipe emission vehicles: FCEVs emit only water. The hydrogen they require as fuel can potentially be produced cleanly and sustainably, sourced from diverse renewable energy sources. Hydrogen fuel therefore has significant potential for achieving carbon-neutral vehicle technology along the whole hydrogen value chain
- FCEVs have the potential to enter market segments that other zero-emission vehicles have been unable to enter in the past: FCEVs' properties correspond to the typical car usage patterns seen today. They are similar to conventional vehicles with combustion engines: Driving range is already more than 500 km per tank fill, and refueling only takes a few minutes. With the right rollout strategy in place, FCEVs therefore have the potential to capture significant market share
- From a technological point of view, FCEVs are ready for serial production: Major car manufacturers already have advanced prototypes or close-to-production FCEVs in their portfolio. Hyundai and Toyota plan to introduce FCEVs in key markets from 2015; Daimler, Ford and Nissan plan to launch mass-market FCEVs in 2017

### ► **Policy frameworks at EU and Member State level supporting the introduction of FCEVs and a hydrogen refueling infrastructure**

Policymakers at the EU and in Member States are promoting the commercial introduction of FCEVs and the hydrogen refueling infrastructure needed for a successful rollout of FCEVs by means of policy action:

- The Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles (EU 2009) promotes the development of a market for zero-emission and low-emission vehicles,

including FCEVs. It requires public authorities, contracting entities and operators under a public-service contract to take into account vehicles' operating lifetime energy and environmental impacts (including their CO<sub>2</sub> emissions) when procuring road transportation vehicles

- The "regulation setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO<sub>2</sub> emissions from light-duty vehicles " defines a limit for vehicle manufacturers' fleets and thereby also supports the introduction of FCEVs by European vehicle manufacturers. The regulation is currently undergoing amendment<sup>7</sup>
- The European Commission's proposal for a directive on the deployment of alternative fuels infrastructure explicitly names hydrogen as one of the main alternative fuel options substituting oil in the future. The draft directive requires Member States to develop national policy frameworks to promote the market development of alternative fuels and their infrastructure. In addition, Member States are required to ensure the build-up of a minimum refueling infrastructure for hydrogen in order to facilitate the circulation of FCEVs within their entire national territory (European Commission 2013)
- The German government's Mobility and Fuels Strategy acknowledges the potential of hydrogen-based mobility for a sustainable, low-emission road transportation system and recognizes that public-sector commitment may be required to support the market preparation phase (Federal Ministry of Transport, Building and Urban Development, 2013)
- The UK government has endorsed the role of FCEVs as a key pillar of its efforts to de-carbonize the transportation sector and announced its willingness to play an active role in the promotion of ultra-low-emission vehicles, including FCEVs (Office of Low Emission Vehicles, 2013)

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<sup>7</sup> On 29 November 2013, the Permanent Representatives Committee of the Council of the EU reached an agreement with the European Parliament on regulation (EC) No 443/2009: car manufacturers' fleets of new passenger cars have to reach 95g CO<sub>2</sub>/km by 2021, after a one-year phase-in period in which 95% of car sales have to comply with this target. Cars with low emission levels (less than 50g CO<sub>2</sub>/km) benefit from 'super credits'. See also: Council of the European Union, Informal agreement on car CO<sub>2</sub> emissions reduction, 29 November 2013, [http://www.consilium.europa.eu/uedocs/cms\\_data/docs/pressdata/en/envir/139786.pdf](http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/envir/139786.pdf)

# I. Approach and methodology

## ► **Interactive approach with industry stakeholders, financiers and public-sector stakeholders in the UK and Germany**

The study builds on an interactive approach involving stakeholders who play a key role in the rollout of HRS networks in the UK and Germany:

- **UK and German national coalitions:** Assumptions, methods and conclusions were shared and discussed with representatives of the national coalitions working on the market introduction of hydrogen-based mobility in the UK and in Germany
- **Potential financing partners:** Financiers that may be in a position to be part of a financing concept were involved into the study through workshop discussions, providing input on preconditions for financing, assessment of risk mitigation measures and financially viable commercial and legal structures
- **Public-sector stakeholders:** Assumptions and findings were shared and discussed with public-sector stakeholders with a focus on the feasibility of state support for financing the rollout of HRS infrastructure

## ► **Data sources for HRS rollout business cases**

Indicative business case calculations for the HRS rollout in the UK and Germany form the basis of this study.<sup>8</sup> The data used in these business case assessments were drawn from publicly available sources, cross-checked and validated by the coalition members and industry experts. Where no data were publicly available, industry experts' estimates were used to complement the available information. Publicly available sources used for the study include the following:

- Energy Independence Now (2012): Incentivizing Hydrogen Infrastructure Investment
- Study by various industry players, NGOs and governmental organizations: A Portfolio of Powertrains for Europe – a fact-based analysis
- A Roland Berger Strategy Consultants study for the German government on the successful commercial introduction of hydrogen-based e-mobility and fuel-cell vehicles in Germany (German title: "Analyse von Ansätzen für die erfolgreiche kommerzielle Einführung von Elektromobilität mit Wasserstoff und Brennstoffzellenfahrzeugen in Deutschland")

Data from these studies served as a basis for determining the procurement cost for HRS (CAPEX), the cost of running the HRS, including maintenance, electricity and insurance (OPEX), and the

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<sup>8</sup> Discussions continue within the national coalitions, and the assumptions underlying the business cases therefore need to be adjusted on an ongoing basis. Additionally, both FCEVs and HRS are new technologies that have never been deployed on an industrial scale before, and limited market research exists on the expected absorption of these technologies by the market. The business cases presented in this study should be seen as an illustration only, a way of assessing the main features and commercial challenges of the HRS rollout and of identifying the main financing challenges for the initial HRS infrastructure. However, although the business cases do not reflect mature, operating business plans that have been adopted by the national coalitions, the key findings of the analyses regarding the challenges for financing presented in this study are not fundamentally affected by adjustments to the assumptions underlying the business cases.

wholesale price for hydrogen to be paid by retailers. The data from the studies were validated and, where necessary, updated and expanded.

### ► Key parameters of the business case: HRS and FCEV rollout curves

The HRS rollout business case builds on two key parameters:

- Costs: The number of HRS to be installed by the joint venture and the resulting investment in the assets (CAPEX) and costs for running the stations (OPEX)
- Revenues: The number of FCEVs on the road and the resulting revenues of the joint venture from H<sub>2</sub> sales

The assumed HRS and FCEV ramp-up curves have a major impact on the business case for the HRS rollout. The following section discusses the assumed FCEV rollout and HRS ramp-up curves for the UK and Germany in this study and describes how they were developed.

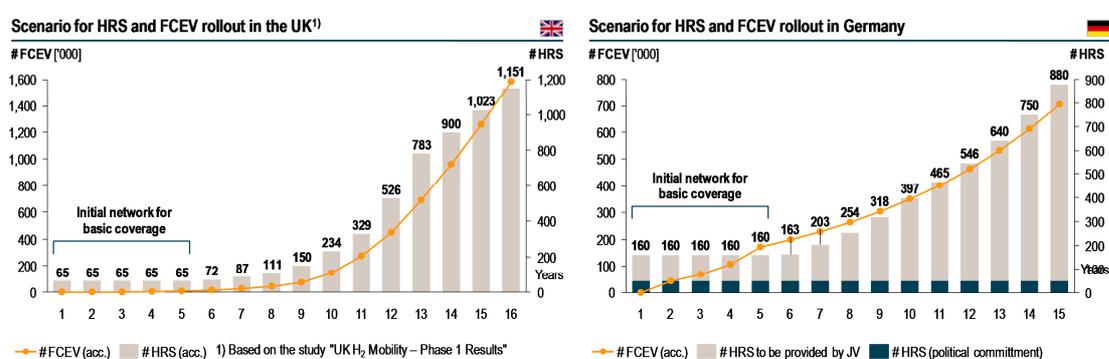


Fig. 19: HRS and FCEV rollout in the UK and Germany

For the UK business case, we used the FCEV ramp-up curve put forth by UK H<sub>2</sub> Mobility in its roadmap for the roll-out of FCEVs and HRS in the UK. The roadmap was developed in the context of a fact based study undertaken by the members of the UK H<sub>2</sub> Mobility project in 2012 (UK H<sub>2</sub> Mobility 2013).

The resulting scenario is characterized by a relatively slow FCEV market uptake in the first years after the market launch of the vehicles. Afterward, vehicle costs are expected to become more competitive, leading to a steep assumed increase in FCEV sales after Year 8. In Year 16, the scenario envisages a stock of roughly 1.6 m FCEVs in the UK, with annual sales volumes of above 300,000 vehicles.

The HRS ramp-up schedule for the UK business case was also derived from the roadmap for the rollout of FCEVs and HRS in the UK (UK H<sub>2</sub> Mobility 2013). This ramp-up plan is based on a quantitative consumer survey complemented by focus groups conducted in the UK, which served to evaluate consumers' expectations regarding the coverage of the HRS network. The analysis found that consumers' willingness to buy FCEVs depends largely on the convenient availability of HRS, both locally and nationwide.

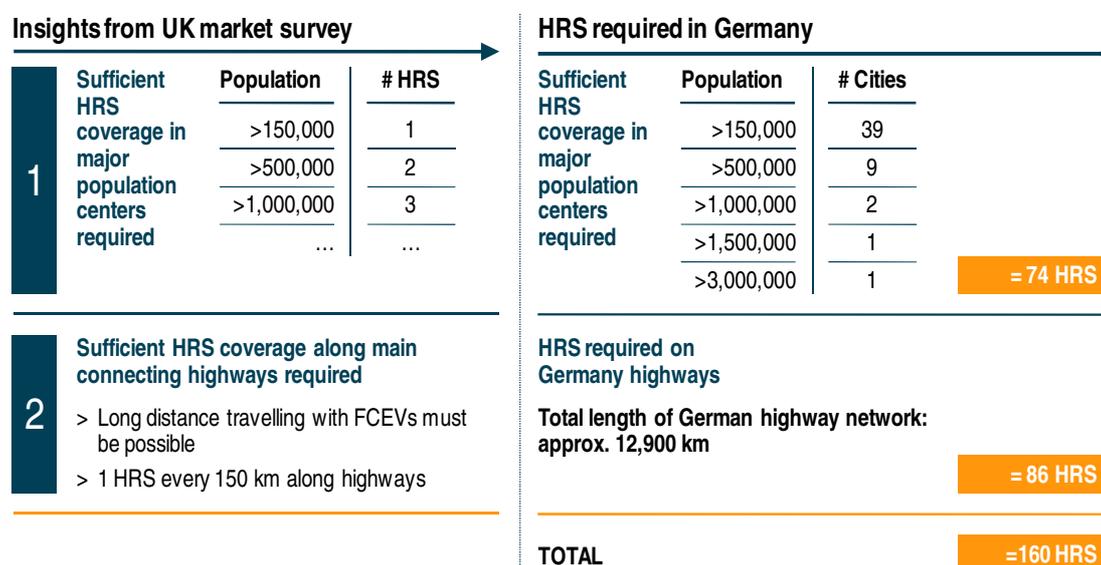
For Germany, the FCEV ramp-up curve was derived from scenarios for FCEV market uptake for the European Union as a whole<sup>9</sup>. This derived ramp-up scenario was updated to take into account recent developments. Most importantly, the beginning of the FCEV ramp-up was postponed to 2017, reflecting the decision by major carmakers to launch mass-market FCEVs in 2017. The FCEV ramp-up curve used in this study was approved by the Steering Committee for this study.

The vehicle ramp-up curve for Germany is characterized by comparatively high initial sales volumes. The increase in sales volumes in later phases is less steep than in the UK case, leading to a lower total FCEV stock of approximately 705,000 vehicles in Germany in Year 15, with annual sales volumes reaching a level of around 100,000 vehicles.

The HRS ramp-up schedule for the German business case was derived from the insights gained from the UK H<sub>2</sub> Mobility's consumer study for the UK market, applied in a rough top-down manner to the German market using the following assumptions:

- In every city with a population above 150,000, at least one HRS is required. The number of HRS per city increases in proportion to the population size
- One HRS should be available every 150 km on national highways

Applying this approach to the German market yields an estimated 74 HRS needed in larger cities across the country and 86 HRS needed on national highways. In total, the initial minimum network for basic coverage in Germany is thus approximately 160 HRS. This approach is in line with the results of a recent representative consumer survey on the acceptance of FCEV technology in Germany, which confirmed the fundamental importance of a basic refueling network for a successful market launch of FCEV (HyTrust 2013).



Source: Destatis (2013)

Fig. 20: Estimation of the initial HRS network required for Germany

<sup>9</sup> Based on scenarios developed in the study "A Portfolio of Powertrains for Europe – a fact-based analysis"

Furthermore, it was assumed that the number of HRS will remain constant for five years, until increasing FCEV sales improve the utilization of existing HRS. Starting in Year 6, the network will be extended roughly in proportion to the growth in the number of FCEVs on the road. After 15 years, it is assumed that the national network will reach a total of 880 HRS.

In June 2013, a number of industry stakeholders (Air Liquide, Air Products, Daimler, Linde and Total Germany) and the Federal Ministry of Transport, Building and Urban Development (BMVBS) concluded an official agreement to install 50 HRS in Germany by 2015 within the framework of the National Innovation Program Hydrogen and Fuel Cell Technology (NIP) as a large-scale research and demonstration project. These 50 HRS will be in place by 2015 and do not have to be provided and financed within the scope of the potential HRS rollout project that is the subject of our study. This leaves an initial network of 110 HRS to be financed through the rollout project. Accordingly, all of the business case analyses and results presented in the remainder of this study refer to this reduced number of HRS.

## ► Approach of the business case analysis and key concepts – Overview

To determine potential financing options for the HRS rollout, our study focuses on evaluating the HRS project business case with regard to two key criteria: profitability (i.e. the project's returns from an investor's point of view) and bankability (the project's ability to access debt financing). For the analysis of the business case, we draw on four key concepts typically used in financial analysis:

- Cash flow: A fundamental concept relevant for profitability and bankability
- Net present value (NPV): Used to assess profitability
- Annual debt service coverage ratio (ADSCR): Used to assess bankability
- Categories of project risks and risk assessment: Used to assess bankability

A full profitability or bankability analysis by a potential financier would typically draw on a broad variety of indicators associated with the specific business case to be financed. This exceeds the scope of this study and would also add little value with regard to the general, overarching insights on financing the HRS rollout which we aim to achieve. Therefore, we limit our assessment mainly to the key indicators listed above.

In the following sections, we explain how we used these concepts in our analysis of the profitability and bankability of the HRS rollout. We also provide a short explanation for readers who are not familiar with these concepts.

## ► Cash flow: A fundamental metric for business cases

### Cash flow – Concept

Cash flow analysis is used to determine the amount of cash generated (cash inflows) and used (cash outflows) by an economic entity (i.e. a company or a project vehicle) in a given period of time. It is a key metric of an economic entity's financial performance. Unlike some other KPIs, it is not distorted by accounting effects and captures the fundamental economic reality of business operations, as it focuses on actual movements of money.

Cash flows are typically broken down into three categories:

1. Cash flows from operating activities (the proceeds from regular business activities, most importantly cash inflows from sales revenues and cash outflows from operating costs)
2. Cash flows from investing activities (in particular sale or purchase of assets)

### 3. Cash flows from financing activities (in particular issuing of debt or equity)

#### Cash flows in our analysis

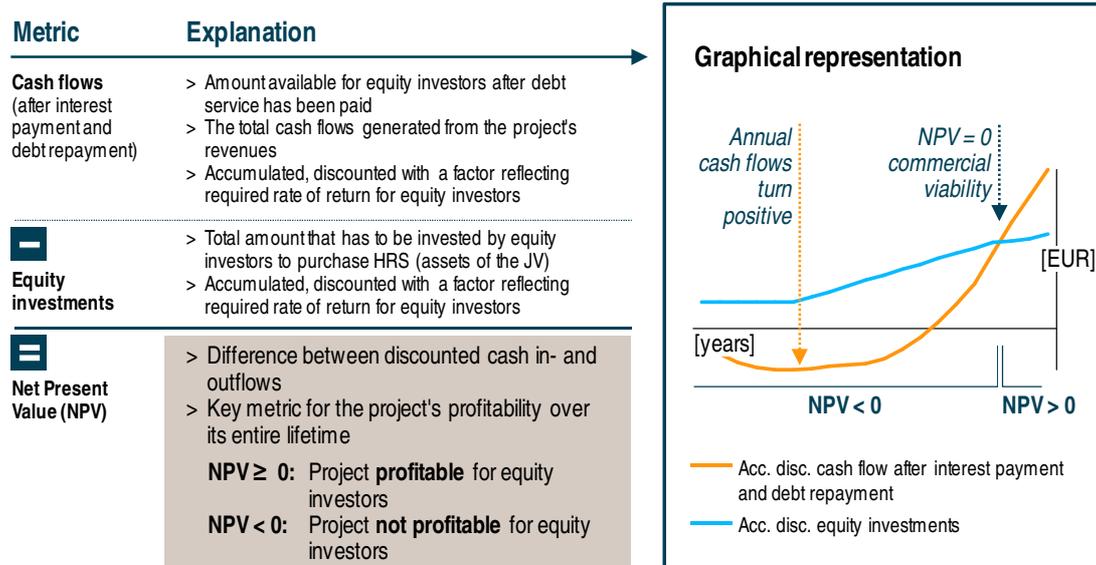
The actual or projected cash flows generated by a project's business activities are crucial for assessing both bankability and profitability/returns. In a bankability assessment, the financial analysis focuses on whether the cash flows generated by the project's operations are sufficient to meet its debt service obligations. In a profitability assessment, the cash flows generated by a project over the time horizon of the investment are analyzed and benchmarked against a required rate of return. The use of cash flows as an input for bankability and profitability assessments is explained in the relevant sections below.

