European Hydrogen and Fuel Cell Technology Platform

The Implementation Plan – Achieving the "SNAPSHOT 2020"

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Synergies between HYPOGEN and the Hydrogen Economy
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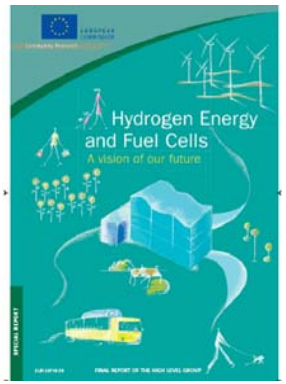
Overview

- Background / Process
- Implementation Plan
- Sustainable Hydrogen Production and Supply
- Key Issues

From Vision to Implementation



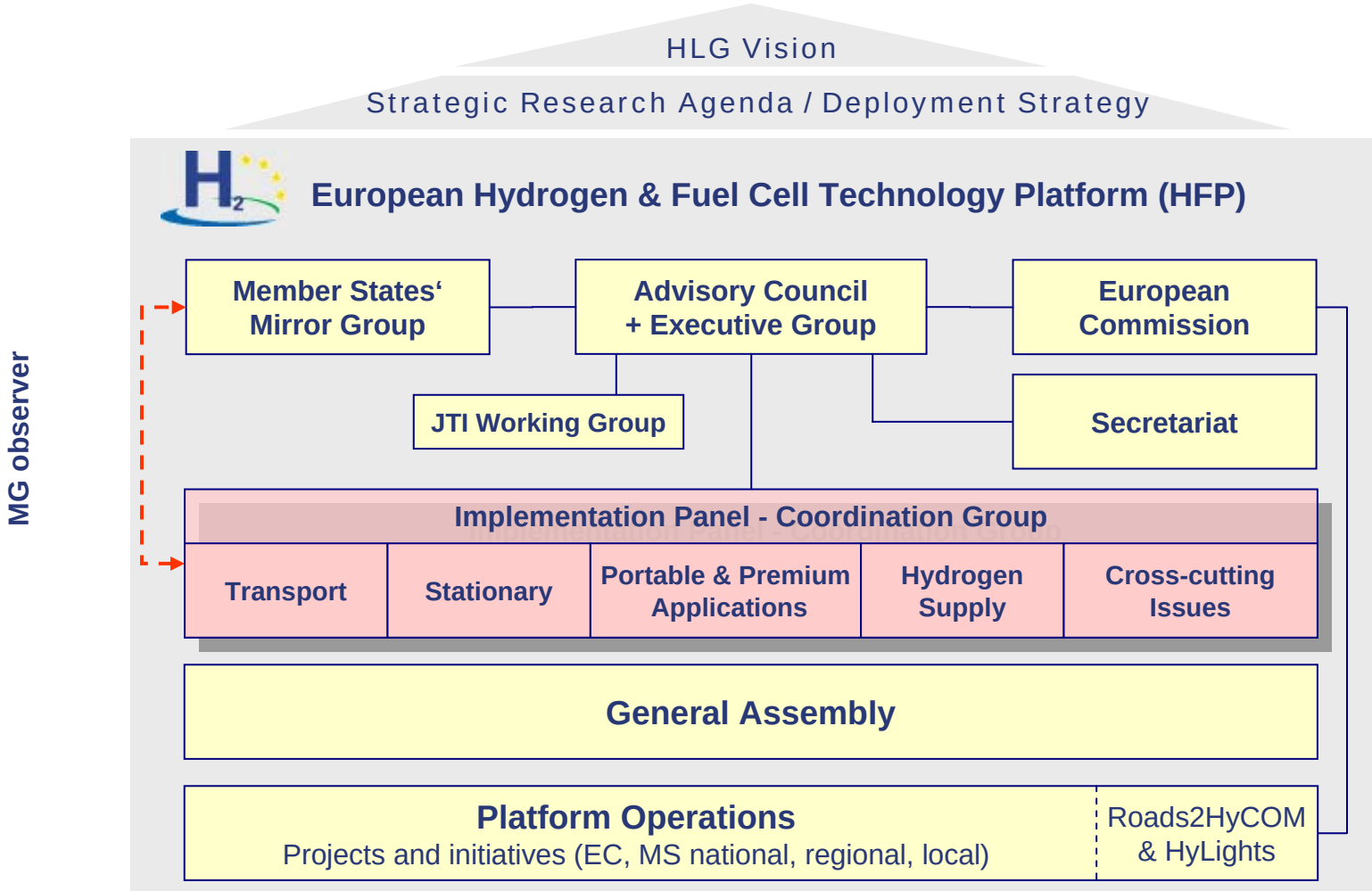
VISION
(2003)

