Introduction to portfolio of ENERGY demonstration projects

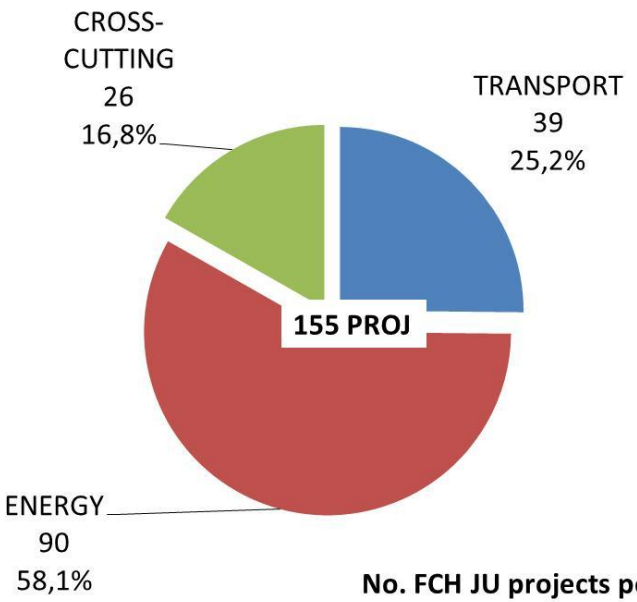
Mirela Atanasiu – Project Manager

Team Leader Energy Applications

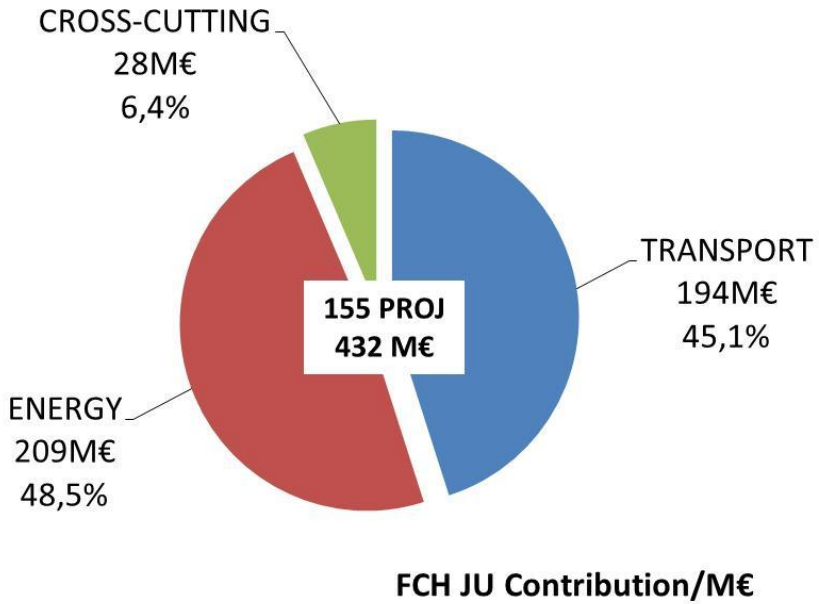
FCH for ENERGY: 90 projects
209 mill EUR committed by EU/FCH

- Currently distributed in 3 different application areas:
  - Hydrogen Production and Storage
  - Stationary applications and CHP
  - Early markets (Back-up power and off-grid systems)