#### ► Methodology of the profitability analysis for the HRS rollout

#### Net present value (NPV) – Concept

The NPV is a key metric to assess the overall profitability of an investment project from an equity investor's point of view. It represents the difference between the discounted cash inflows and cash outflows of a project, accumulated over the entire time period under assessment. The cash flows are discounted using the investor's required rate of return, i.e. the minimum rate of return that is acceptable to the investor for a certain investment. An NPV equal or greater than zero indicates that the investment meets or exceeds the equity investor's required rate of return.

As long as accumulated discounted cash flows after interest payment and debt repayment are lower than the accumulated discounted equity investments, the NPV is negative. The NPV is zero where the two curves intersect (breakeven point). It is above zero when the accumulated discounted cash flows after interest payment and debt repayment are higher than the accumulated discounted equity investments.



Source: Roland Berger

Fig. 21: How the NPV assessment works

## NPV in our analysis

To provide a complete assessment of the overall commercial viability of the business case for the HRS rollout, we need to determine if the project, over its entire lifetime, yields a sufficient minimum rate of return to meet equity investors' expectations. In our illustrative business case analysis, we use the NPV as an indicator to assess the profitability of the rollout project.

### ► Methodology of the bankability analysis for the HRS rollout

One of the main objectives of our study is to determine when and under which conditions the HRS rollout could secure funding from private financiers, especially in the form of debt financing. For that purpose, we carried out a rough "bankability analysis" of the project.

Before providing loans, lenders analyze the bankability of a project. Successfully passing this test is a precondition for accessing financing. While the exact procedure followed in a bankability analysis differs for different lenders and investors and changes over time, financiers typically evaluate two main aspects of bankability:

- I. Ability to cover debt
- II. Risk control

#### I. Ability to cover debt

Banks analyze various project KPIs to determine whether the project will be able to cover the debt service and interest payments. Typical KPIs used by banks are shown below.

#### Most frequent financial covenants

Bank's question	Covenant providing answer	Frequency of use of covenant
Is the cash flow sufficient to service interest and debt repayment?	Annual Debt Service Cover Ratio (ADSCR) > 1.1-1.5	 <i>Very high</i>
How sustainable is the capital structure?	Leverage Ratio < 4.0-4.6	 <i>Very high</i>
To what extent are earnings available to cover interest payments?	EBITDA Interest Cover > 3.0-3.6	 <i>High</i>
How much leeway is there to improve free cash flow in case investment stops?	CAPEX Limit < 110-115% of planned value	 <i>Medium</i>

Source: Roland Berger

**Fig. 22:** Indicators most commonly used in bankability assessments

#### Annual debt service coverage ratio (ADSCR) – Concept

The debt service coverage ratio (DSCR) helps potential lenders determine if a company or project vehicle will be able to cover its debt repayment and interest payments out of the cash flows

generated through its operations. DSCR can be calculated as cash flows before interest payment and debt repayment over total debt service in a given year:

- If  $DSCR < 1$ , cash flows are too low to meet the debt service obligations
- If  $DSCR = 1$ , cash flows are just enough to cover the debt service obligations
- If  $DSCR > 1$ , cash flows exceed debt service obligations

However, it is important to note that in real life, banks and other lenders will typically ask for a DSCR well above 1.0. This is because the borrowing entity's cash flows are likely to fluctuate due to variation in demand and possible cost increases. To hedge against these risks, lenders typically want to see a certain buffer in the project's ability to cover debt. This buffer ensures that the debt will be serviced even if the business outlook deteriorates over time.

One key distinction regarding the ability to service debt is between corporate finance and project finance. This distinction is discussed later in this study (see **Chapter J**). For the time being, it should be noted that in the case of corporate finance, the project sponsor's general assets and revenues serve as security for lenders. When reviewing a corporation's request for a loan for a project, lenders look at the cash flows generated by the company as a whole and assess the assets on the company's balance sheet as potential collateral. The project sponsor's general creditworthiness thus determines the availability of financing and the terms under which it is offered.

In the case of project finance, lenders are repaid exclusively from the cash flows generated by the project itself. The general assets of the project's shareholders or the cash flows generated through other business activities are not subject to recourse by lenders ("non-recourse" financing). Thus, lenders focus their analysis on the project's capacity to produce sufficient secure cash flows.

### **ADSCR in our analysis**

In our rough bankability analysis, we use ADSCR as an indicative quantitative proxy for basic bankability requirements, along with an assessment of the risks associated with the project at different points in time.

While financiers use a large array of indicators to assess a project's bankability, we focus on the ADSCR analysis, since this metric yields the insights we require to identify the basic conditions that must be met in order for the HRS rollout to access financing.

## **II. Risk control**

Financiers analyze and evaluate project risks before they decide to provide financing. Lenders and investors will consider a project bankable only if the main risks are controlled or absorbed. Typical infrastructure projects, for example, are considered low-risk projects once the construction has been completed. They usually involve a capital-intensive asset (e.g. a road or pipeline) that yields highly predictable and stable revenues guaranteed through long-term contractual agreements with a very limited market risk. The main risk is typically a delay or cost excess during the construction period, and investors may decide to enter the project only after construction is completed.

In general, risks that cannot be controlled by risk mitigants implemented via the project and that are not absorbed by other stakeholders with the required financial capacity are a show-stopper for financing. The only regular exception is where the investment or loan is secured via the assets and returns of a corporation with a good credit rating (see also **Box 3** on corporate finance vs. project finance).

### Typical categories of project risks:

- **Market risks:** The market does not pick up the product as well as expected – lower sales and lower revenues than forecast are the result
- **Planning risks:** Higher costs than expected and/or delays to the project lead to cost overruns. For example, the project is delayed in the construction or rollout phase. The project organization already has to meet the construction or rollout costs, including financing costs, but the project does not yet generate revenues. As a consequence, the project costs are higher than initially planned, cash inflows are delayed and additional capital may be required
- **Technology risks:** Equipment used in the project has higher failure rates and/or maintenance costs than expected, which results in higher project costs. This risk is especially relevant if new technologies or even prototypes are used in a project
- **Regulatory risks:** The laws and regulations governing the project (e.g. the law on feed-in tariffs for electricity in renewable energy projects) change unexpectedly and lead to additional costs or lower revenues than expected. For example, a project's business case assumes that the project will benefit from tax advantages, but the laws providing these tax advantages are later changed. As a consequence, the project has to pay higher taxes than initially forecast

### Ways to address project risks

Two principal ways of addressing project risks can be distinguished:

- **Risk mitigation:** This approach aims at preventing risks from materializing in order to avoid the resulting negative financial impact. Depending on the specific risk at hand, this can be achieved by a variety of means, such as creating the right incentives for relevant actors or implementing effective control mechanisms
- **Risk absorption:** This approach means that one or more actors with a stake in the project commit themselves to covering the financial burden that would arise if a particular risk is realized. The potential financial losses relating to the risk are thus borne and absorbed by that actor

### Assessment of project risks in our analysis

In our analysis, we assessed the project risks for the HRS rollout using two methods:

- A quantitative analysis: The potential impact of risks materializing on NPV and ADSCR (sensitivity analysis)
- A qualitative assessment: The importance of risks from the point of view of financiers

This allowed us to qualify all the project risks for the HRS rollout and identify the most important ones (in particular the FCEV ramp-up, which translates into hydrogen sales). Our analysis then focuses on these risks.

## Key learnings from Chapter H: Approach and methodology

Results presented in this study draw on and are confirmed by an interactive approach with the UK and German coalitions driving HRS rollout, with financiers and with public sector stakeholders.

The business cases for UK and Germany used in this study serve as an illustrative tool and to generate findings on financing options for HRS rollout.

Key parameters of the business cases are (1) the FCEV ramp-up curve and resulting revenues from H<sub>2</sub> sales, and (2) the HRS rollout curve and resulting investments. The FCEV ramp-up and HRS rollout curves for the UK business case are based on the roadmap provided by UK H<sub>2</sub> Mobility. For Germany, the FCEV ramp-up curve was derived from a scenario for the EU, and the HRS ramp-up curve was developed by roughly applying the results from a UK consumer survey to the German context. The rollout scenarios used by the national coalitions are subject to ongoing discussions. Therefore, the most up-to-date versions of the scenarios may deviate from the scenarios used in this study. This will, however, not change the fundamentals of the business case.

Input data for the business cases (e.g. on OPEX and CAPEX) were derived from publicly available data sources that were cross-checked and validated by the national coalitions and industry experts, and, where no data was available, estimates from industry experts were used.

Both the German and the UK business cases reflect the need for an initial HRS network covering main population centers and highway connections, which has to be available when FCEVs are brought to the market. FCEV ramp-up curves develop differently: For the UK, the assumption is a slow market uptake but a steep increase in year ten. For Germany, comparatively higher sales are assumed in the first years, but then sales increase less steeply.

Based on these data, this study provides a rough profitability and bankability analysis for HRS rollout using the following key concepts:

- Cash flows
- Net present value (NPV)
- Annual debt service coverage ratio (ADSCR)
- Categories of project risks and risk assessment

## J. Business case for the HRS rollout – Detailed analysis

### ► Main drivers of the business case for the HRS rollout

The business case for creating the HRS infrastructure rests on two key elements. These two elements determine its commercial viability and ultimately the feasibility of its financing. They are as follows:

- Costs: HRS involve procurement costs (CAPEX) and running costs (OPEX). Both cost blocks depend directly on the number of HRS that are built and operated
- Revenues: The amount of H<sub>2</sub> sold through the HRS translates into the project's revenues. These revenues depend directly on the number of vehicles on the road, which drives the demand for hydrogen

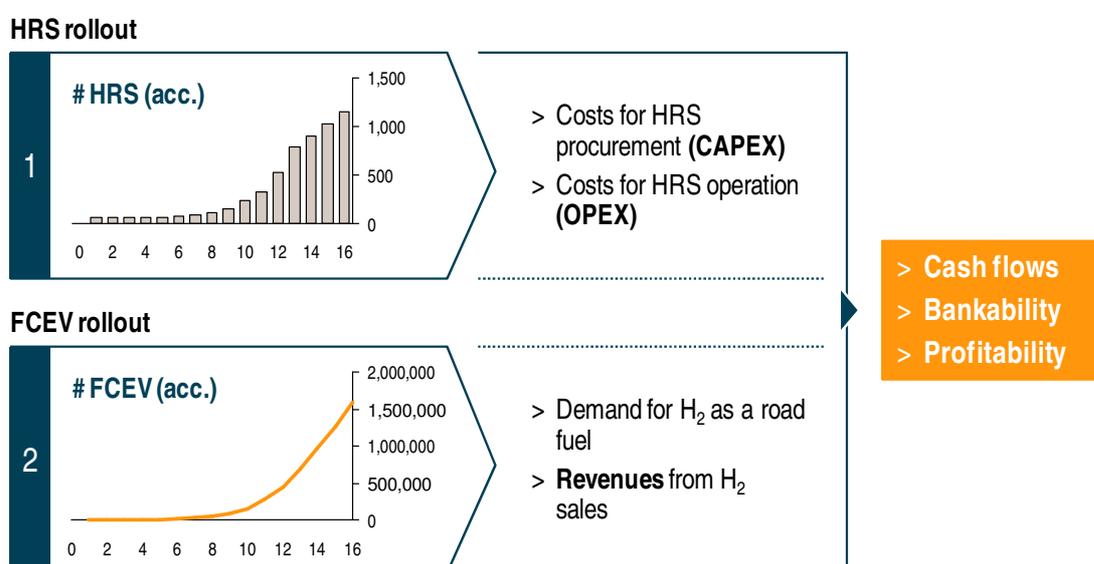


Fig. 23: Main drivers of the business case for the HRS rollout

### ► Underutilization of the initial HRS network

Building and operating an infrastructure that is underutilized in the initial years represents a challenging business case, as losses in the early years will put a heavy burden on both financing costs and later operating margins.

The network of HRS has to be deployed and operated before significant revenues can be generated from H<sub>2</sub> sales. There will thus be a period of underutilization until such time as FCEVs become more popular and the demand for H<sub>2</sub> as a road fuel increases. During this period the infrastructure will incur losses. The development of the FCEV market will determine how long this phase lasts and how large the losses are.

The result is low cash flows and high risks at the start of the HRS rollout. As far as cash flows are concerned, our calculations show that the project will incur negative cash flows from operations in the initial years of the rollout, with the costs of running the HRS exceeding the revenues generated from H<sub>2</sub> sales. This reflects the underutilization of the stations. In the German case, the period of

negative operating cash flows is estimated to last approximately for the first four years. For the UK, our calculations show negative operating cash flows for the first seven years, reflecting the lower level of initial FCEV sales in the UK scenario.

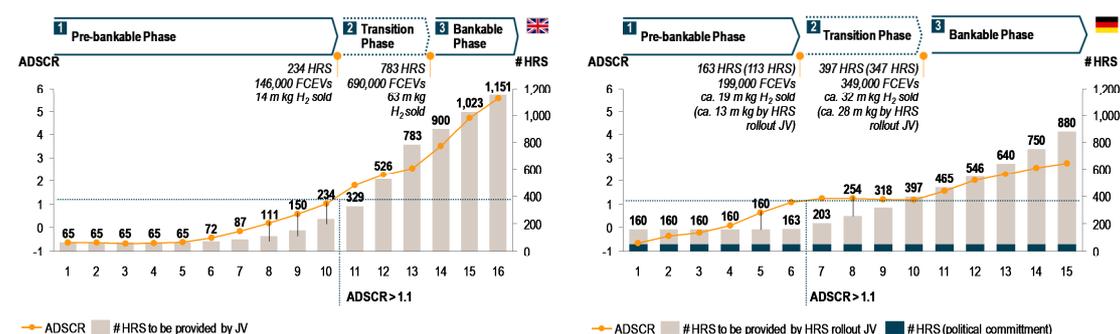
In terms of risk, the HRS rollout project is first and foremost subject to a significant demand risk. The project's sales revenues depend exclusively on the number of FCEVs on the road, which determines the demand for hydrogen. At the same time, a commercial-scale market for FCEVs needs to be built from scratch, with no proven sales track record for FCEVs. The future level of revenues is therefore highly uncertain. A delayed or weaker FCEV ramp-up compared to the baseline of the assumed ramp-up curves could result in considerable revenue shortfalls.

In this regard, the business case for the HRS rollout differs substantially from more "regular" infrastructure projects, where a capital-intensive asset (e.g. a road or a pipeline) yields highly predictable and stable revenues, typically guaranteed through long-term contractual agreements. These stable cash flows, in turn, provide security for potential lenders, which facilitates access to debt financing from banks.

► **HRS rollout is not bankable at first – Debt may become available gradually**

The strong underutilization of the assets in the initial years of the HRS rollout, and the resulting negative cash flows, suggest that the project will have difficulty accessing financing in the beginning.

As discussed in **Chapter III.H**, a typical bankability assessment for a project seeking financing rests on two main pillars: the (projected) ability to service debt and the level of project risks. An analysis of the development of the project's ADSCR provides insights into the ability of the HRS rollout to meet its debt service obligations. Thus, an ADSCR value above 1.1 can be considered a minimum threshold for a basic bankability requirement, as it indicates that the cash flows generated through the project exceed the debt service obligations by a slight margin. We based our ADSCR analysis on a hypothetical financing structure for the JV of 30% equity and 70% debt (for a detailed overview of the assumptions, see the **Annex**). We used ADSCR as an indicative quantitative proxy for the project's bankability.