STRATEGY
(2005)

IMPLEMEN-
TATION
(2006)

IMPLEMENTATION PLAN – Status 2006

IP within the HFP Structure



Implementation Panel Members

Coordination Group

Chairs	J. Loughhead & F. Jackow	
Vice-Chairs	D. Stolten & K. Scheuerer	
WG	Lead	Deputy
Transport	K. Bonhoff	G. Rovera
Stationary	R. Rosenberg	J. Lewis
H2 Supply	P. Mulard	J. Reijerkerk
Early Markets & Portable	(A. Delfrate) E. Middelman	M. Diehl
Cross-cutting	H. Wancura	B. Mayo

Secretariat: ***S.D. Peteves, M. Altmann***

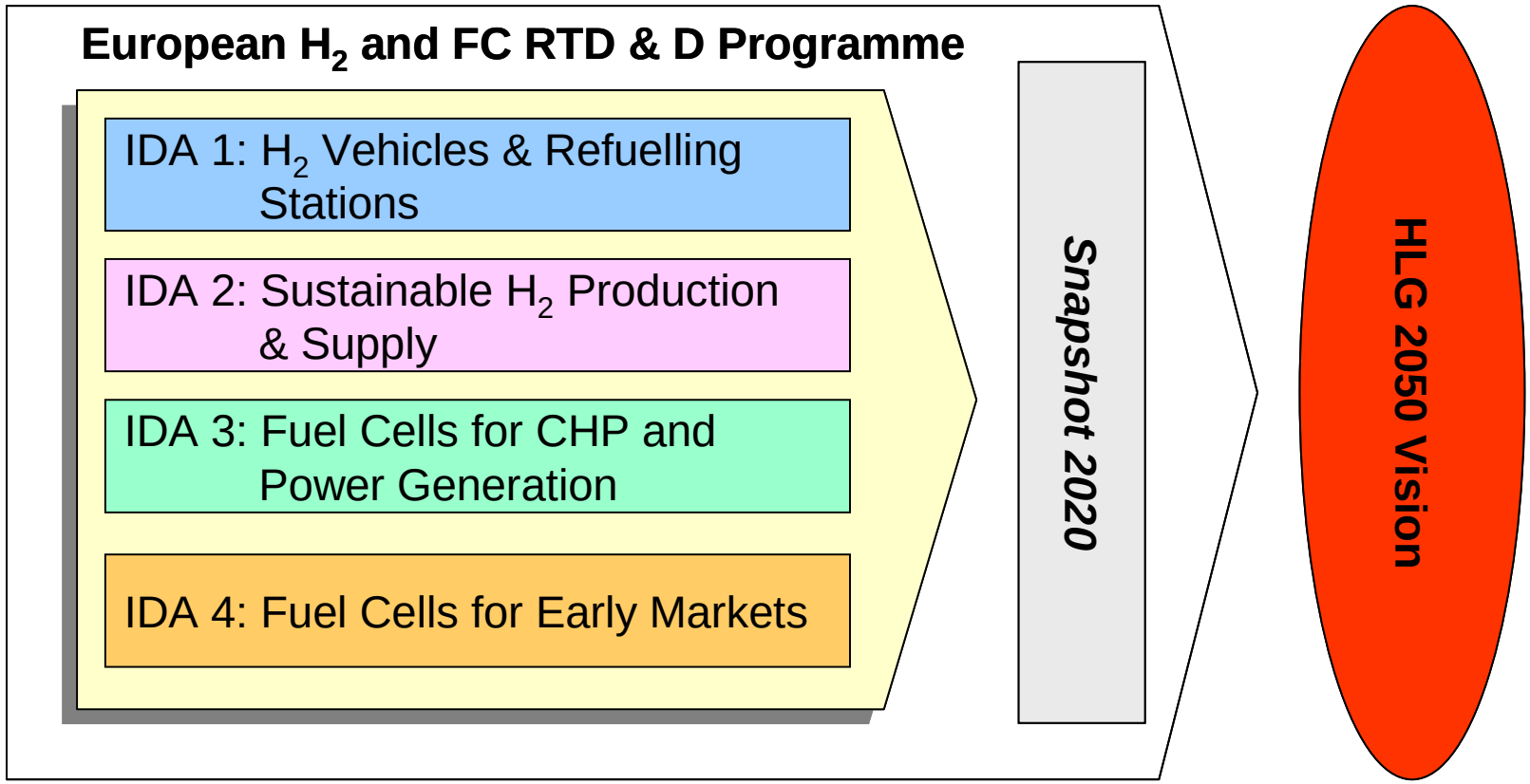
⇨ 120 technical experts & stakeholders

Starting Assumptions: "*Snapshot 2020*"

	Portable FCs for handheld electronic devices	**Portable Generators & Early Markets**	**Stationary FCs** Combined Heat and Power (CHP)	**Road Transport**
***EU* H2/ FC units sold per year projection 2020**	~ 250 million	~ 100,000 per year (~ 1 GW_e)	100,000 to 200,000 per year (2-4 GW_e)	0.4 million to 1.8 million
***EU* cumulative sales projections until 2020**	n.a.	~ 600,000 (~ 6 GW_e)	400,000 to 800,000 (8-16 GW_e)	1-5 million
***EU* Expected 2020 Market Status**	**Established**	**Established**	**Growth**	**Mass market roll-out**
Average power FC system	15 W	10 kW	<100 kW (Micro HP) >100 kW (industrial CHP)	80 kW
FC system cost target	1-2 €/ W	500 €/kW	2.000 €/kW (Micro) 1.000-1.500 €/kW (industrial CHP)	< 100 €/kW (for 150.000 units per year)

"Snapshot 2020": Key assumptions on Hydrogen & Fuel Cell Applications for a 2020 Scenario

The European Programme Foundation : Four Innovation & Development Actions (IDA)