Almost 50% of the budget committed to **ENERGY oriented projects**



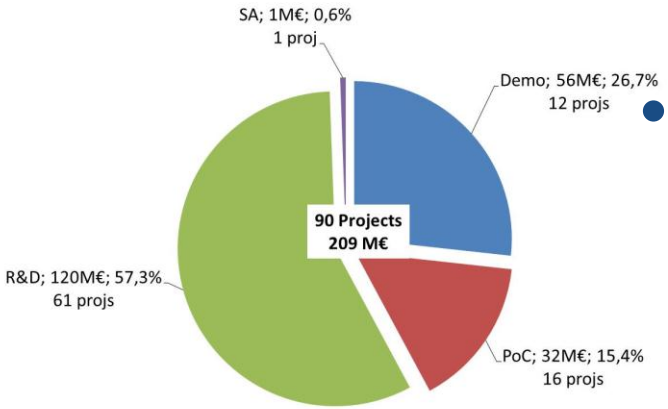
No. FCH JU projects per pillar



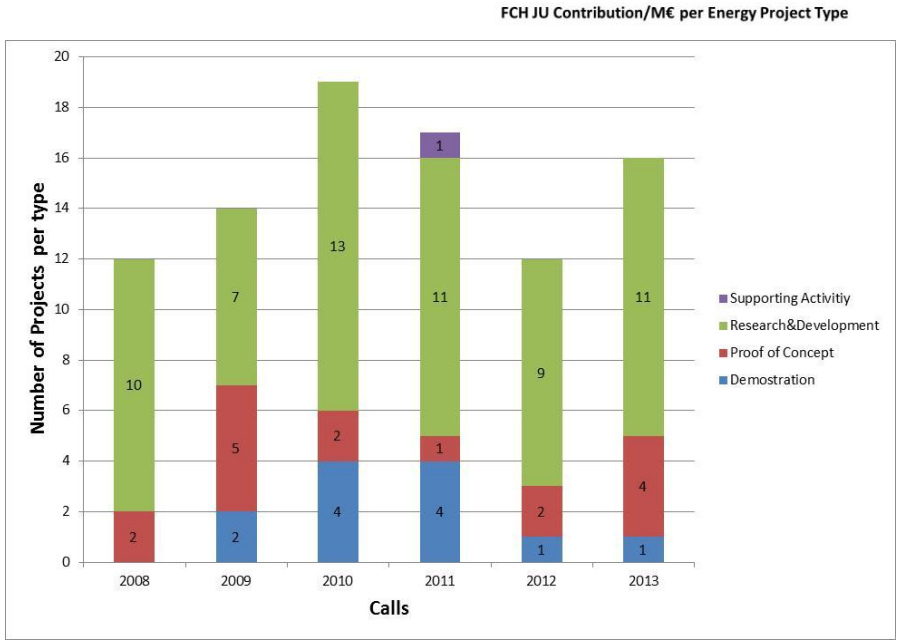
FCH JU Contribution/M€

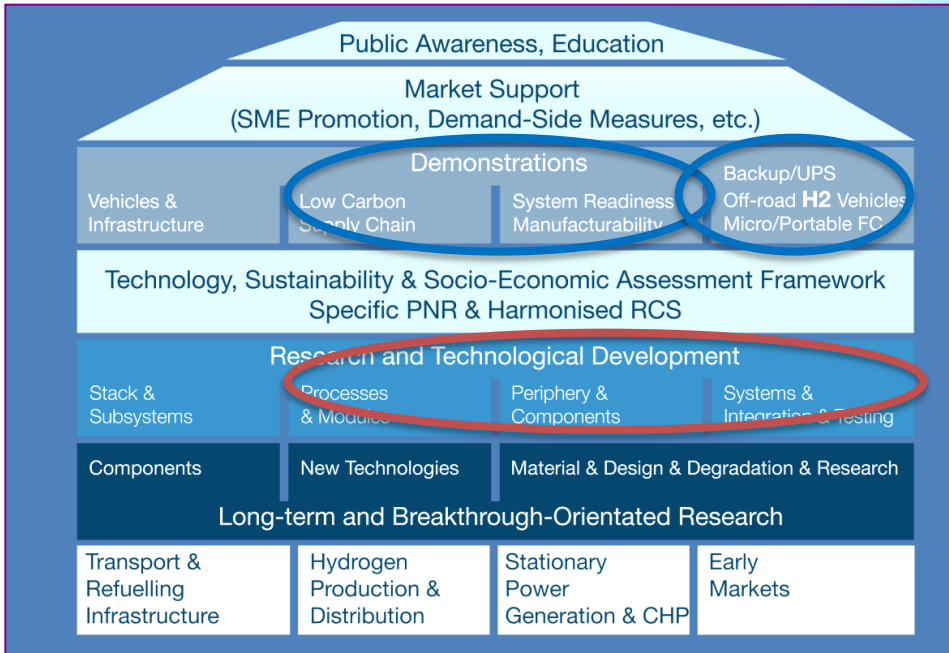
88 mill EUR in demo-type projects for ENERGY applications