**Fig. 24:** ADSCR analysis for the HRS rollout in UK and Germany

Our ADSCR analysis of the business case for the HRS rollout yields similar findings for the UK and Germany. In both cases, ADSCR is well below 1 in the first years of the HRS rollout, indicating that the cash flows generated by the project are insufficient to meet the debt service obligations. This is a direct reflection of the problem of underutilization and negative operating cash flows in the initial years. In the UK, ADSCR remains well below 1 for approximately ten years and then increases

steeply, reflecting the assumed dynamic growth of the FCEV stock. In Germany, projected ADSCR passes the threshold of 1.1 sooner (after about 7 years), reflecting the higher initial sales levels in the German scenario. ADSCR then stagnates at just above 1.1 for a few years and then starts to grow dynamically as utilization of the HRS network improves

These results suggest that, from a financing point of view, the HRS rollout can be divided into three phases:

- In **Phase 1 (the Pre-bankable Phase)**, cash flows from running the HRS network are too low to meet the debt service obligations. Additionally, the development of H<sub>2</sub> revenues is still highly insecure, as FCEV deployment on a mass-market scale has only just started. The project is subject to significant market risk at this stage – if the FCEV rollout does not take place at the forecasted scale or is delayed, the HRS network will incur significant revenue shortfalls. Based on our evaluation, Phase 1 is likely to last longer in the UK than in Germany due to the more moderate initial FCEV ramp-up in the UK-scenario. Financing from private lenders will not be available for the HRS rollout in this phase. Phase 1 will therefore have to be financed through equity from strategic investors, potentially complemented by support from the public sector.
- In **Phase 2 (the Transition Phase)**, H<sub>2</sub> sales generate sufficient positive operating cash flows to allow for debt repayments and interest payments. However, the rollout is still subject to significant market risk, as the FCEV market and resulting demand for H<sub>2</sub> are still developing. In Germany, ADSCR is just above 1 in the Transition Phase, indicating that there is hardly any buffer after debt service and interest payments to absorb potential shortfalls in the projected cash flows. In the UK, projected ADSCR is higher in the Transition Phase due to a steeper increase in FCEV sales. Financing from private lenders (e.g. commercial banks) will still not be accessible for the HRS rollout in the Transition Phase due to the high level of risk. However, this phase could see the start of partial debt financing through public bank facilities with the capacity to absorb higher risks. This would help the rollout to gradually build up a credit history, which would help it access debt financing from private investors at a later stage.
- In **Phase 3 (the Bankable Phase)**, basic demand for H<sub>2</sub> is established thanks to a sufficiently large FCEV stock, and the utilization rate of HRS is high enough to generate sufficient operating cash flow for debt service, including an appropriate buffer. The H<sub>2</sub> demand risk is still present, but to a much lower extent than before. A solid, multi-year track record of successful large-scale FCEV ramp-up and H<sub>2</sub> sales by the HRS rollout JV indicates that the market risk is unlikely to be realized at this stage. As a consequence, commercial bank debt becomes available in this phase.

### ► Profitability is only achievable toward the end of the project

To assess the profitability of the HRS rollout, we analyzed the project's NPV, building on the results of the previous bankability analysis. We split the business cases for the UK and Germany into three phases: Phase 1 (Pre-bankable Phase) with pure equity financing, Phase 2 (Transition Phase) with 20% debt financing, and Phase 3 (Bankable Phase) with 70% debt financing – see the **Annex** for detailed assumptions.

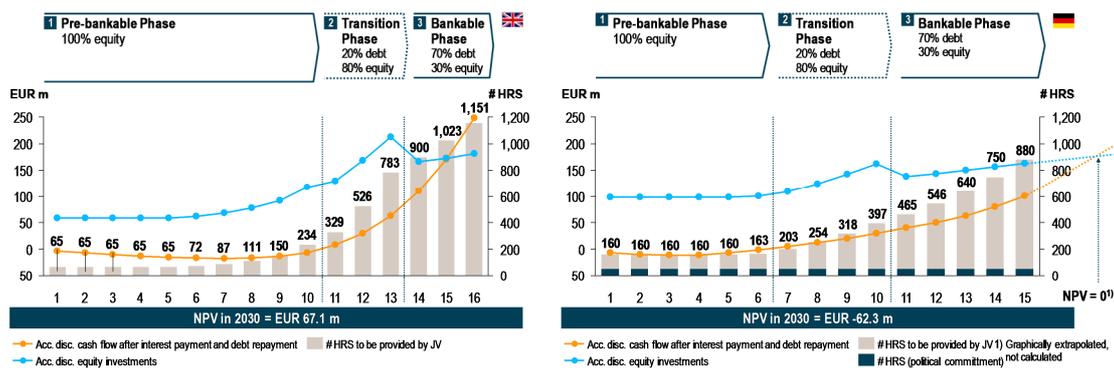


Fig. 25: NPV analysis for the HRS rollout (UK and Germany)

The NPV analysis of the business cases for the HRS rollout produces similar findings for the UK and Germany. In the initial years of the HRS rollout, cash flows are negative, as HRS operating costs exceed revenues from H<sub>2</sub> sales. Positive cash flows from the operations of the HRS JV that can be disbursed to equity holders only become available after a few years (approximately five years in Germany and eight years in the UK). The NPV breakeven point is late, but the project is expected to reach profitability eventually in both cases. The UK business case shows a positive NPV after 16 years, resulting from a very strong increase in H<sub>2</sub> demand toward the end of the period examined. The German business case shows a negative NPV after 15 years, but a consistent and strong upward trend in the final years, which suggests profitability will be reached after the time period captured by our analysis.

From an investment perspective, the business case for the HRS rollout is challenging for both equity investors and lenders. Most importantly, equity investors have to accept a very long phase of low returns before the project finally breaks even. Furthermore, reaching the breakeven point hinges on strong growth in revenues from H<sub>2</sub> sales more than ten years into the project. This revenue boost is subject to an important caveat, however: When HRS utilization rates go up and HRS can be run profitably a few years after the start of the rollout, competitors are likely to enter the market and capture a share of it. This would result in lower revenues and lower profit margins for the project than reflected in our business case evaluations.

Overall, our analysis suggests that, looking at the HRS rollout as a standalone investment project, equity investors would be very hesitant to provide capital for the project at the beginning of the rollout. However, strategic equity investors could be expected to invest in the HRS rollout due to the strategic value of the project with regard to their core business activities (for a detailed discussion of strategic equity investors, see Chapter III.H).

### ► Risks in the HRS rollout

The business case for the HRS rollout is subject to a number of specific risks that may affect the economic performance of the JV, and as a consequence its ability to service debt.

We identify eight relevant project risks for HRS rollout. The risk of lower FCEV sales than expected or a delayed FCEV rollout ("FCEV ramp-up risk") is the key risk from financiers' points of view (see Chapter III.H for risk categories).

Risks	Market	Technology	Planning	Regulation
1 FCEV sales lower than expected / delayed FCEV rollout	✓			
2 Delayed HRS rollout		✓	✓	
3 Unexpected change in H <sub>2</sub> taxation				✓
4 Lower H <sub>2</sub> retail margin	✓			
5 HRS price development below forecast	✓	✓		
6 Higher HRS procurement price	✓	✓		
7 Costs of JV operation exceed forecast			✓	
8 HRS OPEX exceed forecast	✓	✓		

Key risk from investors' point of view

Fig. 26: Overview of risks in the HRS rollout

- Risk 1 – FCEV sales lower than expected or FCEV rollout delayed:** The demand for H<sub>2</sub> as a road fuel is determined solely by the number of FCEVs on the road. If the number of FCEVs falls short of the levels foreseen by the ramp-up curves reflected in the business case for the HRS rollout, HRS revenues decrease accordingly. This risk comes in two main forms: (1) The market uptake of FCEVs could be slower than expected, and (2) the market introduction of FCEVs by carmakers could be delayed.

Compared to other risks, the shortfall in demand for H<sub>2</sub> is by far the most relevant and fundamental risk for the HRS rollout. Given the fact that there is no established market for FCEVs yet, there is substantial uncertainty regarding the timing and success of the commercial-scale FCEV market launch and the evolution of vehicle sales over time. Moreover, the FCEV ramp-up risk is purely exogenous, in other words it cannot be controlled or mitigated through precautionary measures by the project organization. Accordingly, this risk was universally named as the single most critical risk by all potential investors involved in the study (public banks, private banks, private equity, infrastructure investors). It should therefore be treated as the **make-or-break risk** for the HRS rollout project.
- Risk 2 – Delayed HRS rollout:** A delay in the HRS rollout would mean that part or all of the investment cost for the initial network would have to be met before revenues from H<sub>2</sub> sales were generated; these would only begin later, when the HRS came on stream. In addition, FCEV sales can be expected to be lower than forecast in the years following the delay, due to a drop in consumer confidence in the reliability and availability of the technology. This risk could have a number of causes, such as station operators' unwillingness to include H<sub>2</sub> in their portfolio, a delay in the delivery of HRS by suppliers, or mistakes in the planning or permission processes.
- Risk 3 – Unexpected change in H<sub>2</sub> taxation:** The current business case estimations assume that hydrogen as a road fuel will be subject to VAT, but exempt from the fuel taxes levied on conventional fossil fuels. An increase in hydrogen taxation would result in lower revenues for the HRS JV. An increase could also occur once the HRS network was in operation, due to a change in legislation.

- **Risk 4 – Lower retail margin:** Lower retail margins from H<sub>2</sub> sales could result either from a lower than expected sales price for H<sub>2</sub> at the pump or from a higher than expected wholesale price for H<sub>2</sub>, paid by the JV.
- **Risk 5 – HRS cost development below forecast levels:** Cost reductions for procuring HRS due to learning effects and economies of scale may be lower than expected.
- **Risk 6 – Higher HRS procurement price:** It is also possible that the HRS procurement price in the first year of the rollout will be higher than anticipated. This higher base price would translate into higher CAPEX throughout the entire project lifetime.
- **Risk 7 – Costs of JV operation exceed forecast levels:** Costs for the management of infrastructure projects often exceed forecast levels, especially in complex construction phases (or in this case, rollout phases). The costs of running the project organization or the JV that handles the HRS rollout are not reflected in the business case.
- **Risk 8 – HRS OPEX exceeds forecast levels:** The operating costs for the HRS network (maintenance, electricity, insurance, etc.) exceed forecast levels.

#### ► Sensitivity analysis of the HRS rollout

To explore the potential financial impacts of these risks, we examined each risk's quantitative effect on the business case by means of a **sensitivity analysis**. The sensitivity analysis shows changes in NPV and ADSCR resulting from particular risks being realized, compared to the baseline business case. The results shown below refer to the German business case, for illustration purposes. Results obtained for the UK business case were comparable.

RISK		SENSITIVITY ANALYSIS	
		NPV [EUR m]	ADSCR at start Bankable Phase
Description	Variation		
<b>1</b> FCEV sales lower than expected – insufficient H <sub>2</sub> demand  & Delayed FCEV rollout – H <sub>2</sub> demand grows more slowly than forecast	Baseline: 705,000 FCEVs in 2030	-62.3	3.1
	-15%: 599,000 FCEVs in 2030	-101.1	2.29
	-30%: 493,500 FCEVs in 2030	-143.6	1.4
	-1 year: 613,000 FCEVs in 2030	-102.5	2.45
<b>2</b> Delayed HRS rollout – station operators unwilling to include H <sub>2</sub> in portfolio/ delay in delivery/planning mistakes <sup>1)</sup>	Baseline: start 2016, ready 2017	-62.1	3.1
	-1 year (start of HRS rollout in 2017, ready for use by FCEVs in 2018)	-177.7	0.91
	-3 years (start of HRS rollout in 2019, ready for use by FCEVs in 2020)	-231.3	0.06
<b>3</b> Unexpected change in H <sub>2</sub> taxation <sup>2)</sup>	Baseline: VAT, but no energy tax	-62.3	3.1
	Energy tax equivalent to LPG: 0.67 EUR / kg H <sub>2</sub>	-126.3	1.79
	Energy tax equivalent to diesel: 2.54 EUR / kg H <sub>2</sub>	-347.6	-2.1
<b>4</b> Lower H <sub>2</sub> retail margin – sales price lower or procurement price higher than expected	Baseline assumptions	-62.3	3.1
	H <sub>2</sub> sales price: -5%	-96.2	2.4
	H <sub>2</sub> sales price: -10%	-131.4	1.65
	H <sub>2</sub> procurement price: +5% <sup>3)</sup>	-83.1	2.7
	H <sub>2</sub> procurement price: +10% <sup>3)</sup>	-104.4	2.25
<b>5</b> HRS price development below forecast	Baseline: 0.6% p.a. cost decrease	-62.3	3.1
	0.4% p.a. cost decrease	-66.6	3.0
	0.2% p.a. cost decrease	-71.0	3.0
<b>6</b> Higher HRS procurement price	Baseline: EUR 896,000 per HRS in 2016	-62.3	3.1
	+5 %: EUR 941,000 per HRS in 2016 <sup>4)</sup>	-71.7	3.0
	+10 %: EUR 986,000 per HRS in 2016 <sup>4)</sup>	-81.2	2.9
<b>7</b> Costs of JV operation (cost of SPV) exceed forecast	Baseline: no SPV costs included in business case	-62.3	3.1
	SPV cost included <sup>5)</sup>	-82.5	3.1
	SPV cost higher than expected <sup>6)</sup>	-91.4	3.0
<b>8</b> HRS OPEX exceed forecast	Baseline: Total Retail OPEX 2030: EUR 93.3 m	-62.3	3.1
	+5% (Total Retail OPEX in 2030: EUR 97.9 m)	-68.8	3.1
	+20% (Total Retail OPEX in 2030: EUR 111.9 m)	-88.3	2.6

- 1) Assumption: Delay in HRS results in corresponding delay in FCEV ramp-up plus reduced FCEV ramp-up-level (70% of initial curve) due to drop in consumers' confidence in technology. CAPEX expenditure occurs according to original schedule
- 2) Business case assumes that H<sub>2</sub> sales price to customers remains unchanged. The burden of the tax is thus fully absorbed by the JV through lower revenues. Taxation levels for H<sub>2</sub> relative to other fuels are computed on an approximate cost per km basis
- 3) Business case assumes that H<sub>2</sub> sales price to customers remains unchanged when H<sub>2</sub> procurement price increases (10% below diesel price to ensure competitiveness). The burden of the higher procurement price is thus fully absorbed by the JV through lower revenues
- 4) Price increase refers to higher HRS procurement price at the beginning of the HRS network rollout. Subsequent price reductions (learning rate 0.6%) are computed based on the increased initial price, resulting in higher HRS procurement costs throughout the entire project
- 5) Rough cost estimate (SPV management costs starting at EUR 5 m p.a. in 2016 and decreasing gradually to EUR 1 m p.a. in 2030)
- 6) SPV management costs starting at EUR 7 m p.a. in 2016 and decreasing gradually to EUR 2 m p.a. in 2030

Fig. 27: Sensitivity analyses

## Key learnings from Chapter I: HRS rollout – A challenging business case

The main characteristics of the business case for the HRS rollout are as follows:

- **In the first years of the project, cash flows are negative:** Negative cash flows result from the underutilization of HRS in the early years of the project. An initial network for basic coverage is needed right from the start, which results in high upfront investments and operating costs. This combines with a gradual FCEV ramp-up, translating into low initial demand for H<sub>2</sub>
- **The HRS rollout has three phases with regard to accessing financing:**
  - Phase 1 – Pre-bankable Phase:** The HRS rollout does not yet have sufficient cash flows to cover debt service and interest payments. The risk level of the project is very high. As a consequence, financing from public and private lenders and investors cannot be accessed. Instead, the HRS rollout has to rely on investments from strategic equity investors and potentially public-sector support
  - Phase 2 – Transition Phase:** Cash flows from operating the network are just high enough to cover debt service and interest payments. The risk level of the project is still high. While investments and loans from most private financiers are still not available, public banks with instruments that have a higher risk appetite may consider providing funds for the HRS rollout at this stage
  - Phase 3 – Bankable Phase:** Cash flows are sufficient for debt service and interest payments, including an adequate buffer. Project risks are significantly lower. Market risk in particular is less relevant, because sufficient FCEVs are on the road to provide relatively secure demand for H<sub>2</sub> and resulting revenues for the JV. As a consequence, investments and lending from private financiers also becomes available in this phase
- **The HRS rollout is expected to be profitable, but profitability will only be reached late in the project:** Investors have to accept a long phase of low returns before the project breaks even. Once HRS utilization rates increase and HRS can be run profitably, competitors are likely to enter the market and narrow the returns of the planned HRS rollout JV
- **The HRS rollout is subject to significant project risks:** The most important project risk for the HRS rollout is the market risk – a slower or less steep growth curve for FCEVs on the market resulting in less demand for H<sub>2</sub> and lower returns for the HRS rollout JV than projected

## K. Corporate finance or project finance?

### ► The difference between corporate finance and project finance for the HRS rollout

Strategic investors in the HRS rollout project will have to decide if they want to finance the HRS rollout through corporate finance or through project finance.

#### **BOX 3: Corporate finance or project finance – What is the difference?**

With **corporate finance**, one or several corporations decide to fund a project as part of their overall business. The project is handled by existing corporate structures or by new structures set up within the corporations. Financing is organized by the corporations' own corporate finance departments and the assets of the company are available to hedge risk. Potential sources of financing for the project include equity, debt and capital generated by the corporations' operations.

Key characteristics of handling a project via corporate finance are:

- Debt obtained for the project via corporate finance is secured via the project sponsors' general balance sheets, i.e. the assets of the corporations involved in the project serve as collateral for creditors. As a consequence, risks are automatically absorbed by the project sponsors. Debt raised for a project by large industry stakeholders with a good credit rating via corporate finance is typically cheaper than debt obtained via project finance (the latter is not secured via the corporations' balance sheets)
- Corporations allocate their financial resources between competing investment opportunities and follow internal rules about the allocation of financial resources
- The handling of the project is typically organized within existing structures of the corporation. As a consequence, transaction costs are comparatively low
- The financing setup for the individual project is less complex than the financing setup for project finance. Debt is raised by the corporate finance department, mostly in cooperation with existing financing partners (e.g. banks affiliated with the firm)

In the case of **project finance**, one or several corporate project sponsors provide funds to a special purpose vehicle (SPV), i.e. a legally independent entity that has the single purpose to build and operate a project, and secure the required financing. Potential sources for financing are equity, debt and capital generated by the project. Corporate assets of the project sponsors, beyond the assets of the SPV itself, are not available to serve as collateral and absorb risks.