Four Innovation and Development Actions (IDA) with specific goals

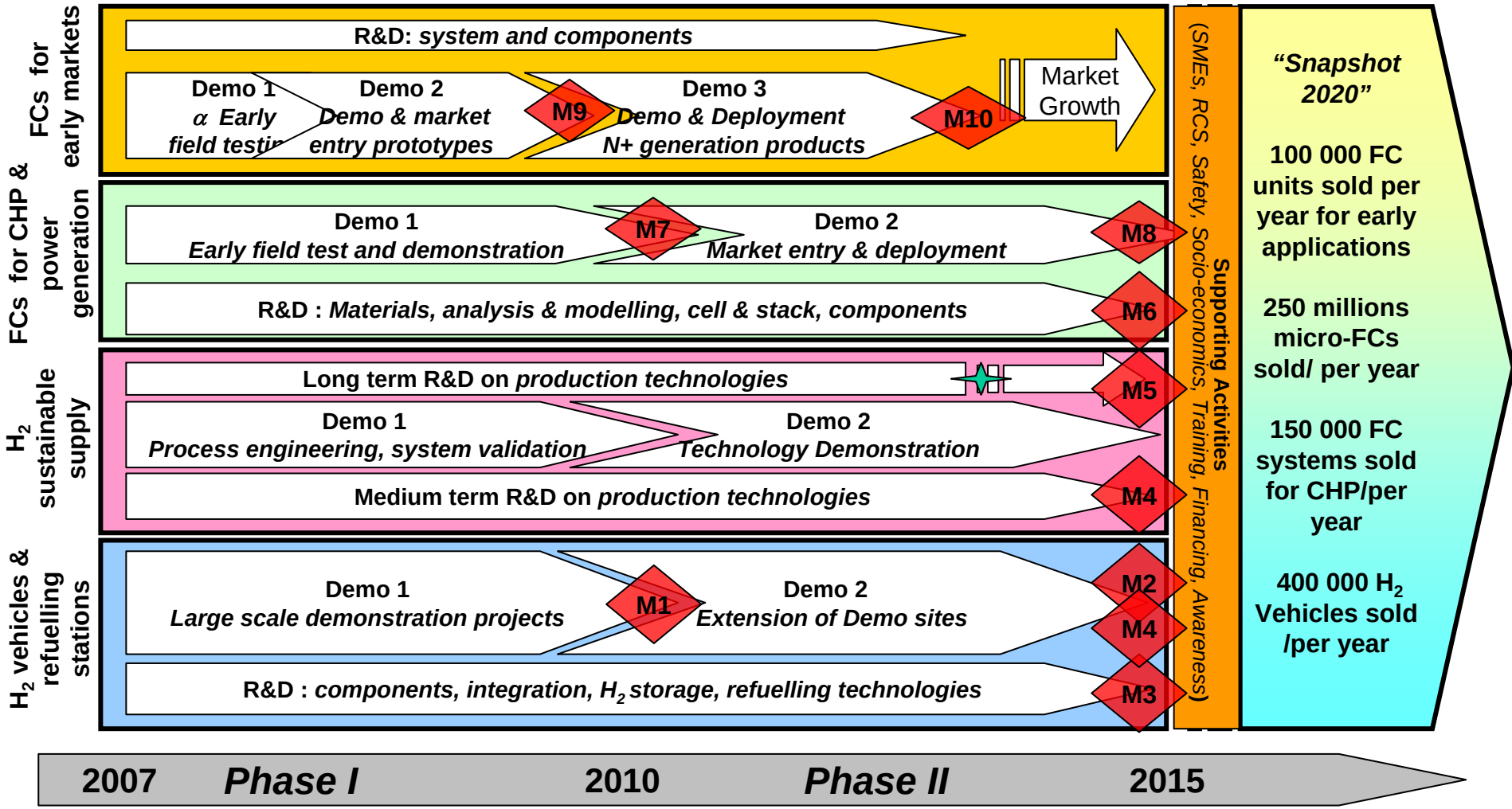
1. Hydrogen Vehicles & Refuelling Stations - *Improve and validate hydrogen vehicle and refuelling technologies to the level required for commercialisation decisions by 2015 and a mass market-rollout by 2020*

2. Sustainable H_2 Production and Supply - *10-20% of the Hydrogen supplied for energy applications to be CO2 lean or free by 2015*

3. FCs for CHP and power generation - *> 1 GW capacity in operation by 2015*

4. FCs for Early Markets – *X000 commercial early market FC products in the market by 2010 (200MW – 20000 units not later than 2012)*

European Roadmap for the development and deployment of H_2 & FC Technologies



Specific strategic milestones

M1	**13 demo sites for road vehicles including captive fleet, 200 vehicles, 9 refuelling stations**
M2	**30 demo sites, 3000 vehicles, Cost of delivered H_2 at pump <2.5 €/kg (1)**
M3	**Cost 100 €/kW, durability 5000h(2)**
M4	**10 -20 % of Hydrogen energy demand, carbon free/lean**
M5	**Cost of hydrogen production 2 to 5 €/kg(3)**
M6	**6 000 €/kW (Micro CHP FC), 1 000 to 1 500 (industrial CHP)**
M7	**100 MW installed**
M8	**1 GW installed**
M9	**3 000 products in the market**
M10	**17 000 new products in the market**