Energy projects still strongly R&D oriented

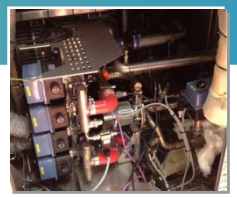


- 28 DEMO type projects
  - 12 Field Demonstration
  - 16 Proof-of-concept, components, diagnostics and control

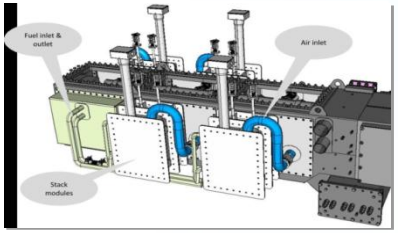




MAIP Coverage
Technology/Activities Projects examples



ASSENT: development of **fuel and water management** for SOFC systems



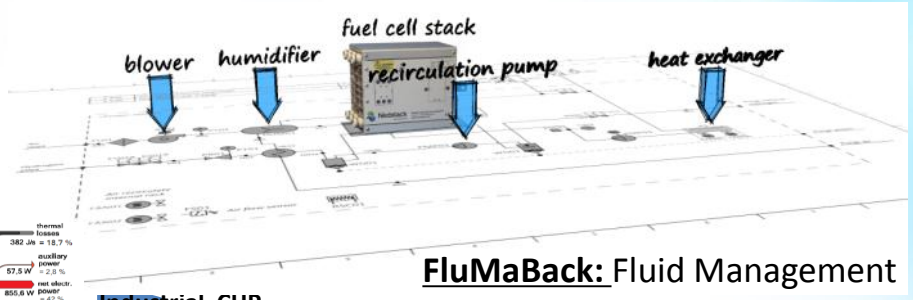
CATION: optimal process and mechanical **solutions for the cathode** and stacks subsystems

sofcom
FCH-JU project

proof-of-concept CCHP plants based on SOFC fed by different typologies of biogenous primary fuels (locally produced), integrated by a process for the CO2 recovery

RE4CELL

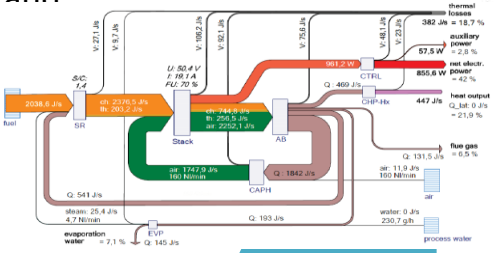
new **multi-fuel membrane reformer** for pure hydrogen production (5 Nm3/h) based on Catalytic Membrane Reactors



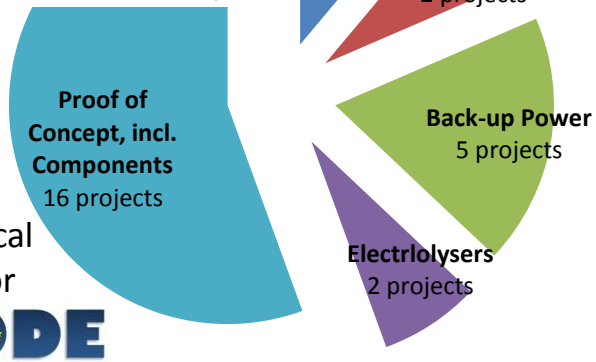
FluMaBack: Fluid Management component improvement for Back-up fuel cell systems

CHP system based on ASC technology, at reduced stack-temperature of 650C and high electrical efficiency (min. 45%)

LOTUS



SAPPHIRE: System Automation of PEMFCs with Prognostics and Health management



TriSOFC: low-cost durable low temperature (LT) SOFC tri-generation (cooling, heating and power) prototype

new DC/DC converter to use on-line electrochemical impedance spectroscopy (EIS) as **diagnostic tool** for back-up power and CHP applications