Typical characteristics of handling a project via project finance are:

- Debt raised for the project is secured via the project's assets and cash flows only. Lenders do not have recourse to the corporate project sponsors' balance sheet assets or to the corporations' overall cash flows to secure their claims (non-recourse debt). As a consequence, risks are concentrated at the SPV. Therefore, lenders and investors put a strong emphasis on a solid risk mitigation concept and on mechanisms which ensure predictable, guaranteed revenue streams. Given the higher risk level, debt raised for a project by large industry sponsors with good credit rating via project finance is typically more expensive than debt obtained by the same sponsors via corporate finance
- The cost effectiveness of the SPV setup depends on the size of the project. While the setup

of the SPV results in high transaction costs (e.g. organizational setup, complex contractual arrangements between shareholders, complex financing structure, extensive contracting), the SPV also achieves economies of scale through the concentration of operational management (e.g. coordination of contractors, handling of contracts and lease agreements). For large projects with a high number of project sponsors, economies of scale are likely to exceed transaction costs

Due to its high transaction costs and the limitation of lenders' recourse to the project's assets and cash flows, project finance is typically used for large projects with secure or guaranteed revenues. For example:

- Large gas or oil pipeline projects – These infrastructure projects provide secure revenues based on long-term contracts with offtakers (often >20 years). Financiers typically invest in these projects after the construction phase, since this phase is subject to a higher risk level than the subsequent operations phase
- Renewable energy projects in Germany – These projects benefit from a statutory feed-in tariff, combined with a legally enshrined feed-in priority. Based on these solid guarantees, renewable energy projects benefit from a long-term secure return perspective, while high project risks are concentrated in the construction phase, before the power generating unit comes on stream

In the case of corporate finance, debt financing is available from the start of the HRS rollout, since loans are secured through the general balance sheet of strategic investors. In the case of project finance, the leverage of strategic equity through debt financing and private investments starts to become possible in the transition phase of the HRS rollout.

#### ► Implications for risk mitigation of the HRS rollout

While the HRS rollout is of essential strategic value for the strategic investors, the project's risk level is (compared to other infrastructure projects) rather high and its prospects for returns are moderate over the short and medium term. For corporate finance, the project is unlikely to comply with strict corporate investment criteria, but corporations acting as strategic investors may decide to waive these requirements due to the strategic value of the HRS rollout.

Before providing funds for the HRS rollout project via corporate finance, the finance departments of the strategic investors involved would assess the project risks. Based on the findings of this analysis, the distribution of risks among the different industry stakeholders would be negotiated. To avoid the materialization of project risks and the resulting negative financial impact on the companies involved, the strategic investors would put a strong emphasis on negotiating and anchoring a solid risk mitigation concept as a prerequisite for funding the HRS rollout through corporate finance.

Financing the HRS rollout via project finance and leveraging strategic investors' equity through loans requires reliable, predictable revenue streams which can be used for debt service to lenders. Since the strategic investors' general corporate assets and cash flows are not available to cover debt service, effectively addressing risks is crucial from a lender's point of view to ensure that the cash flows required for debt service are not affected by project risks. Effective risk mitigation is thus indispensable for securing access to debt financing under a project finance approach.

In sum, a solid risk mitigation concept will be required both for a corporate finance and for a project finance approach. With corporate finance, risk mitigation is mostly handled internally among the strategic investors involved. With project finance, potential lenders will scrutinize the risk mitigation approach in the course of a due diligence to assess the SPV's creditworthiness. This provides for an in-depth check of the risk mitigation concept from an independent, outside perspective, which can be an important driver for optimizing the risk mitigation mechanisms.

► **Impact on organizational setups**

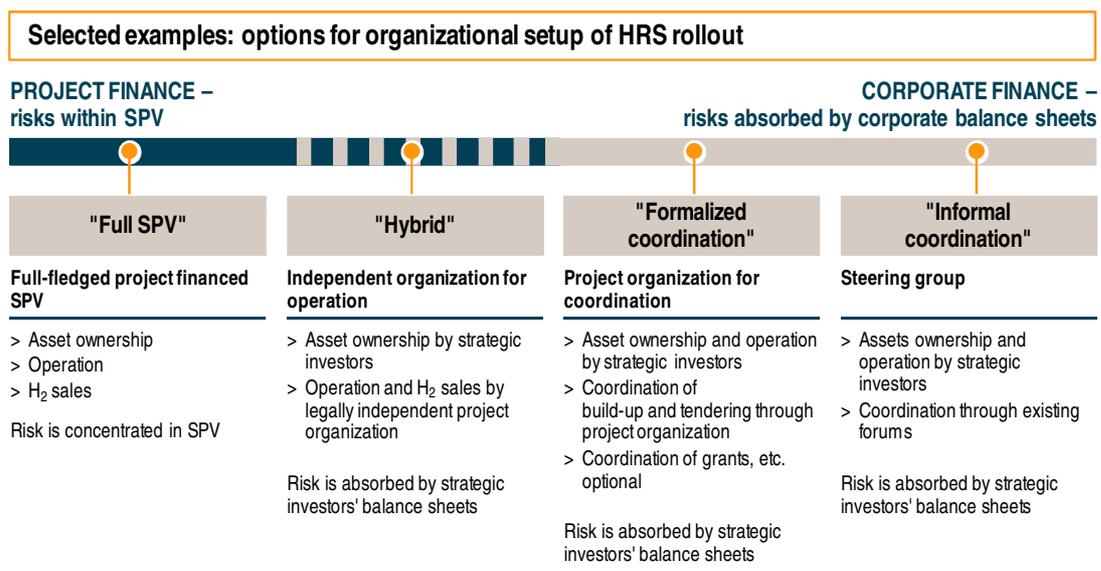
Choosing corporate finance or project finance determines the specific organizational setups that can be adopted for the HRS rollout project.

Various organizational setups are possible in corporate finance, for example:

- "Informal coordination": Each strategic investor handles the installation and operation of a set of HRS by itself. The different strategic investors are coordinated through existing groups, e.g. UK H<sub>2</sub> Mobility and NOW (National Organization Hydrogen and Fuel Cell Technology) in Germany
- "Formalized coordination": While each strategic investor handles the installation and operation of its set of HRS, a project organization is set up to manage all of them. The project organization coordinates tasks for the HRS rollout that can reasonably be pooled, e.g. site selection, permitting issues, tendering, access to grants

In the case of project finance, the consortium of strategic investors has to create a legally independent Special Purpose Vehicle (SPV) exclusively for the purpose of installing and operating the HRS network. The strategic investors as shareholders would contribute equity and try to leverage these funds through debt.

Hybrid structures are also possible in which each strategic investor finances and owns a share of the network's assets as part of its corporate activities. At the same time, a legally independent project organization is set up to handle operating the network.



**Fig. 28:** Illustrative options for organizational setups of the HRS rollout

In sum, choosing between corporate finance and project finance has important implications for the organizational setup. While creating an SPV is necessary for implementing a project finance approach, adopting the corporate finance model opens up a broad range of different organizational setups.

### ► Defining an appropriate organizational setup for the HRS rollout

The transaction costs involved in setting up a legally independent project organization are relatively high in relation to the overall HRS rollout costs. Nevertheless, doing so can yield several advantages:

- **The HRS rollout can be coordinated more effectively** by a legally independent project organization which manages the network as a whole through a consistent and integrated approach. This includes aligning the HRS and FCEV rollout speed, securing sufficient geographical coverage of the network, further developing the HRS technology, and optimizing H<sub>2</sub> supply and procurement.
- It is easier to **transfer risks to the parties best suited to control them**. A legally independent project organization for the HRS rollout requires a firm and elaborate contractual agreement that governs the cooperation of the different strategic investors. The necessity of setting up such a contract provides a framework which facilitates discussions on the explicit allocation of risks and financial challenges of the business case between strategic investors. If no contractual framework is required – as in the case of corporate finance – firm commitments from the strategic investors regarding the appropriate allocation of risks and financial challenges may be more difficult to achieve.
- **The exit options for strategic equity investors** are more favorable. For some potential strategic equity investors (for example vehicle manufacturers), operating a network of refueling stations is not part of their core business. They are likely to be interested in selling their shares in the project after establishing an HRS network sufficient for a successful introduction of FCEVs. Selling the HRS network will be easier if an interested investor can obtain a share in a large, integrated national network managed by a legally independent project organization, which rests on a firm contractual framework and provides a long-term strategic investment perspective.

The general findings of this chapter on key differences between corporate finance and project finance, as well as on potential organizational setups for the HRS rollout project, will serve as a basis for the detailed evaluation of financing options in Chapter III.M.

### **Key learnings from Chapter J: Corporate finance or project finance**

In corporate finance, debt is secured via the corporate assets and cash flows of the strategic investors involved. Lenders would make funds available depending on the corporations' overall credit rating. The HRS rollout could access loans from the start of the project.

If the HRS rollout is financed using the project finance approach, debt would only be secured using the project's own assets and cash flows. Creditors would not have recourse to strategic investors' general assets and cash flows. Lending would only become accessible in the transition or the bankable phase of the project.

Regardless of whether corporate or project finance is chosen, the HRS rollout will require a solid risk mitigation concept. In the case of project finance, potential lenders as well as strategic investors would evaluate the risk mitigation concept in the course of a due diligence.

Corporate finance does not require a legally independent project organization for the HRS rollout and allows for a variety of different setups. Organizational structures can range from a legally independent project organization to informal and loose coordination among the different strategic investors, e.g. via existing forums. By contrast, project finance requires the setup of a legally independent entity in the form of an SPV.

Setting up a legally independent project organization yields several potential advantages for the HRS rollout project, in spite of high transaction costs relative to project size. These advantages include effective coordination of the HRS rollout, a facilitated transfer of project risks to parties best positioned to control them, as well as favorable exit options for strategic investors.

## L. Potential for minimizing project risks

### ► Requirements for an effective risk mitigation concept for the HRS rollout

The fundamental project risks for the HRS rollout are lower FCEV sales than expected and a delay in the FCEV rollout, plus a delay in the rollout of the HRS network, which would in turn have a negative impact on FCEV sales. If these risks materialize, they will have a strong impact on H<sub>2</sub> sales and hence on the NPV and the bankability of the HRS rollout.

The main challenge for the risk mitigation concept for the HRS rollout is to effectively control these fundamental project risks. The risk mitigation concept should:

- Align the FCEV market introduction schedule and sales with the rollout of the HRS network, and align the commercial interests of FCEV producers and HRS investors
- Involve all industry stakeholders along the value chain: H<sub>2</sub> production and distribution, HRS provision, HRS maintenance, FCEV sales and corresponding H<sub>2</sub> sales. This is necessary in order to stop any delay or significant cost increase for one element of the value chain leading to the commercial failure of the HRS rollout
- Ensure that car manufacturers – who have the biggest influence on the FCEV market introduction in terms of its timing and sales volumes – have a stake in the HRS rollout that is large enough to give them an incentive to meet their commitments
- Draw on public-sector support where possible, while not releasing industry stakeholders from their responsibilities
- Be adapted over the lifetime of the project. Project risks change over time, and risk mitigants should be reduced or their focus changed accordingly

#### **BOX 4: Risk mitigation concepts**

Where risks have been identified for a project, a risk mitigation concept is a precondition to accessing financing. The risk mitigation concept defines mitigants that either prevent the risk from materializing or – if this is not possible – transfer financial risks from the SPV or the project organization to other stakeholders.

Different types of project risks (see **Chapter III.H** for definitions) are typically addressed by different mitigants:

- **Market risks:** Mitigants include contracts with off-takers ensuring minimum demand, regulations, and incentives provided by the public sector
- **Technology risks:** Mitigants include strict requirements regarding equipment trials by the supplier (and their documentation), supplier guarantees for the technology (including meeting any maintenance costs that exceed forecasts), and fixed-price contracts with maintenance providers
- **Planning risks:** Mitigants include verification of planning, available resources and related tools by third parties early on in the project
- **Regulation risks:** Mitigants include the existence of relevant laws and regulations combined with an evaluation of the host country's legal and regulatory stability

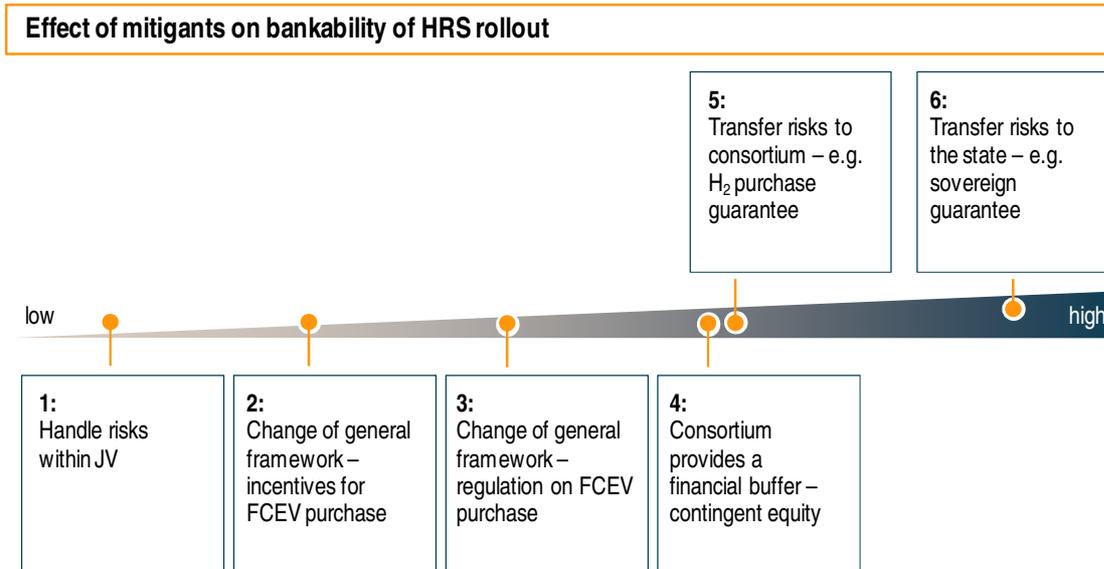
A risk mitigation concept consists of a set of risk mitigants that address the fundamental project risks and other relevant risks. The risk mitigation concept is always assessed in its entirety.

Getting the right combination of mitigants is critical – typically more than one mitigant is needed to make a project bankable. A successful combination of several weaker mitigants can replace a very effective mitigant, if this mitigant cannot be realized.

Risk mitigation concepts are assessed by potential financiers for their effectiveness and enforceability. The remaining project risks are then priced into the cost of capital.

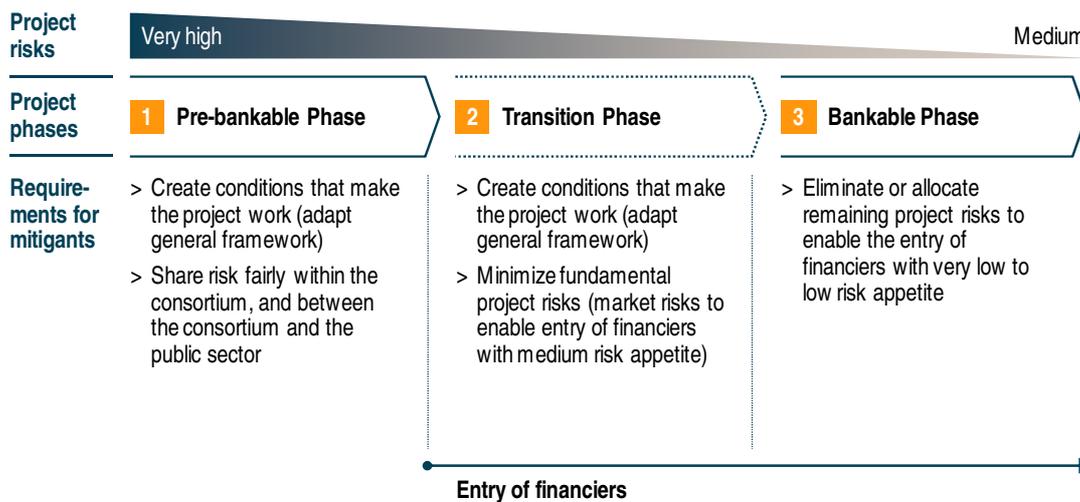
### ► Evaluation of the effectiveness of mitigants from the financiers' perspective

We asked financiers (public banks, commercial banks, private equity investors) to evaluate potential mitigants for the HRS rollout from their perspective. The fundamental project risks – lower FCEV sales volumes and a delay in the market introduction of FCEVs – cannot be completely eliminated by any risk mitigant for the HRS rollout. As a consequence, mitigants that absorb the financial impact of these risks materializing are rated the highest by financiers. Mitigants that improve the general conditions for the absorption of FCEVs by the market are considered helpful, but insufficient to control the fundamental project risks.



**Fig. 29:** Categories of mitigants and their effect on the bankability of the HRS rollout

The evaluation of risk mitigants differs depending on the project phase in which they would be used.