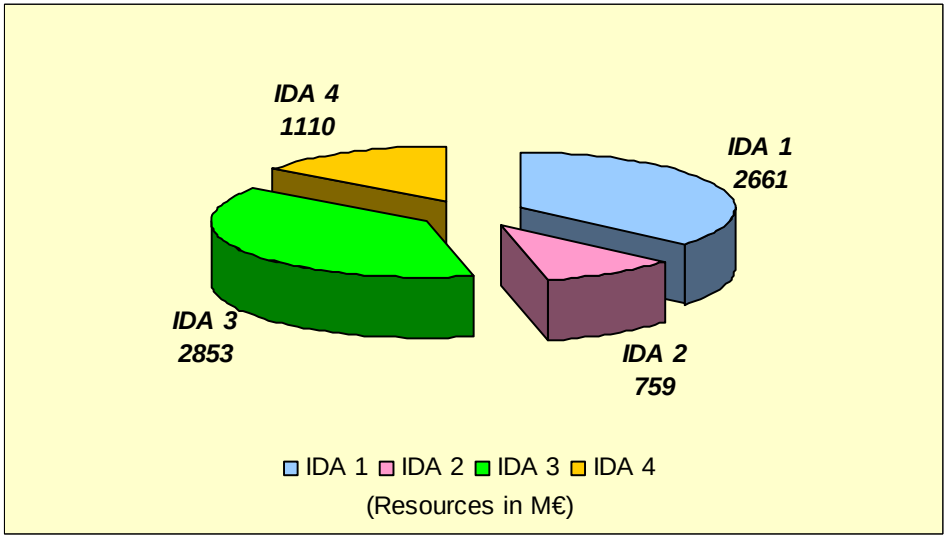
(1) Cost of hydrogen delivery at the pump (centralized and decentralised) (excl. taxes)
(2) Road propulsion FC systems
(3) Cost of hydrogen production

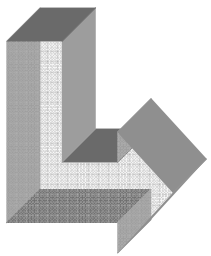
Programme Resources (1)

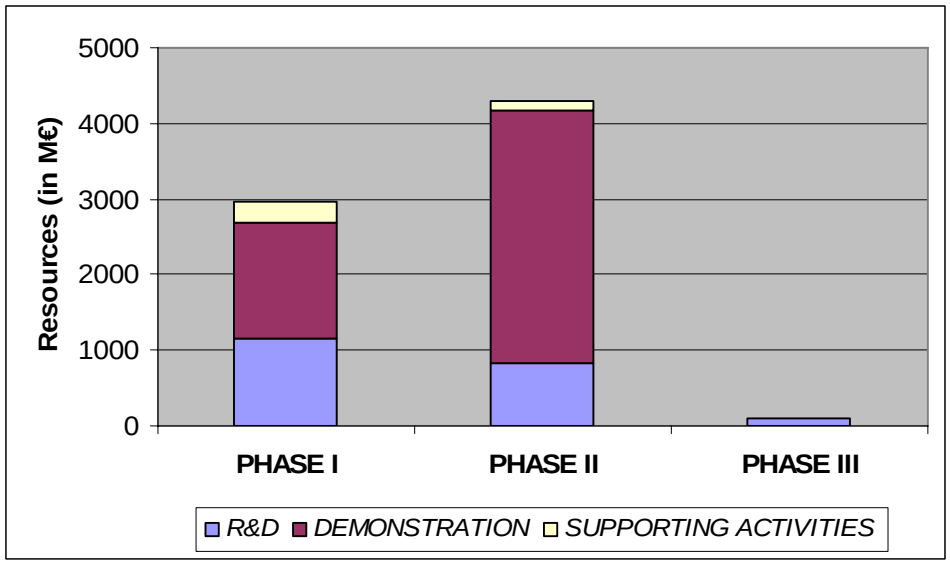
7 400 M

- ✓**Achievable** increase over current or already planned spending, both from **public** and from **private** sources
- ✓Requires **coordination** and **alignment** at **European level**
- ✓Without **major contributions from Member States and regions** it will **not be possible** to achieve the common goals set by this Implementation Plan