DECODE

MAIP Coverage *Volumes*

SOFT-PACT

ene.field

CLEARgen™Demo

POWER-UP

ELYGRID

Improvements to Integrate High Pressure Alkaline Electrolysers for Electricity/H2 production from Renewable Energies to Balance the Grid

fitup

FCpoweredRBS

Research

100 micro-CHP units *(1 manufacturer, 4 countries)*

1000 micro-CHP units *(9 manufacturers, 12 countries)*

1 MW industrial CHP unit /PEM based *(in Europe – place tbc)*

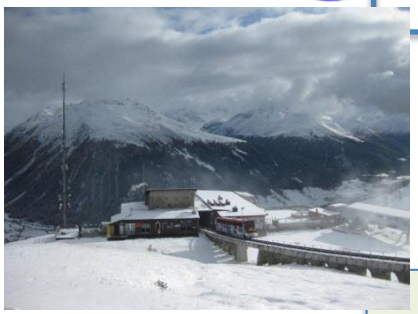
500 kW industrial CHP unit/alkaline based *(in Germany)*

1 MW alkaline electrolyser *(coupled with wind energy, in Spain)*

19 back-up and UPS units *(3 countries)*

18 live Radio stations (off-grid) *in Italy*

2010 2013 2016



Different climates/technologies/routes-to-market

Increased volumes

Cost reduction/Increased durability

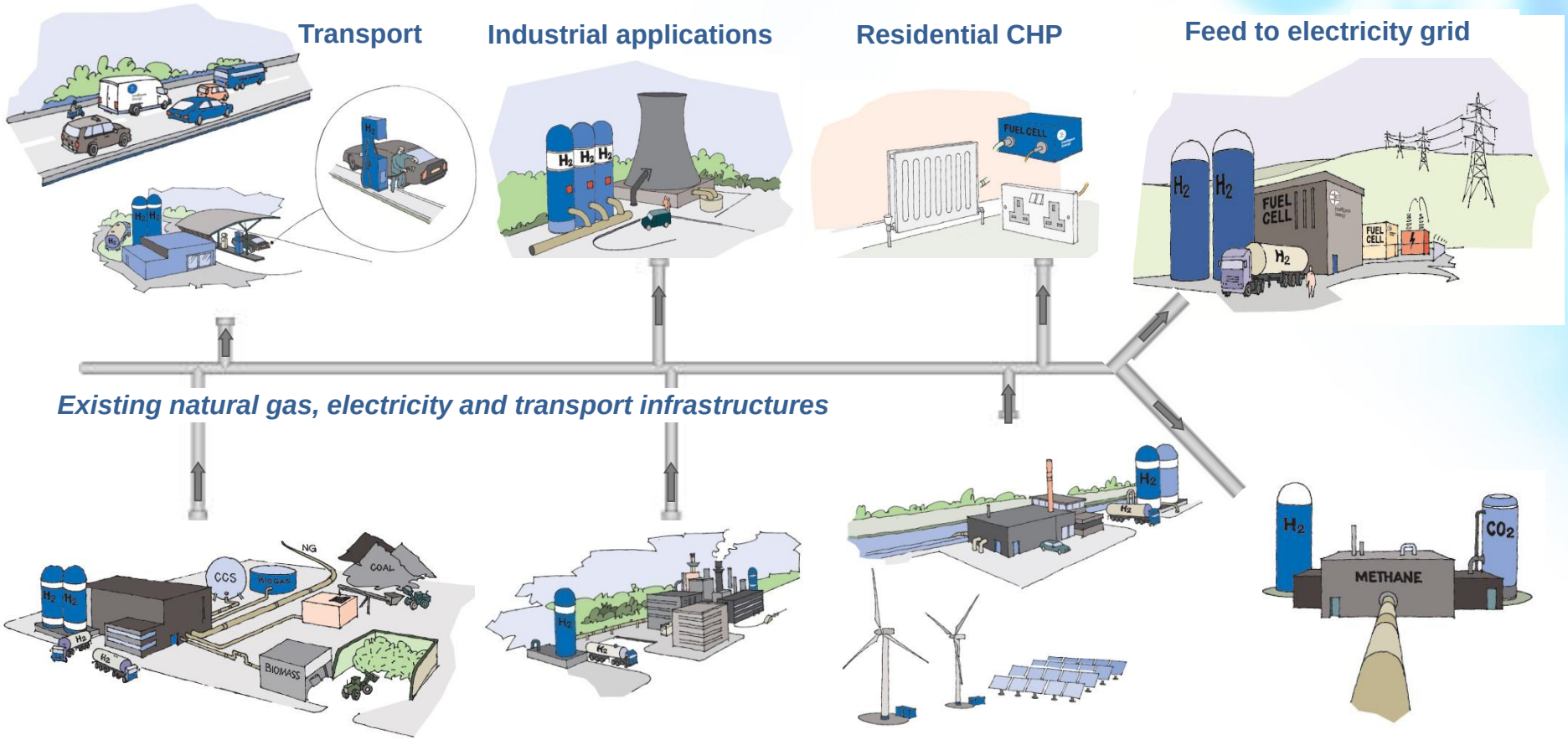
Research

Important achievements in m-CHP early-demonstration

- More than 60 BlueGen units in DE, UK, NL
  - 56% electrical efficiency, 25% reduction of CAPEX
- More than 50 units in DE, FR, CH, IT, DK, UK
  - 8 field trials/manufacturers
  - Commercial discussions on-going (more than other 200 contracts signed and other 200 in final negotiation) – ramping-up of 500 units by Sept 2015
  - Electrical eficiency around 35% for PEM units and 45-50% for SOFC units

- *Challenges*
  - *reduced interest of utilities (mainly electricity), although main route to the market – direct contracts with end-users less suitable for mass-deployment !*
  - *Duration of service contract, some-time longer than life-time of the project – related issue in addressing national/regional funding*
  - *Only approx 1/3 of the end-users/houses contacted meet the required conditions for m-CHP installation*
  - *Small quantity supply chain, need for training of installers etc*

FCH2: Self Reliant in Energy Provision with Fuel Cells and Hydrogen



Natural gas, biogas, coal, biomass

By-product from Chemical Industry

Renewable generation, storage and 'buffering'

Methanisation feed to natural gas grid

Energy-oriented objectives under FCH2

- 3 out of the 4 main objectives are in ENERGY