**Fig. 30:** Requirements for risk mitigants in different project stages

In Phase 1, the level of project risks that have to be addressed by the mitigation concept is highest. Strategic equity investors, and potentially the public sector, provide funds to start the project. These stakeholders have a strong interest in implementing mitigants that can create conditions in which the project will work, and which create a fair distribution of risks between stakeholders. Financiers are not yet involved in the HRS rollout at this stage.

In Phase 2, the level of project risks is still high. Financiers with instruments that have a high to medium risk appetite may be interested in becoming involved in the project under certain conditions. The EIB, for example, has financing facilities with a comparatively high risk appetite. Private equity might be interested in becoming involved toward the end of Phase 2, in spite of the high risk level, if high returns can be expected. The mitigants must keep project risks to a level that is acceptable to financiers, thereby enabling them to become involved in the project

In Phase 3, the level of project risks has decreased considerably. Now, financiers with a low risk appetite may become interested in the HRS rollout. The mitigation concept has to almost completely eliminate or absorb the project risks and provide secure project revenues to enable these financiers to become involved.

Below, we evaluate specific mitigants for the fundamental project risks and other relevant risks for the HRS rollout from the perspective of financiers. As financiers would only become involved in the project in Phase 2, we do not carry out an evaluation for Phase 1. The evaluation looks at Phases 2 and 3 separately.

# 1 Risk: FCEV sales lower than expected & Delayed FCEV rollout

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Large-scale market study on FCEV customer acceptance and demand	✓	✓	✓	● ● ○	Requirement (shows market understanding by key stakeholders), but not sufficient	● ○ ○	Requirement, but not sufficient
<b>b</b> Commitment by carmakers on FCEV market introduction schedule (incl. car models, pricing, sales channels)	✓	✓	✓	● ● ○	Requirement (commitment needs to be firm and address key risks), but not sufficient	● ○ ○	Requirement, but not sufficient
<b>c</b> Government incentives for FCEV purchase bridging price gap to conventional vehicles	✓	✓		● ○ ○	Incentives are supporting factors but may have limited impact on adoption	● ○ ○	Helpful, but not sufficient
<b>d</b> Tax credits for private FCEV owners (e.g. vehicle tax)	✓	✓	✓	● ○ ○	Incentives are supporting factors but may have limited impact on adoption	● ○ ○	Helpful, but not sufficient
<b>e</b> Tax credits for fleet operators integrating FCEVs in their fleet	✓	✓	✓	● ● ○	Incentives are supporting factors, but targeting fleets may be more effective	● ○ ○	Helpful, but not sufficient
<b>f</b> Regulation requiring minimum share of alternative fuel vehicles in fleets	✓	✓	✓	● ● ●	Most effective way to adapt the general framework and spur FCEV demand	● ● ○	Helpful as indication of future demand, but not sufficient (regulation might change)
<b>g</b> Government committing to min. share of FCEV in public fleets	✓	✓	✓	● ● ○	Helps to reduce the market risk, but insufficient because limited no. of FCEVs	● ● ○	Helpful, but not sufficient
<b>h</b> Higher weight of CO <sub>2</sub> emissions in vehicle tax making FCEVs more attractive vis-à-vis conventional vehicles	✓	✓	✓	● ● ○	Helpful as accompanying measure, but not sufficient	● ○ ○	Helpful, but not sufficient
<b>i</b> Contracts with fleet operators on FCEV purchase have been concluded	✓	✓	✓	● ● ●	Potentially very effective (impact of mitigant depends on amount of off-take committed to in contracts)	● ● ●	Debt can be made available on the basis of contracts – amount in relation to secured demand. Possibly required in addition: confirmation of demand level resulting from contracts, e.g. 6- to 12-months trial period
<b>j</b> Letter of intent from fleet operators on FCEV purchase	✓	✓	✓	○ ○ ○	Ineffective (no binding instrument)	○ ○ ○	Ineffective (no binding instrument)
<b>k</b> Pre-purchase of H <sub>2</sub> by carmakers in line with planned FCEV ramp-up	✓	✓		● ● ○	Effective to secure lenders' and investors' return, but not sufficient to provide longer term perspective for the project (shifting the risk, not de-risking the project)	● ● ●	Mitigant provides secure revenues and could be sufficient to attract investors / lenders earlier. Should be combined with repayment obligation of outstanding debt in case commitment is stopped
<b>l</b> Risk covered by contingent equity	✓	✓	✓	● ● ○	Effective to secure lenders' and investors' return, but not sufficient to provide longer term perspective for the project (shifting the risk, not de-risking the project)	● ● ○	Requirement (at least for remaining risks), but not sufficient
<b>m</b> Advantages for carbon-neutral vehicles in traffic (e.g. permission to use fast lane for buses and taxis, preferential parking)	✓	✓	✓	○ ○ ○	Limited effectiveness – measure loses its impact when a certain number of carbon-neutral vehicles are on the road	○ ○ ○	Limited effectiveness

Legend ○ ○ ○ Ineffective ● ○ ○ Moderately effective ● ● ○ Effective ● ● ● Very effective

## 2 Risk: Delayed HRS rollout

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Regulation requiring station operators to include H <sub>2</sub> in their portfolio	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	●●●	Most effective way to adapt the general framework and ensure establishment of sufficient HRS network	●●○	Helpful to increase value of SPV servicing large HRS network, but insufficient to provide secure revenues
<b>b</b> Subsidy for station operators for including HRS on their site	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	●○○	Less effective than regulation	●○○	Less effective than regulation
<b>c</b> Contracts with station operators on inclusion of HRS on their site are concluded	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	●●●	Effective if meeting critical mass	●●○	Potential requirement, but insufficient to provide secure revenues
<b>d</b> LOI with station operators on inclusion of HRS on their site are signed	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	○○○	Ineffective (no binding instrument)	○○○	Ineffective (no binding instrument)
<b>e</b> Risk of HRS delivery delay transferred to supplier via contractual penalties	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	●●○	Requirement, but insufficient	●○○	Requirement, but insufficient
<b>f</b> Third party verifies planning at early stage of the project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-	n.a.	-	n.a.

## 3 Risk: Unexpected change in H<sub>2</sub> taxation

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Informal agreement with government authorities on future H <sub>2</sub> fuel taxation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	○○○	Ineffective (no binding instrument)	○○○	Ineffective (no binding instrument)
<b>b</b> National law fixing preferential H <sub>2</sub> fuel taxation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	●●○	Helpful, but exact value depends on content of the law and uncertain because laws can change	●●○	Helpful, but exact value depends on content of the law and uncertain because laws can change

**Legend** ○○○ Ineffective ●○○ Moderately effective ●●○ Effective ●●● Very effective

#### 4 Risk: Higher HRS procurement price

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Open tendering to ensure competitive pricing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ○ ○	Requirement, but insufficient	● ○ ○	May be required by equity investors (risk not relevant for commercial lenders because they would restrict their funds to identified CAPEX)
<b>b</b> HRS tender completed and purchasing contracts finalized before approaching bank	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ● ○	Helpful, as procurement price is determined for a certain period	● ● ○	May be required by equity investors (risk not relevant for commercial lenders because they would restrict their funds to identified CAPEX)

#### 5 Risk: HRS cost development below forecast

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Cost development fixed in contracts (with incentives for additional price reductions)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ● ○	Helpful, because the mitigant provides visibility of cost evolution	● ● ○	May be required by equity investors (risk not relevant for commercial lenders because they would restrict their funds to identified CAPEX)
<b>b</b> Annual or bi-annual tendering to spur competition on price development	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ○ ○	Helpful, but cost evolution not predictable	● ○ ○	May be required by equity investors (risk not relevant for commercial lenders because they would restrict their funds to identified CAPEX)

#### 6 Risk: H<sub>2</sub> price development falls behind forecast

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Diversification of H <sub>2</sub> procurement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ○ ○	Helpful, but insufficient	● ○ ○	Helpful, but insufficient (lenders are likely to expect concluded contracts)
<b>b</b> H <sub>2</sub> price guarantee by H <sub>2</sub> suppliers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ● ○	Helpful, but effectiveness depends on time period covered by the guarantee	● ○ ○	Limited effectiveness, as covered time period most likely much shorter than lenders'/investors' horizon in phase 3 (> 10 years)
<b>c</b> Uncertainty covered by contingent equity	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	● ● ●	Helpful, as contingent equity can cover for risks where specific mitigants are harder to secure.	● ● ○	Likely requirement by lenders, but insufficient

Legend ○ ○ ○ Ineffective ● ○ ○ Moderately effective ● ● ○ Effective ● ● ● Very effective

## 7 Risk: Costs to run the project (costs of SPV) exceed forecast

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Third party verifies planning at early stage of the project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	n.a.	Risk typically materializes in phase 1	n.a.	Risk typically materializes in phase 1
<b>b</b> Contracts define cost limits and transfer liability for exceeding costs to contractors	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	n.a.	Risk typically materializes in phase 1	n.a.	Risk typically materializes in phase 1

## 8 Risk: Costs of OPEX exceed forecast

Mitigant	Relevance			PHASE 2: Transition Phase		PHASE 3: Bankable Phase	
	Ph. 1	Ph. 2	Ph. 3	Evaluation	Comment	Evaluation	Comment
<b>a</b> Long-term fixed price agreement on use of site and operations excl. maintenance between SPV and operators of existing stations	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	n.a.	Risk typically materializes in phase 1	n.a.	Risk typically materializes in phase 1
<b>b</b> Fixed price maintenance agreement (independent of frequency of service) with HRS maintenance provider	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	n.a.	Risk typically materializes in phase 1	n.a.	Risk typically materializes in phase 1

Legend ○ ○ ○ Ineffective ● ○ ○ Moderately effective ● ● ○ Effective ● ● ● Very effective

Fig. 31: Evaluation of individual risk mitigants from the perspective of financiers

### ► Spotlight on mitigants addressing the FCEV ramp-up risk

We held discussions with the German and UK coalitions for the HRS rollout and with financiers. Participants at the meetings shared their ideas about what mitigants would effectively address the fundamental risks for the HRS rollout. Below we present some key ideas for the design of these mitigants based on our discussions.

We identify six mitigants that address the FCEV ramp-up risk for the HRS rollout (see below). Only mitigants that provide revenue guarantees to financiers make project finance available (mitigants 1.a and 1.b). If these mitigants cannot be realized by project promoters, other mitigants addressing the fundamental risks for the HRS rollout become relevant for de-risking the project.

Effectiveness	High <span style="float: right;">Low</span>		
Category	<b>1 Guaranteed revenue</b>	<b>2 Regulations on FCEV purchase</b>	<b>3 Incentives for FCEV purchase</b>
Selected mitigants	<ul style="list-style-type: none"> <li>a. Contract with large-scale off-taker (fleets) concluded</li> <li>b. Pre-purchase of H<sub>2</sub> by carmakers in line with planned FCEV ramp-up ("Take or pay")</li> </ul>	<ul style="list-style-type: none"> <li>a. Regulation requiring minimum share of alternative fuel vehicles in fleets</li> </ul>	<ul style="list-style-type: none"> <li>a. Government incentives for FCEV purchase bridging price gap to conventional vehicles</li> <li>b. Tax credits for fleet operators integrating FCEVs in their fleet</li> <li>c. Higher weight of CO<sub>2</sub> emissions in vehicle tax</li> </ul>
Impact	<b>Makes project finance accessible</b>	<b>Helpful</b> (a deferred positive effect on financing through a higher H <sub>2</sub> offtake from the start of the rollout and the resulting improvement of business case KPIs is possible), <b>but insufficient to access project finance</b>	

**Fig. 32:** Effectiveness of different types of risk mitigants for the HRS rollout and their impact on the availability of project finance

### 1.a Guaranteed revenue – Contract with large-scale off-taker (fleets) concluded

Contracts could be concluded with large fleet operators with back-to-base refilling in urban areas (e.g. taxis, postal companies, telecommunications companies, utilities, homecare service providers). To be effective as a mitigant, these contracts should include a minimum H<sub>2</sub> off-take by the fleet operator, or alternatively a flat rate that includes a certain amount of H<sub>2</sub> per month or per year.

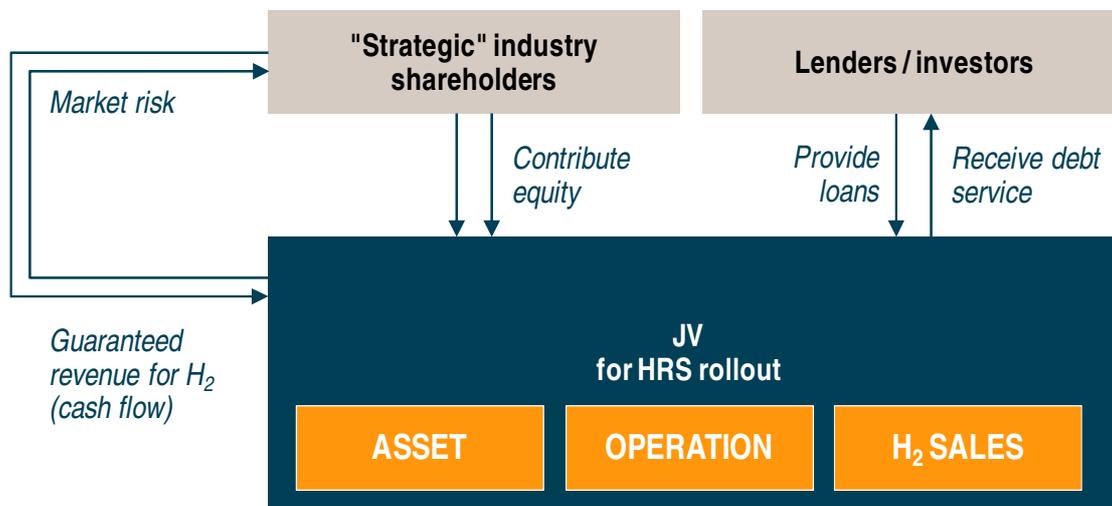
The public sector could take a lead in implementing this mitigant, similar to the support for battery electric vehicles seen in France – approximately 50,000 BEVs will be bulk tendered for public fleets in France by 2015.

Debt provided thanks to this mitigant would most likely be limited to the guaranteed H<sub>2</sub> demand set out in contracts with fleets, and the resulting guaranteed revenue for the joint venture.

### 1.b Guaranteed revenue – Pre-purchase of H<sub>2</sub> by carmakers in line with planned FCEV ramp-up ("take or pay")

Industry stakeholders could issue a guarantee for the revenues for the HRS rollout joint venture proportionate to the FCEV ramp-up forecast and resulting revenue from H<sub>2</sub> sales. The guaranteed revenue would be available for debt service and interest payments to lenders, or as guaranteed returns for investors. To be most effective, the guarantee should be combined with a repayment obligation for outstanding debt and interest payments the moment the guarantee ceases. The H<sub>2</sub> price risk would rest with the joint venture.

The revenue guarantee can be issued by one stakeholder or by several. If the guarantee is split between strategic equity investors, the guarantee can be split into different shares. To incentivize the key stakeholders who influence the FCEV ramp-up and resulting H<sub>2</sub> demand, a relatively large share of the revenue guarantee would be supplied by the FCEV manufacturers. In any case, the split of the revenue guarantee between shareholders should take into account each company's creditworthiness; in other words, each share of the guarantee must be sufficiently covered by the company's balance sheet or contingent equity must be provided.



**Fig. 33:** Functioning of an H<sub>2</sub> purchase guarantee

## 2.a Regulations on FCEV purchase – Regulation requiring a minimum share of alternative fuel vehicles in fleets

A regulation would have to be adopted by the public sector requiring a minimum share of zero-emission or ultra-low emission vehicles in corporate car fleets that exceed a certain size. The public sector typically takes a "technologically neutral" approach. As a consequence, the share of FCEVs in fleets resulting from this regulation can only be forecast with a range of uncertainty – but the competitiveness of FCEVs compared to other alternative powertrains (driving range, refilling time) could lead to a relatively high share of FCEVs in fleets.

To limit the negative impact of this regulation on fleets, the phase-in could be stretched out over three years to take into account car replacement intervals in corporate fleet leasing contracts. An increase in the required minimum share over time could be established. This increase could be based on a predefined schedule and take into account typical car replacement intervals.

The HRS rollout joint venture would have to ensure the provision of an HRS within a certain range of the fleets' locations. The regulation could link the provision of HRS with incentives, or fleet operators' obligations could be made dependent upon the timely availability of an HRS.

## 3.a/b/c Incentives for FCEV purchase – Government incentives for FCEV purchases bridging the price gap between FCEVs and conventional vehicles; tax credits for fleet operators; greater weight given to CO<sub>2</sub> emissions in vehicle tax

Given the diverse vehicle registration tax levels within the EU, incentives for FCEV purchases should be implemented at Member State level and tailored to national markets. Incentives could target both private households and corporate customers, and provide tax cuts for FCEV owners if the car registration tax is high, or direct cash subsidies if there is no registration tax.

FCEV purchase incentives should necessarily be linked with the existence of a comprehensive HRS network, enabling short or long journeys by FCEV in the country in question. A UK consumer survey shows that the existence of a minimum number of HRS is a key condition for most potential

FCEV buyers.<sup>10</sup> A review of the effectiveness of incentives for the purchase of BEVs confirms that the effectiveness of financial incentives for vehicle purchases depends on whether or not they are combined with the existence of sufficient refueling options.