Programme Resources (2)





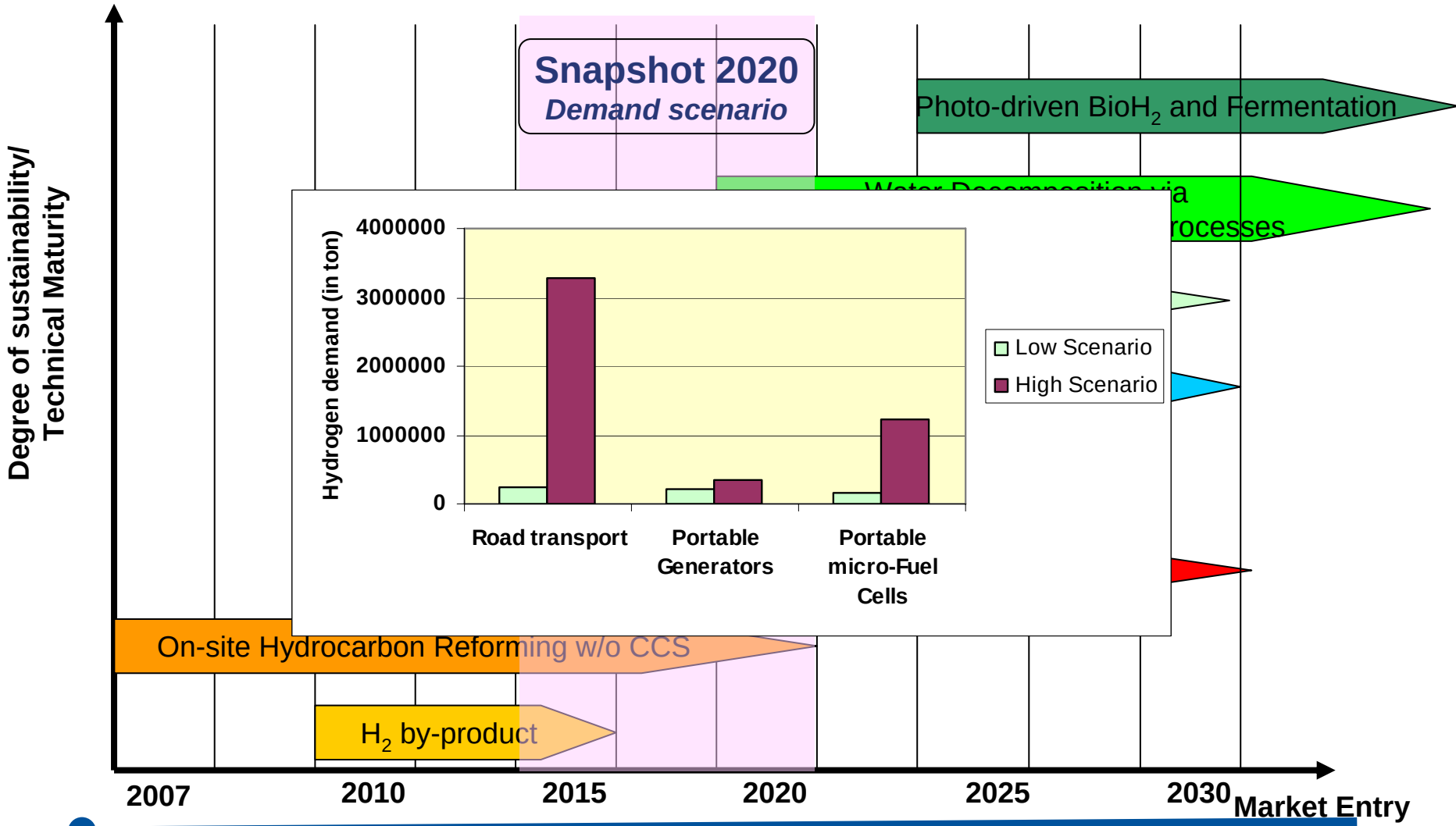


Impact of the Proposed IP – a first approach

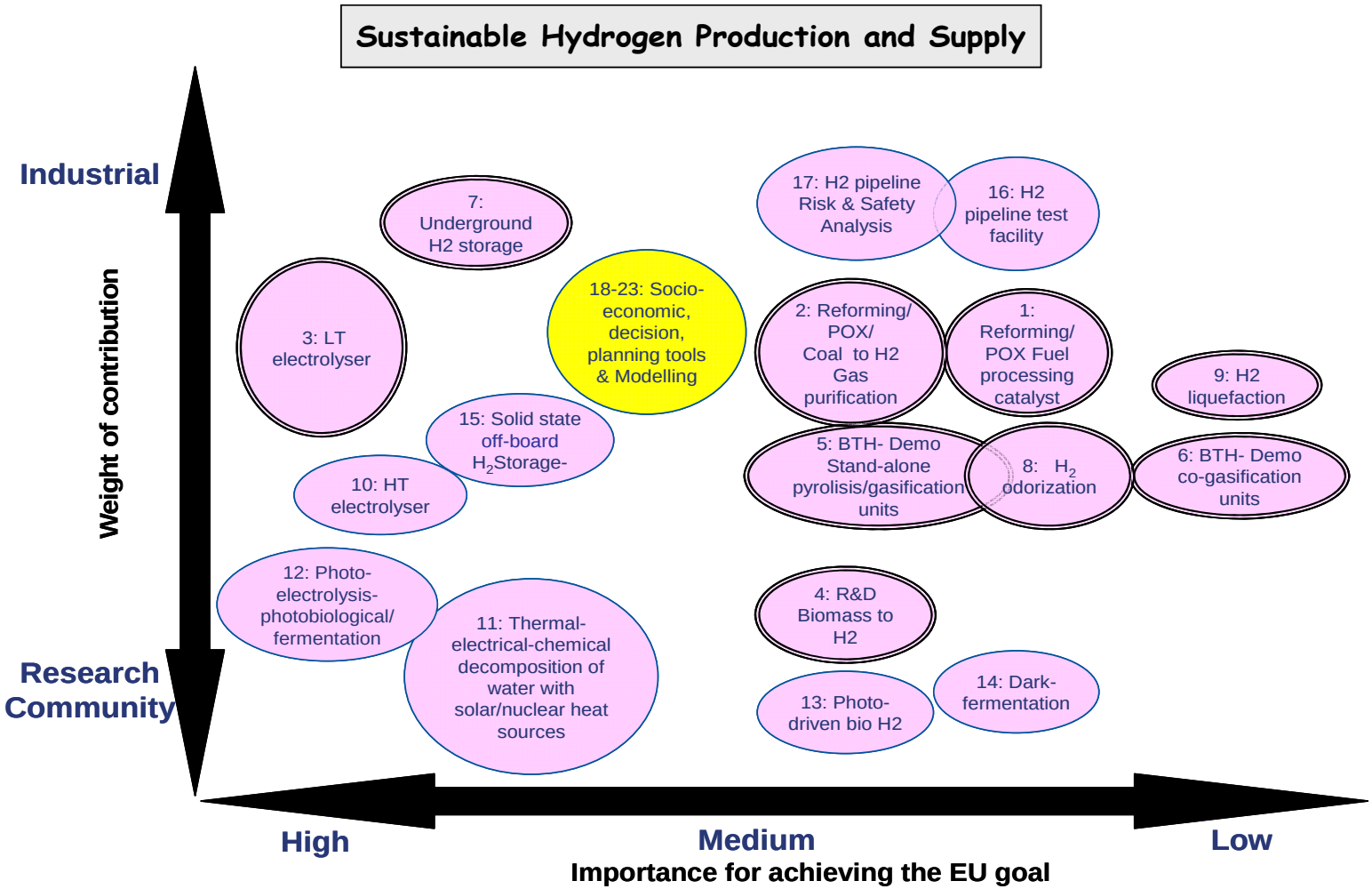
Expected **achievement rate in 2015** versus the reference scenario (snapshot 2020 or SRA) allowed by proposed Implementation Plan