  - increase electrical efficiency and durability of the different fuel cells used for power production
  - increase energy efficiency of the production of hydrogen from water electrolysis and renewable sources
  - demonstrate the feasibility of using hydrogen for energy storage to support the integration of renewable energy sources into energy systems

+ reduce the use of ‘critical raw materials’

Energy priorities by 2020
Multi Annual Work Plan, MAWP

- Hydrogen production for energy storage and grid balancing from renewable electricity (water electrolysis)
  - *Electrolysers Study already published*
  - *Energy Storage Study to be published soon*

		State-of-the-art	2017	2020	2023
KPI 1	H2 production electrolysis, energy consumption (kWh/kg) @ rated power	57-60 @100kg/d	55 @500kg/d	52 @1000+kg/d	50 @1000+kg/d
KPI 2	H2 production electrolysis, CAPEX @ rated power including ancillary equipements and comissioning	8.0 M€/(t/d)	3,7 M€/(t/d)	2.0 M€/(t/d)	1.5 M€/(t/d)
KPI 3	H2 production electrolysis, efficiency degradation @ rated power and considering 8000 H operations / year	2% - 4% / year	2% / year	1,5% / year	<1% / year

- Hydrogen production with low carbon footprint from other resources

Study under preparation

- Fuel cell systems for CHP and power only
  - *Distributed Generation Study to be published soon*

Topic	Key performance indicator (KPI)	Unit	SoA	FCH-JU target		
			2012	2017	2020	2023
Residential: mCHP for single family homes and small buildings (0,3 - 5 kW)	CAPEX	€/kW	16,000	14,000	12,000	10,000
	Durability	years of plant operation	10	12	13	14
	Availability	% of the plant	97	97	97	97
	Electrical efficiency	% LHV	30-60	33-60	35-60	35-60
	Thermal efficiency	% LHV	25-55	25-55	25-55	25-55
	LCOE	€ Ct/kWh	3*grid parity	2.5*grid parity	2*grid parity	<2*grid parity
	Emissions	mg/kWh	NOx < 2 ppm, no SOx	NOx < 2 ppm, no SOx	NOx < 2 ppm, no SOx	NOx < 2 ppm, no SOx

- Hydrogen storage, handling and distribution

Thank you for your attention !

Further info :

- **FCH JU (Programme Office) http://fch-ju.eu**
- **NEW-IG http://www.new-ig.eu**
- **N.ERGHY http://www.nerghy.eu**