The financial incentives for FCEV purchases could be limited to a certain number of FCEVs, and the incentive program could be stopped when a predefined number of FCEVs had been reached. This would ensure support for the FCEV ramp-up in the critical start-up phase, and mean that the required public funds were secure. The public sector may require such limitations in order to back the implementation of financial incentives.

### **Key learnings from Chapter K: Potential for minimizing project risks**

The risk mitigation concept is always considered as a whole by financiers. The risk mitigation concept for the HRS rollout therefore has to address all the project risks. Individual mitigants are not enough to make financing available: an effective combination of mitigants is needed.

The requirements for the risk mitigation concept change over the course of the HRS rollout:

- Phase 1 (Pre-bankable Phase): The risk level of the HRS rollout is very high. Only strategic investors and potentially the public sector provide funds. The risk mitigation concept implemented by these stakeholders aims to create conditions that make the project work in its start-up phase
- Phase 2 (Transition Phase): The risk level of the HRS rollout is still high. To make it potentially interesting for financiers with a higher risk appetite, project risks – especially the FCEV ramp-up risk – have to be fully controlled or absorbed by other stakeholders, e.g. strategic investors or the state. Moreover, the risk mitigation concept has to ensure the project's success and growth potential in the long run
- Phase 3 (Bankable Phase): The risk level of the HRS rollout has been significantly reduced. Commercial financiers may become interested. These financiers are very risk-averse, so the risk mitigation concept has to fully control or absorb the risks

Evaluating specific mitigants addressing the main project risk – the FCEV ramp-up risk – from the perspective of financiers gives us the following picture:

In Phase 2:

- A regulation requiring large fleet operators to integrate a certain share of zero-emission vehicles in their fleets: This mitigant receives top rating, equal with the following mitigant. It provides an assessable minimum H<sub>2</sub> off-take. It also supports the long-term growth perspective of the project by bringing a large number of FCEVs onto the road
- Contracts with large fleet operators, including a minimum H<sub>2</sub> off-take: This mitigant also receives top rating, equal with the preceding mitigant. It also provides an assessable minimum H<sub>2</sub> off-take and supports the H<sub>2</sub> growth perspective
- H<sub>2</sub> pre-purchase by strategic investors or the state (or a revenue guarantee corresponding to a predefined H<sub>2</sub> sales level): This mitigant receives a high rating, but not the top rating. It absorbs the financial risk related to the FCEV ramp-up, but it does not address the causes of low revenues, i.e. the low number of FCEVs on the road

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<sup>10</sup> UK H<sub>2</sub> Mobility, Phase 1 Results, 2013

In Phase 3:

- H<sub>2</sub> pre-purchase or a corresponding revenue guarantee and contracts with large fleet operators: These mitigants receive the top rating because they fully absorb the potential financial impacts of the FCEV ramp-up risk
- A regulation requiring large fleet operators to integrate a certain share of zero-emission vehicles into their fleets: This mitigant is considered helpful but not sufficient in this phase, as it does not provide a secure minimum H<sub>2</sub> off-take, but just improves the conditions for a higher H<sub>2</sub> off-take

The risk mitigation concept for the HRS rollout will only be enough to make project financing available if it achieves guaranteed revenues for financiers. For this, the FCEV ramp-up risk has to be fully absorbed. Contracts with large fleet operators and pre-purchase of H<sub>2</sub> (or corresponding guaranteed revenues) create the necessary conditions and make project financing possible.

Other mitigants addressing the FCEV ramp-up risk (e.g. regulation or financial incentives provided by the government for FCEV purchases) are helpful for the project and for accessing financing, but are insufficient to ensure such financing.

## M. Different types of financiers may be interested in financing the HRS rollout – Profiles of investors and lenders

### ► **Conditions for accessing financing by different types of investors and lenders – Overview**

Potential financiers in the HRS rollout need to know that it is likely that the undertaking will yield returns and become profitable in the long run. This applies to private lenders and investors, and equally to public lenders and government institutions that might consider providing grants, subsidies or guarantees for the project.

Private lenders and investors require a secure return perspective on their loan or investment. As a consequence, the financing of the HRS rollout by private lenders and investors is only realistic if the fundamental project risks can be fully controlled or transferred from the JV to industry stakeholders or the state.

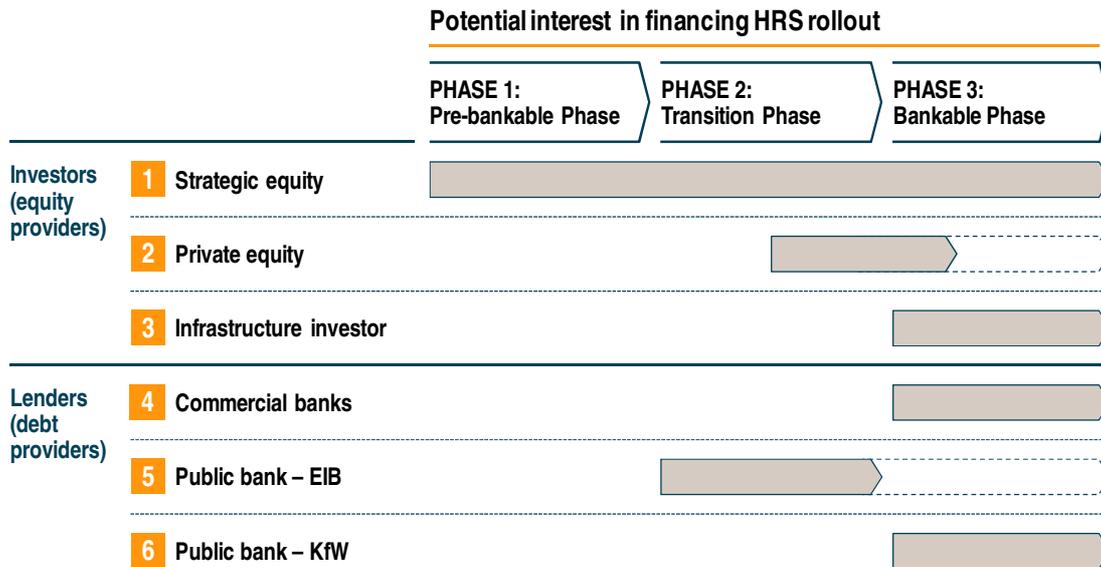
The same applies in principle to public investors. While some public banks have financing facilities with a stronger risk appetite, they will not absorb the fundamental project risks of the HRS rollout. The FCEV ramp-up risk would have to be effectively controlled or absorbed by another stakeholder for a public lender to get involved in the project.

A strong risk mitigation concept building on long-term commitments from industry stakeholders is a precondition for private or public financing. However, there are differences with regard to the risk appetite of different financiers. These differences determine in which phase and under which conditions a financier would consider financing the HRS rollout.

Below, we present the different types of financiers and their potential interest in the HRS rollout, along with the conditions they require.

### ► **Profiles of different types of financiers that might be involved in financing the HRS rollout**

Different types of financiers might be interested in financing the HRS rollout. Depending on their risk appetite and their financial instruments, they could potentially be involved at different stages of the project, as shown below.



**Fig. 34:** Different types of financiers' potential interest in financing the HRS rollout

► **Strategic investors**

**Rationale for funding the HRS rollout**

The HRS rollout is not part of strategic investors' core business. But strategic investors need the HRS rollout to bring the products that they produce as part of their core business to the market. Strategic investors include the following:

- Car manufacturers who aim to bring FCEVs to the market
- HRS suppliers who aim to move beyond customized or small-batch production and reach industrial-scale production of HRS
- H<sub>2</sub> suppliers who want to help establish an H<sub>2</sub> market
- Refueling station operators who want to extend their business model into the future, including upstream (hydrogen production) and downstream (distribution and retail) perspectives

**Conditions for providing funds**

Strategic investors' decisions to finance the HRS rollout are mainly based on strategic considerations with regard to their core business activities. However, the prospect of the project achieving profitability in the long run also plays an important role for strategic investors. Every corporation investigates potential investments carefully with regard to the expected returns. The project is expected to become profitable in the long run, but the very long period until it does so represents a challenge for strategic investors. This is particularly true as, once profitability is in sight, competitors may enter the market and reduce the potential returns for strategic investors in Phases 2 and 3 of the project.

While strategic investors therefore have a strong motivation to provide financing for the HRS rollout – their desire to see it reach Phases 2 and 3 – their investment decision may require some support from the public sector.

### **Long-term expectations (strategic perspective)**

The HRS rollout is not part of most strategic investors' core business. It is therefore advantageous for strategic investors to retain the option of disinvesting in the HRS rollout once the HRS network is established and strategic investors' products have entered the market successfully.

### **Risk-absorption capacity**

Strategic investors are in a position to address and absorb the project risks for the HRS rollout, including the FCEV ramp-up risk. In particular, vehicle manufacturers are best positioned to address the FCEV ramp-up risk by ensuring that FCEVs are introduced onto the market on time and through effective marketing and sales channels. Fuel station operators are best positioned to ensure that HRS are installed on time and with the right geographical scope. Due to their strategic interest in the HRS rollout, strategic investors are expected to absorb a large share of the project risks.

### **Entry point**

Due to the strategic significance of the HRS rollout for them, strategic investors are expected to provide equity for the project right from Phase 1.

### **► Private equity investors**

#### **Rationale for funding the HRS rollout**

The precondition for private equity investors to be interested in the HRS rollout are promising return prospects after restructuring the project, strategic reorientation or expansion.

#### **Conditions for providing funds**

The HRS rollout has to offer a robust growth story. For example, the possibility must exist of increasing the stations' profitability via an increase of H<sub>2</sub> sales or add-on sales at the stations. The project has to be able to capture growth before potential competition comes in and reduces profit margins. Therefore, the HRS rollout SPV's business has to be shielded from competition, for example by providing an exclusivity agreement with a large refueling station operator or by having hold of a large network of sites at supermarkets, parking spaces or other locations.

Private equity investors have to be convinced that they can make the growth story actually happen. An important precondition is that they are in a position to control the HRS rollout and turn the business around on their own, irrespective of any other stakeholders' individual interests in the undertaking.

### **Long-term expectations (strategic perspective)**

Private equity investors would seek to exit the HRS rollout after the growth story has been realized. Resale of the SPV with significant returns must be foreseeable. For example, an infrastructure investor that would potentially purchase the SPV after the growth has been realized should already be identified when the private equity investor considers acquiring the HRS rollout SPV.

### **Risk-absorption capacity**

Private equity investors do not absorb fundamental project risks. Before they consider financing the HRS rollout, the FCEV ramp-up risk has to be under control. Initial H<sub>2</sub> demand has to be proven and provide for stable returns of the HRS network. In return for strong growth potential, private equity investors are willing to absorb a moderate level of risk and provide funding before other more conservative stakeholders are prepared to do so.

## **Entry point**

Private equity investors could become interested in financing the HRS rollout in the late Transition Phase (Phase 2) or the Bankable Phase (Phase 3).

### **► Infrastructure investors**

#### **Rationale for funding the HRS rollout**

To interest infrastructure investors, the HRS rollout has to offer a return guarantee combined with very low risk levels. Typically, infrastructure investors pursue a long-term buy and hold strategy and invest their funds in assets with low management complexity and long-term, predictable cash flows, e.g. regulated assets.

#### **Conditions for providing funds**

The HRS rollout joint venture has to provide secured or guaranteed returns in the long run to interest infrastructure investors. This includes assurance that competition is unlikely to enter the market and reduce the returns on the HRS rollout after infrastructure investors have entered the project. Secure or guaranteed returns could be created, for example, by concluding long-term contracts with fleet operators that guarantee a minimum H<sub>2</sub> off-take for the SPV. Alternatively, strategic equity investors could provide an H<sub>2</sub> off-take guarantee ensuring basic minimum returns.

Infrastructure investors also insist on being in a position to steer the project. For this purpose, the structure of the SPV should ensure that the SPV's management and operation is independent from strategic investors' individual interests, i.e. the SPV's strategy and returns should not depend on individual strategic investors' decisions.

#### **Long-term expectations (strategic perspective)**

Infrastructure investors require a secure long-term strategic perspective for the HRS rollout SPV. The SPV should be operational for another 10 to 15 years after the infrastructure investors have purchased the project. Returns must be guaranteed for this entire period.

#### **Risk-absorption capacity**

Infrastructure investors are very risk-averse. They would not absorb any major project risks of the HRS rollout.

## **Entry point**

Private equity investors could become interested in the HRS rollout financing in the Bankable Phase (Phase 3).

### **► Commercial banks**

#### **Rationale for funding the HRS rollout**

Commercial banks would provide financing for the HRS rollout if the project offers competitive interest payments in relation to its risk level and other available investment opportunities.

#### **Conditions for providing funds**

Commercial banks could consider financing the HRS rollout when cash flows become sufficient (including a buffer) to cover debt repayment and interest, and project risks are fully under control.

#### **Long-term expectations (strategic perspective)**

For commercial banks, debt service and interest payments have to be secured for the duration of the loan. If the project is terminated before the loan has been fully repaid, the commercial bank will require the security from the debtor so that the outstanding loan tranches will be fully repaid.

### **Risk-absorption capacity**

Commercial banks would not absorb any major project risks relating to the HRS rollout. The FCEV ramp-up risk in particular would have to be solidly under control of or absorbed by other stakeholders (e.g. strategic investors, the state) before commercial banks would consider providing funds. Any remaining project risk would then be reflected in the pricing of the loans.

### **Entry point**

Private equity investors could become interested in financing the HRS rollout in the Bankable Phase (Phase 3).

## **► Public/development banks**

### **Rationale for funding the HRS rollout**

Public banks can provide financing for the HRS rollout if the project complies with their mandate and policy goals, which are defined by the bank's shareholders. The EIB, for example, has signaled that the HRS rollout is eligible in terms of compliance with its policy objectives.

Below, we look in more detail at financing from the EIB and KfW – the two public banks relevant for the HRS rollout in the UK and Germany.

### **Conditions for providing funds**

As policy-driven entities, public banks can offer favorable financing conditions for the HRS rollout. This has three potential benefits:

- Public banks have a higher risk appetite for projects that comply with their policy objectives through partially state-backed instruments. They may be able to provide financing for the HRS rollout already in the Transition Phase, or they may be able to take a larger share of the project than commercial investors or lenders would
- Public banks can assume the role of "anchor investor". The fact that the HRS rollout has successfully passed a due diligence carried out by an anchor investor increases confidence with potential subsequent lenders and investors, backed up by the anchor investor's know-how in the industry and its reputation. In this case, the volume of the anchor investor's loan can serve as a signal to other potential investors or lenders. In addition, anchor investors can support the project with their know-how in financial structuring
- Public/development banks are typically able to provide loans at lower rates than commercial banks because their own borrowing is partially backed by state guarantees. They can transfer part of this advantage to borrowers

To access loans from the KfW or EIB, the HRS rollout joint venture would have to supply a solid risk mitigation concept that successfully mitigates project risks, especially the FCEV ramp-up risk, or ensures their absorption by strategic investors or the state.

To access a loan from the KfW, the HRS rollout would have to undergo the "private investor test". This test requires that the project can raise at least an equal amount of loans to those provided by the KfW from private lenders and investors. This requirement is due to EU legislation. It aims to

ensure that the KfW does not offer better products than are available on the market and in so doing provides state aid, which would require prior approval by the European Commission.

The EIB's Risk-Sharing Finance Facility (RSFF, see **Box 5**) is a financing instrument by which the EIB provides financing for research, development and innovation (RDI) projects with low to sub-investment grade risks. The instrument can cover up to 50% of eligible RDI investments. The HRS rollout could potentially be eligible under the program's mandate. To evaluate its eligibility, the project would have to undergo a comprehensive and rigorous due diligence by the EIB, based on prudential banking standards. The due diligence would have to show it to be technically, economically, financially and environmentally feasible (see **Box 5**).

### **Long-term expectations (strategic perspective)**

For both the EIB and KfW, the HRS rollout would have to demonstrate that it is likely to become a successful, privately-driven business in order to obtain support from their favorable financing instruments.

### **Risk-absorption capacity**

Neither the EIB nor KfW would absorb the FCEV ramp-up risk. A comprehensive, solid risk mitigation concept addressing all project risks, especially the FCEV ramp-up risk, would be required from the HRS rollout JV to access lending from these institutions.

The EIB and KfW could still absorb more risks than commercial lenders, however. For example, the KfW could act as anchor investor in Phase 3 and take a larger ticket size than commercial lenders would normally do. Similarly, the EIB's RSFF allows it to take on more technical and credit risk than commercial lenders typically do, and more than it normally does itself according to its traditional standards.

### **Entry point**

Normally, public bank loans become available in the Bankable Phase (Phase 3). The EIB's RSFF could potentially already become available for the HRS rollout in the Transition Phase (Phase 2). The support from the EIB Research Development & Innovation (RDI) Advisory team could already be available for the HRS rollout joint venture in the Pre-bankable Phase. The HRS rollout could already undergo a due diligence with the EIB in this stage, and the EIB has the possibility to offer a general commitment to provide a loan in the Transition Phase, subject to the HRS rollout meeting a set of pre-defined milestones.

### **Typical examples of public bank loans**

Supporting RDI in the areas of clean vehicle technology and energy efficiency has been a focus of RSFF lending in the past. For example, a EUR 300 m loan was granted by the EIB to French powertrain systems manufacturer Valeo in 2009. The loan covered almost 50% of the company's "car efficiency and safety RDI" project, with a total volume of EUR 645 m.