	Technology	Industrial deployment	Market acceptance	Reference scenario
IDA 1				Snapshot 2020 for road
IDA 2				SRA
IDA 3				Snapshot 2020 Stationary
IDA 4				Snapshot 2020 Early & portable markets

IDA 2: Sustainable Hydrogen production and Supply - Rationale



IDA 2: Sustainable H_2 production and Supply key priorities

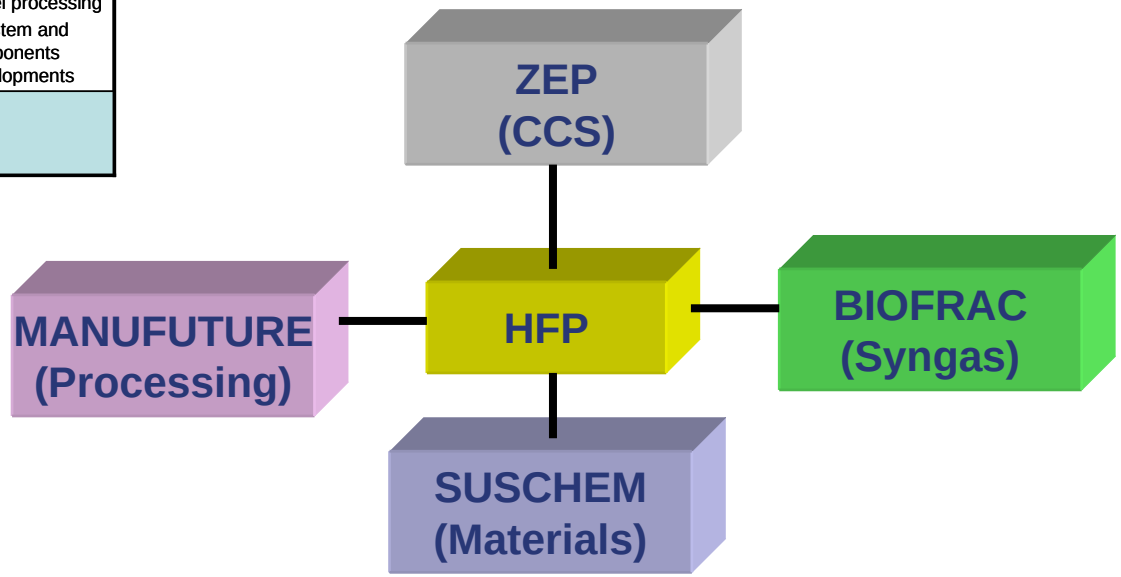


Synergies

	IDA 1	IDA 2	IDA 3	IDA 4
IDA 1		•Off/on board hydrogen storage •Fuel processing •Refuelling stations/ fleet vehicles	• SOFC • PEMFC • MCFC • Manufacturing • Fuel processing • System and components developments	• SOFC, • PEMFC, • MCFC • Manufacturing • Fuel processing • System and components developments
IDA 2			• SOFC, HT Electrolysers	• H_2 by product
IDA 3				• SOFC, • PEMFC, • MCFC • Manufacturing • Fuel processing • System and components developments
IDA 4				

Within the Implementation Plan

With some ETPs – an example



OUTSTANDING ISSUES

- Hydrogen Purity
- Hydrogen Quantity

"Snapshot 2020" = limited amounts BUT fast growth

⇨ opportunities

- Infrastructure build-up
  - Link Hydrogen Production to Zero Emission Power Plants
    - Hydrogen Production via Electricity Mix
    - Co-production Hydrogen and Electricity
    - Hydrogen Production by Central SMR with CCS
    - Dedicated Hydrogen facilities

Thank you for your attention