Similarly, an RSFF loan of EUR 30 m was given to Austrian automotive technology supplier AVL List GmbH in 2011 to finance research and development activities aimed at developing cleaner and more efficient powertrain technologies. This included the development of hybrid technology and advanced batteries for electric cars. The loan covers 25% of the total project costs, which amount to EUR 120 m.

### **BOX 5: The EIB Risk-Sharing Finance Facility (RSFF)**

The Risk-Sharing Finance Facility (RSFF) is a debt-based financing program set up jointly by

the EIB and European Commission (EC). Its goal is to improve access to debt financing for research, development and innovation (RDI) projects characterized by a relatively high risk level. RSFF lending is aimed at strengthening a project's financial profile to enable it to attract additional financing.

The EIB and EC each committed up to EUR 1 billion in risk capital between 2007 and 2013, allowing the EIB to provide up to EUR 10 billion as loans or guarantees for RDI projects. An extension of the facility to the programming period after 2013 is expected.

### **Basic mechanism of the RSFF**

The RSFF is a debt-based financial instrument which allows the EIB to finance riskier activities than is usual under its traditional lending standards. Using this facility, the EIB can provide subordinated (i.e. junior) loans, reducing the risk for private investors and encouraging investment. Loans and guarantees issued under the RSFF can be customized for the specific characteristics and needs of a given project.

### **Eligibility criteria**

- The project needs to fall within the sectors covered by the European Commission's Framework Program 7 (EU research policy priorities)
- The RSFF targets debtors with low to sub-investment grade risk (BBB- and below)
- Entities across all EU Member States are eligible
- Loans can be provided on a corporate financing or project financing basis
- Eligible costs include a wide range of RDI investments (CAPEX, OPEX, other)
- Projects financed by the EIB need to be technically, economically, financially and environmentally sound

### **Loan/guarantee conditions**

- The maximum loan is up to 50% of the eligible project cost (EUR 7.5 to 300 m)
- Long-term maturities can be negotiated depending on the needs of each project

### **Availability for the HRS rollout**

The HRS rollout complies with EU policy priorities, given its potential to facilitate emission-free road transport through innovative technologies. The HRS rollout may therefore become eligible for financing under the RSFF, provided that it successfully passes the due diligence by the EIB and is approved by the EIB's governing bodies (see **Box 7**). In this case, RSFF financing could be provided for the first HRS rollout in one EU Member State, as it could qualify as "pilot and demonstration activity".

**Key learnings from Chapter L: Different types of financiers may be interested in financing the HRS rollout – Profiles of investors and lenders**

There are five different types of potential financiers for the HRS rollout:

**Strategic investors:** Strategic investors need the HRS rollout in order to bring the products that they produce as part of their core business to the market (e.g. FCEVs, HRS, H<sub>2</sub>). Due to the strategic value of the HRS rollout for these investors, they are expected to provide financing for the project right from the start, i.e. from Phase 1. These investors are the best positioned to address and, if need be, absorb the project risks, including FCEV ramp-up risk.

**Private equity:** Private equity investors may be interested in providing funds for the HRS rollout if the project offers a growth story, i.e. a significant potential for increasing returns after purchasing the project. To realize the growth story, private equity requires full control of the project, independent of strategic investors' interests. After realizing the growth potential, private equity investors would seek to resell the project. For this purpose, the HRS rollout requires a long-term perspective (typically more than ten years after its purchase by private equity investors). Private equity investors do not absorb major project risks. They are willing to accept a higher risk level than other private financiers in exchange for the prospect of realizing and tapping the project's growth. Private equity investors may be interested in becoming involved in the HRS rollout toward the end of Phase 2.

**Infrastructure investors:** Infrastructure investors require guaranteed or secure returns and full control of the project risks. They also require a long-term perspective, i.e. the continued operation of the HRS rollout with secure returns for typically more than ten years after they purchased the project. They will not absorb any project risks. Infrastructure investors may be interested in financing the HRS rollout in Phase 3.

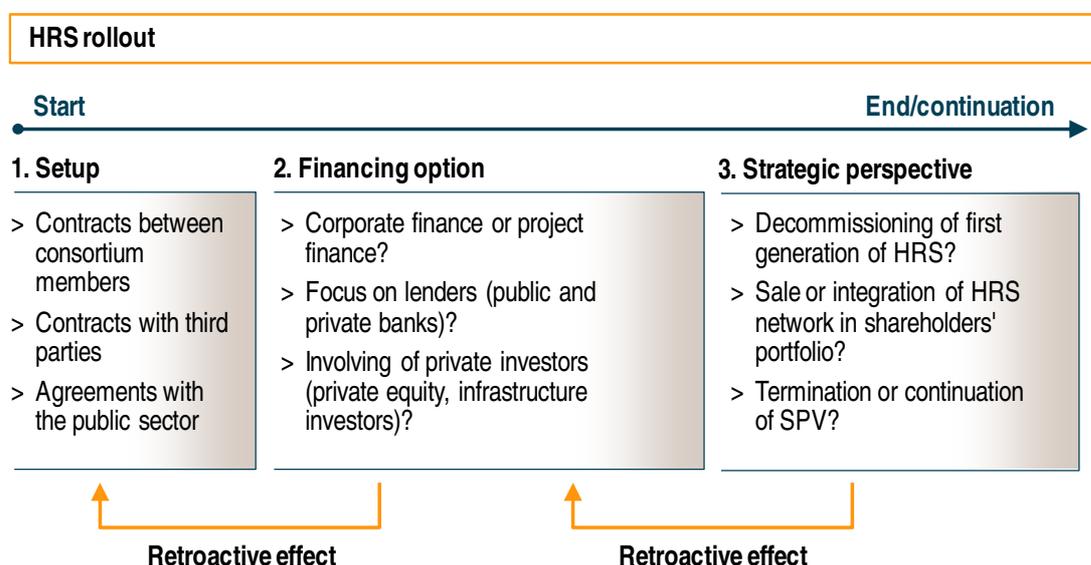
**Commercial banks:** Commercial banks could consider financing the HRS rollout when cash flows become sufficient (including a buffer) to cover debt repayment and interest, and the project risks are fully under control. They would not absorb any project risks. They may be interested in financing the HRS rollout in Phase 3.

**Public/development banks:** Public banks can provide financing for the HRS rollout if the project complies with their mandate and policy goals. Public lenders can offer financing at favorable conditions to eligible projects – with a higher risk appetite, as an anchor investor, with lower interest rates and with adjusted durations. The HRS rollout may be eligible under the EIB's RSFF, an instrument that allows the bank to absorb a higher level of risk than commercial financiers. RSFF financing could become available in Phase 2. The support from the EIB RDI Advisory team could already be available the Pre-bankable Phase. The HRS rollout could already undergo a due diligence with the EIB in this stage leading potentially to a general commitment from the EIB to provide a loan at a later stage if the HRS rollout meets a set of pre-defined milestones. The KfW, the development bank of the German government, can only provide financing on the same basis as commercial banks ("private investor test"), i.e. in Phase 3 and, of course, after satisfactory due diligence. However, it could potentially act as an anchor investor in Phase 3 and provide a larger share of funds than commercial lenders would. Despite their higher risk appetite, public banks would not absorb the FCEV ramp-up risk.

## N. Strategic perspectives and financing options for private-sector participation in financing the HRS rollout

### ► The long-term strategic perspective and its impact on decisions relating to the setup for the HRS rollout at the start of the project

Strategic investors need to define already at the start of the HRS rollout what they want to achieve from it in the long run. The long-term strategic perspective for strategic investors will partially be based on the contracts and agreements drawn up at the outset. As a consequence, the initial setup of the HRS rollout will influence – and to some extent limit – the choices available with regard to the financing structure and the long-term perspective of the HRS rollout. This is illustrated below.



**Fig. 35:** The strategic perspective influences the initial setup of the HRS rollout

- The **long-term strategic perspective** influences decisions about the preferred financing option: What is the strategic purpose of the HRS rollout from the strategic investors' point of view? Do they want to own and operate the HRS network once it has become profitable? Or do they want to withdraw from owning and operating the HRS network as it is outside their core business, once the market for their products (FCEVs, HRS, H<sub>2</sub>) has been established?
- The chosen long-term strategic perspective influences the **choice of financing option** for the HRS rollout, as different types of financiers have different requirements with regard to the long-term strategic perspective of the project. While lenders are normally indifferent with regard to the project setup as long as debt service and interest payments are secure, investors require the continuation of the project for ten years or more after they invest in it. For example, corporate finance makes sense if strategic investors plan to continue operating the HRS network long term. However, if they plan to sell the HRS network later on, project finance involving private equity and infrastructure investors is more suitable
- The chosen financing option influences the **project setup** as defined by strategic investors at the start of the HRS rollout. This includes the ownership of assets (distributed between different corporations or concentrated in an SPV owned by the strategic investors), the level of

involvement in operations of each strategic investor, and the liabilities provided by each strategic investor. Choices with regard to the project design will be set out in the contracts and agreements on which the project is based, i.e. the contracts between the members of the consortium, contracts with third parties, and agreements with public sector actors

### ► Possible strategic perspectives for the HRS rollout

Two possible strategic perspectives have been identified for the HRS rollout in the long term:

**Strategic Perspective 1. Independent operator – Creation of an independent legal entity with a secure long-term perspective:** In this option, the strategic investors form a consortium that then creates a legally independent entity for handling the HRS rollout. The legal entity aims to continue operating after the HRS rollout has become profitable. The independent operator has a business model that secures its long-term operation.

Options for securing this long-term perspective are as follows:

- 1 – HRS network owner and operator: The independent operator owns and operates a network of HRS that is separate from other existing refueling station networks. The HRS are located by a chain of supermarkets or a network of parking garages, for example. The independent operator owns and operates the HRS
- 2 – Exclusive HRS operator: The independent operator runs the HRS network but does not own it. To secure the long-term perspective, the independent operator has exclusivity with regard to operating the HRS owned by the strategic investors, or all the HRS owned by one or more HRS operators

Essential conditions include:

- Creating a legally independent entity (SPV)
- Defining the long-term strategic perspective (see Options 1 and 2) in the consortium's contractual basis at the start of the project

Strategic investors have the option of maintaining ownership of the independent operator or selling it – for example to a refueling station operator, private equity investor or infrastructure investor.

**Strategic Perspective 2. "Jump-starter" – Any organizational structure that will be dismantled after the HRS rollout begins:** Strategic investors finance the initial HRS network, aiming to sell the assets when the HRS network is close to becoming (or has already become) profitable. The assets are then sold to a refueling station operator, a supermarket chain or any other business that can operate the network by themselves. The organization handling the HRS rollout is then shut down.

Essential conditions include:

- The initial years of the HRS rollout can be handled by a more or less formalized organizational structure. This can range from a project organization that operates within the existing structures of the strategic investors to a newly-created legally independent entity
- Contractual arrangements between strategic investors can be open with regard to the future perspective of the organizational structure

## ► Evaluation of the strategic perspectives

If an **independent operator** is created (Strategic Perspective 1), the strategic investors must lay the foundations for the entity to operate successfully over a period of more than ten years. This requires binding commitments from strategic investors with regard to the entity's long-term perspective, acting as the owner of an independent HRS network or its exclusive operator. The feasibility of this option depends on the strategic investors' readiness to make such binding commitments.

Setting up and later dismantling a "**jump-starter**" (Strategic Perspective 2) requires less binding commitments from strategic investors at the start of the HRS rollout. Additionally, dismantling the structure handling the initial HRS network makes it easier to create a competitive market, as there is less incentive for strategic investors to create exclusivity for the operator of the initial HRS network.

## ► Financing options for the HRS rollout

In our workshops with financiers, we identified three basic options for financing the HRS rollout:

- Corporate finance
- Project finance/leveraged joint venture: Leveraging investments from strategic investors through loans
- Project finance/independent operator: Selling the SPV to private equity and/or infrastructure investors

Which of these options are possible for the HRS rollout depends on the strategic perspective chosen by the industry stakeholder (see below).

Financing options	Strategic perspectives	
	1: Independent operator	2: Jump-starter
1 Classical corporate finance		
2 Project finance – leverage through loans		
3 Project finance – sale to private equity / infrastructure investors		

**Fig. 36:** Strategic perspectives for the HRS rollout and possible financing options

The financing options for the HRS rollout, and the preconditions for accessing them, are described below.

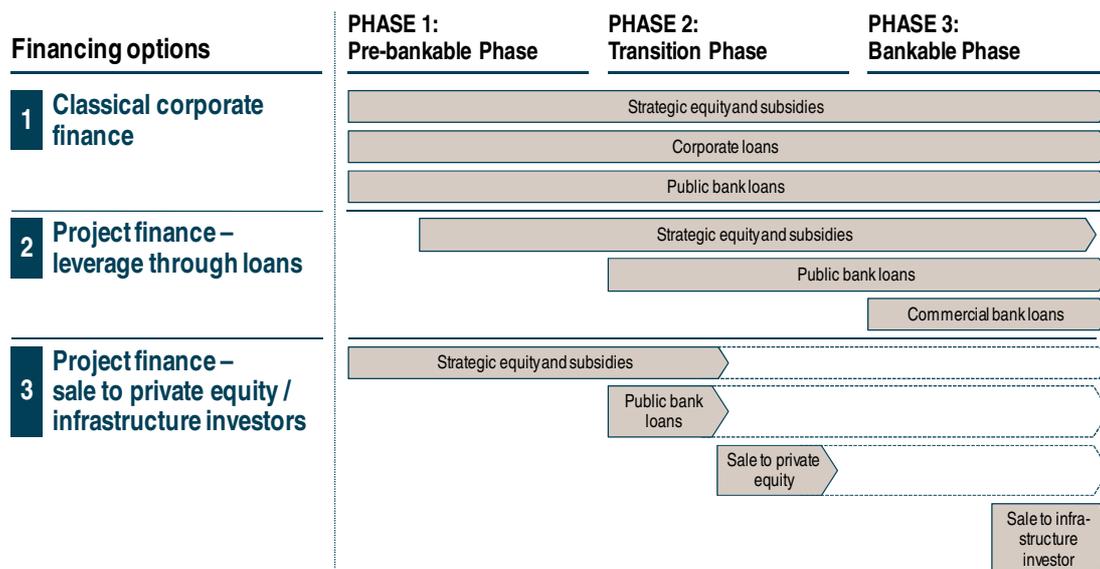


Fig. 37: Financing options for the HRS rollout

### Financing Option 1: Classical corporate finance

In this option, each strategic investor finances a number of HRS. Each corporation's finance department can leverage strategic equity via loans. As the loan is secured via the corporation's balance sheet, leverage can be achieved right from the start of the project, i.e. in Phase 1.

Loans from commercial banks can be complemented with loans from public and development banks, which may be available at favorable conditions (reduced rates of interest, long maturity) if the HRS rollout is in line with the policy objectives of the public/development bank's programs.

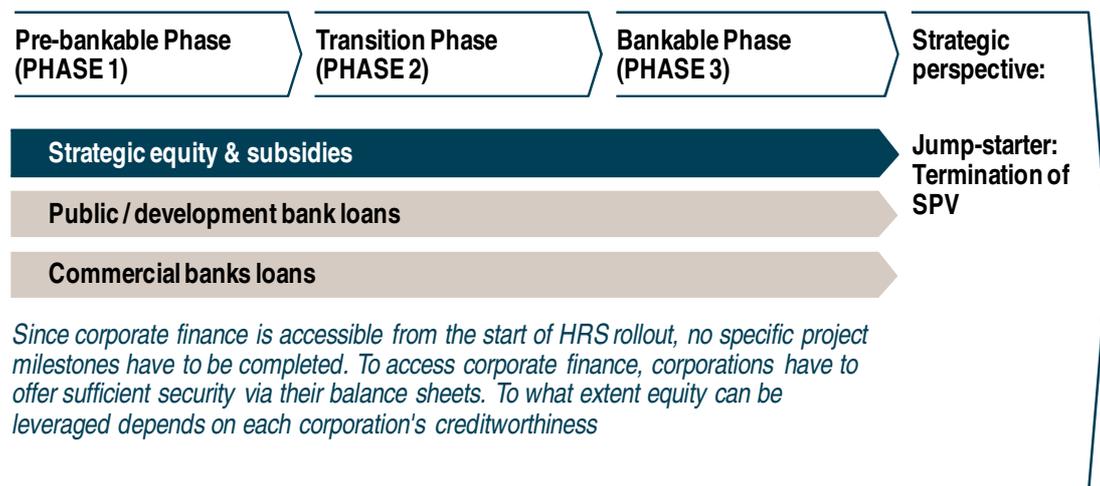


Fig. 38: Conditions for accessing corporate finance for the HRS rollout

### **BOX 6: Example of a development bank program – KfW Environmental Protection Program ("KfW Umweltprogramm")**

The KfW Environmental Protection Program ("KfW-Umweltprogramm") supports investments by companies that help to reduce environmental impact, for example by reducing emissions or improving resource efficiency. Loans under this program are managed and disbursed exclusively by intermediary financial institutions (e.g. the IKB), not by the KfW itself.

#### **Basic mechanism of the Environmental Protection Program**

The loans under this program have a reduced interest rate compared to commercial loans, mainly because the KfW passes its favorable refinancing conditions on to borrowers. The KfW's refinancing conditions are favorable due to the bank's backing by a German government guarantee, and the resulting AAA rating.

To obtain access to a loan under the Environmental Protection Program, borrowers seeking financing have to pass a standard commercial lending due diligence conducted by the intermediary bank through which the loan is channeled. While the program offers particular benefits in the form of reduced interest rates for eligible borrowers, the instrument does not entail a higher risk acceptance. As a consequence, loans from this program could only become available in phase 3 (bankable phase) of the HRS rollout project, provided that the project is found eligible by the KfW.

#### **Eligibility criteria**

- German and non-German enterprises, joint ventures, and PPPs are eligible for investment projects in Germany
- The investments have to contribute substantially to improving the environmental situation
- The maximum loan is for up to 100% of eligible project costs (generally capped at EUR 10 m per project, but higher amounts are possible depending on project characteristics)
- Loans are subject to regular due diligence; no higher risk acceptance

#### **Loan conditions**

- Fixed interest rate: subsidized, below market levels
- Long-term maturity of typically ten years, with a grace period for repayments in the first two years. Maturity of up to 20 years is possible, with a grace period for repayments in the first three years

#### **Availability for the HRS rollout**

Given its potential as a zero emission transport fuel, the HRS rollout project is likely to be eligible under this program (financing of H<sub>2</sub> fuel dispensers). Investments in CNG and biogas fuel dispensers and battery charging stations for electric vehicles were already found to be eligible.

## Financing Option 2: Project finance – Leverage through loans

In this financing option, strategic equity investors form a consortium and create an SPV responsible for handling the HRS rollout.

In Phase 2, the project's cash flows are just sufficient for debt repayment and interest payments, and the risk level is still high. At this stage, debt financing from certain public/development banks becomes accessible (e.g. the RSFF from EIB – see **Box 5**).

In Phase 3, the SPV can access loans from commercial banks. Additional loan instruments from public banks which yield favorable conditions also become available (e.g. the "KfW Umweltprogramm" – see **Box 6**).

In this financing option, the HRS rollout JV has to pass certain key project milestones, as shown below.

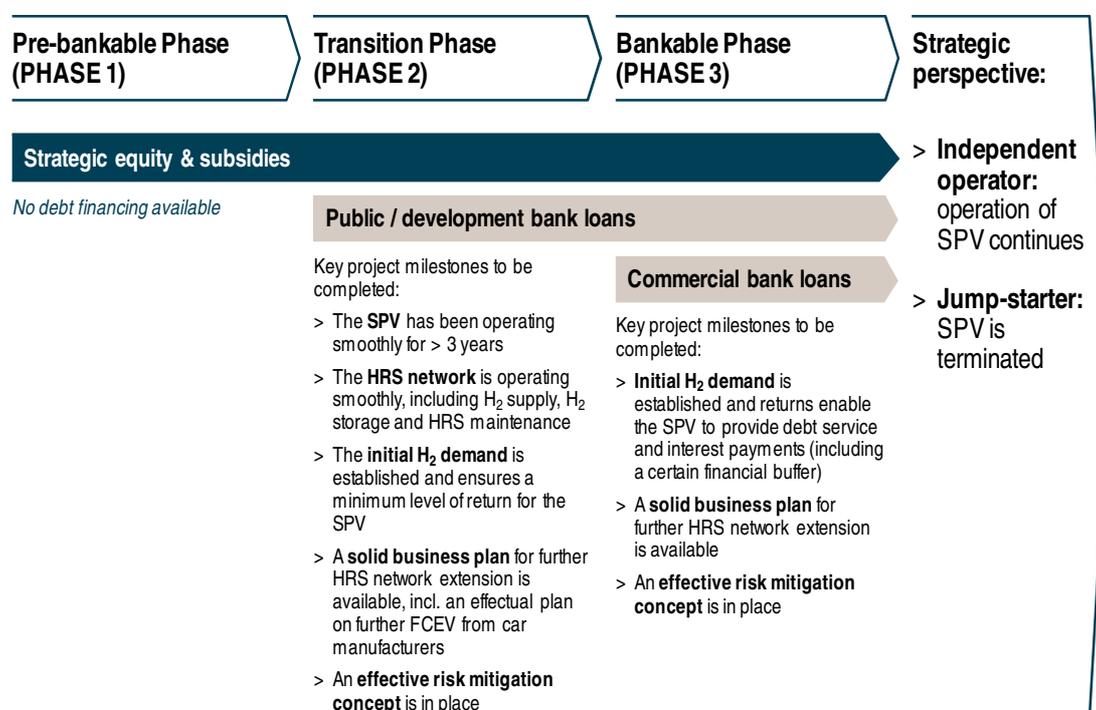


Fig. 39: Key project milestones for Financing Option 2

## Financing Option 3: Project finance – Sale to private equity/infrastructure investors

In this financing option, strategic equity investors form a consortium to set up an SPV responsible for handling the HRS rollout. In Phase 1, the HRS rollout has to rely on strategic equity and potentially public-sector support.

In Phase 2, the SPV can access financing from public banks (see Financing Option 2 for preconditions). Toward the end of Phase 2, a private equity investor may be interested in financing the HRS rollout. For this to happen, the HRS rollout must offer a growth story, in other words the perspective of a significant increase in the SPV's revenues. This growth story could include an exclusivity agreement with large refueling network operators or contracts with large fleet operators, combined with upcoming regulation on a share of zero-emission vehicles in fleets, say.

In Phase 3, an infrastructure investor may be interested in investing in the HRS rollout. Infrastructure investors would seek to operate the HRS rollout SPV typically for ten years or longer. During this period, the SPV would be operated within the same strategic framework and yield secure, if not guaranteed, returns. Secure returns could be achieved through long-term contracts with large fleet operators, for example, including a minimum H<sub>2</sub> off-take, or via exclusivity with refueling network operators for operating their HRS.

In this financing option, the HRS rollout JV has to pass certain key project milestones, as shown below.

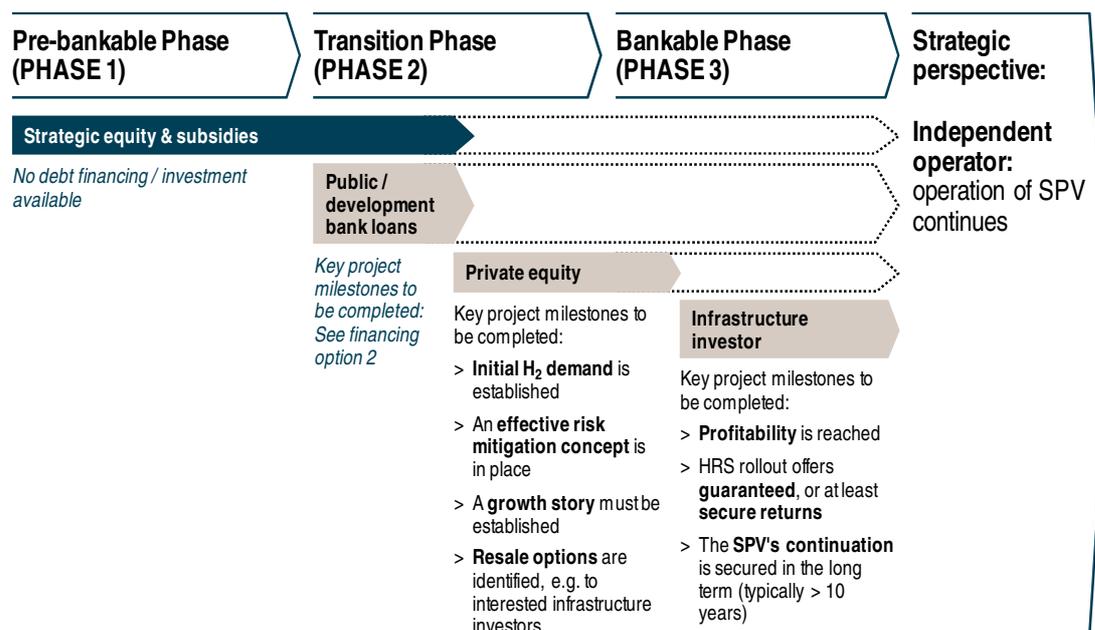


Fig. 40: Key project milestones for Financing Option 3

### BOX 7: Due diligence by EIB – Typical process

#### 1. Applying for financing from the EIB – General overview of process

A project promoter seeking financing from the EIB submits a project to the bank. After an initial examination and preliminary talks, the EIB may decide to carry out a comprehensive due diligence procedure, which the project has to pass to gain access to financing. The procedure for this in-depth assessment is described in detail below ("A closer look at the EIB's due diligence procedure").

The findings of the due diligence are reported to the EIB's Management Committee, the bank's permanent executive body in charge of day-to-day operations. The Management Committee reviews the staff report and decides whether to submit an official financing proposal to the Board of Directors ("soft commitment").

Based on this request, the Board of Directors can approve the proposed operation and take an official decision to provide EIB financing. Upon approval by the Board of Directors, detailed negotiations are initiated, which lead to the signing of a legally binding contract between EIB and the borrowing entity.



**Fig. 41:** Overview: EIB decision-making process on financing

## 2. A closer look at the EIB's due diligence procedure

Due diligences by the EIB are always tailored to the requirements of the specific project. However, some overarching principles, building blocks and process steps typically apply to all due diligences performed by the bank. The EIB's due diligence usually consists of three pillars:

- Project due diligence
- Financial due diligence
- Legal due diligence

These three steps may overlap and take place in parallel. However, there is a typical sequence in the procedure, which is described below.

### Project due diligence

The project due diligence is typically the first step in the process. It is carried out by the EIB's project directorate.

This step includes an **eligibility assessment**, in the course of which EIB staff evaluates the project's compliance with the bank's lending objectives. Eligible projects are those that contribute to EU economic policy objectives in at least one of six priority areas:

- Cohesion and convergence
- Support for small and medium-sized enterprises (SMEs)
- Environmental sustainability
- Innovation
- Trans-European Networks (TEN)
- Sustainable, competitive and secure energy

The project due diligence also includes a **viability assessment** that reviews the technical and economic soundness of the project. It includes the following criteria:

- Technological viability (e.g. technological readiness, level of innovation, reliability, level of standardization)
- Market acceptance (e.g. cost of ownership vs. comparable alternatives, purchasing price/tax incentives, supporting service infrastructure)
- Environmental soundness (compliance with applicable legislation, environmental impact)
- Use of appropriate procurement procedures (international competitive bidding, where appropriate)
- Economic soundness/justification (broad assessment of economic effects beyond financial

profitability, including assessment of the project's overall benefits and costs to society, e.g. through spill-over effects, externalities)

The project due diligence also defines the eligible project cost in order to determine the maximum size of the EIB loan. It typically involves meetings of EIB project directorate experts with operational and technical staff, as well as site visits.

### **Financial due diligence**

The financial due diligence evaluates the potential borrower's financial capacity and creditworthiness. It includes, for example, a review of historical financial information and a management discussion about the company's financial projections. In substance, it corresponds to a standard credit analysis, such as that typically carried out by commercial banks with regard to lending decisions. In the context of project finance, it involves a bankability assessment that builds upon the project viability assessment and focuses primarily on the cash flows of the project vehicle. The results of the financial due diligence serve to determine which financing instrument is suitable for the project. The procedure is handled by the EIB's lending operations unit, which may involve external support in this step.

### **Legal due diligence**

The legal due diligence usually constitutes the final step in the due diligence procedure. It starts when the project due diligence and financial due diligence are complete or near to completion. Its purpose is to evaluate the legal structure and situation of the entity seeking financing. It includes a review of the capacity, statutes and organizational structure of the borrowing entity. It also includes an evaluation of any pending legal issues with third parties or public authorities. The procedure typically involves close interaction between the internal and/or external counsel of the applicant and EIB's legal services unit.

## **► Evaluation of financing options**

Financing Option 2 (Project finance – Leverage through loans) offers the most advantages for strategic investors in terms of practicability of implementation, ability to steer the project and the possibility for strategic investors to tap growth (see below).

Financing options	Practicality of implementation at the start	Steerability in the medium and long run	Consortium's perspective to tap growth
<b>Classical corporate finance</b>	 Mostly internal decision of corporations	 Loose project organization likely	 Option to maintain ownership of HRS when profitability is in sight / reached
<b>Project finance – leverage through loans</b>	 No decision on termination / continuation of SPV in >10 years required	 Legally independent entity with stronger grip on implementation	 Option to maintain ownership of HRS when profitability is in sight / reached 
<b>Project finance – sale to private equity/infrastructure investor</b>	 Far reaching long-term commitments from consortium members needed	 Legally independent entity with stronger grip on implementation	 Sale to private equity needs to happen before growth of H <sub>2</sub> sales fully materialized

Fig. 42: Evaluation of financing options for the HRS rollout

### Key learnings from Chapter M: Strategic perspectives and financing options for the HRS rollout

The long-term strategic perspective of the HRS rollout needs to be determined at the start of the project. There are two possible strategic perspectives:

- Create an independent operator, i.e. a legally independent entity with a secure long-term perspective
- Use the organizational structure of the HRS rollout as a "jump-starter" and dismantle it after the successful creation of the HRS network

There are three possible financing options for the HRS rollout. Which options are possible depends on which long-term strategic perspective is chosen:

- Classical corporate finance (possible with the "jump-starter" strategic perspective): As loans are secured via the project sponsors' assets and revenues on their balance sheets, loans from private and public lenders are accessible from Phase 1
- Project finance leveraged through loans (possible with the independent operator and the "jump-starter" strategic perspectives): In Phase 1, the HRS rollout has to rely on equity from strategic investors and potentially public sector support. In Phase 2, loans from public lenders become available. In Phase 3, loans from commercial lenders become available
- Project finance with the intention of selling the HRS rollout SPV to private equity and/or infrastructure investors (possible with the independent operator strategic perspective): In Phase 1, the HRS rollout has to rely on equity from strategic investors and potentially on public sector support. In Phase 2, private equity investors may be interested in financing the HRS rollout. In Phase 3, infrastructure investors may enter the project

Project finance leveraged through loans offers the most advantages for strategic investors in terms of practicability of implementation, ability to steer the project and the possibility for strategic investors to tap growth.

# Annex

## 1. Business case assumptions

### *Financing*

- Business case computations assume that HRS roll-out will be handled by a joint venture (JV), which is set up as a special purpose vehicle (SPV) financed on a project financing basis
- Hypothetical capital structure of JV is based on yearly Capex financing of 30% equity and 70% debt (for ADSCR analysis)
- Annual interest payments and debt repayments start in year 1; no grace period assumed
- Debt repayment is based on a project financing structure; debt assumed to be issued each year for CAPEX financing with a 12-year maturity and equal annual redemption payments
- Cost of debt is set at 7%, cost of equity at 12%

### *HRS procurement and operation*

- HRS deployed in the network have a maximum capacity of 400 kg H<sub>2</sub>/day
- Procurement costs for HRS are expected to decrease due to learning effects and economies of scale, starting at approximately EUR 900,000 in 2010 and reaching approximately EUR 820,000 in 2030 (-0.6% p.a)
- Asset lifetime of HRS is assumed to be 15 years; depreciation is computed accordingly
- Average annual distance driven per FCEV is set at 12.000 km
- Average fuel consumption for FCEVs decreases over time ca. 0.8 kg H<sub>2</sub>/100 km in 2015/2016; gradual decrease over time to about 0.6 to 0.7 kg H<sub>2</sub>/100 km in 2030
- Operating costs consist of fixed operating costs plus variable operating costs depending on volume of H<sub>2</sub> sales (in particular electricity and maintenance)
- H<sub>2</sub> production is assumed to consist of a mix of production methods, including:
  - (1) by-product from industry,
  - (2) water electrolysis (WE) from renewable energy sources
  - (3) steam methane reforming (SMR), mostly from natural gas
- The share of H<sub>2</sub> produced through WE from renewable energy sources is assumed to increase over time
- H<sub>2</sub> sales price is assumed to be 10% below cost for Diesel<sup>11</sup> (on a per km basis) to ensure competitiveness vis-à-vis Diesel with a slight price advantage for H<sub>2</sub>
- Diesel is subject to fuel tax and VAT; H<sub>2</sub> sales are exempt from fuel tax, but are subject to VAT<sup>12</sup>
- The applicable corporate tax rate for the JV is assumed to be 30%
- The costs of managing the JV are not included

## 2. Additional business case assumptions for NPV analysis (three phases)

- In phase 1, the capital structure of the JV is based on 100% equity financing
- Between phase 1 and phase 2, a financial restructuring takes place to achieve debt/equity ratio of 20:80

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<sup>11</sup> Computations take into account different Diesel price levels in UK and Germany

<sup>12</sup> Computations take into account differences in VAT between UK and Germany

- In phase 2, annual CAPEX required for gradual expansion of HRS network is financed through 20% debt and 80% equity
- Between phase 2 and phase 3, a financial restructuring takes place to achieve debt/equity ratio of 70:30
- In phase 3 annual CAPEX for gradual expansion of HRS network is financed through 70% debt and 30% equity
- Annual interest payments start in year 1 after debt issuance; annual redemption payments start one year after financial restructurings take place (grace period)

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