Linking HYPOGEN with Hydrogen and Fuel Cell Technology Adoption

A view from Roads2HyCom

Presentation to HyPoGen / Dynamis Expert Workshop

Brussels, 18th January 2007

The European Commission is supporting the Coordination Action “HyLights” and the Integrated Project “Roads2HyCom” in the field of Hydrogen and Fuel Cells. The two projects support the Commission in the monitoring and coordination of ongoing activities of the HFP, and provide input to the HFP for the planning and preparation of future research and demonstration activities within an integrated EU strategy.

The two projects are complementary and are working in close coordination. HyLights focuses on the preparation of the large scale demonstration for transport applications, while Roads2Hycom focuses on identifying opportunities for research activities relative to the needs of industrial stakeholders and Hydrogen Communities that could contribute to the early adoption of hydrogen as a universal energy vector.

Further information on the projects and their partners is available on the project web-sites www.roads2hy.com and www.hylights.org.

There is an important synergy between HYPOGEN and the wider uptake of sustainable energy technology - including Hydrogen / Fuel Cell

- **The European Commission is promoting the development, commercialisation and uptake of Hydrogen and Fuel Cell technologies through a Joint Technology Initiative**
  - A ten year public-private partnership
  - Embracing many sectors from Hydrogen supply through Fuel Cell technology to a variety of end use applications
  - With a high profile for public demonstrations in transport and stationary sectors
- **Roads2HyCom is a "techno-socio-economic" project studying the technology landscape, infrastructure and resources, and the profile of early adopters in Hydrogen and Fuel Cells**
  - Supporting the Commission and HFP in future planning
  - Disseminating information to stakeholders
- **It is important to consider the relationship of HYPOGEN projects to the wider uptake of "New Energy" technologies**
  - Supply of Hydrogen to larger demonstrations and developing Hydrogen Economy infrastructure
  - Supply of CO_2-free electricity instead, where this is the best route

Agenda / Contents

- **What is Roads2HyCom - Aims, Approach, Achievements**
- **Linking HYPOGEN initiatives to H2 / FC technology adoption**

Roads2HyCOM is an EU Framework Six Project to co-ordinate, assess and monitor research in the field of Hydrogen for stationary and transport power

Project Objective

- **To assess and monitor Hydrogen and Fuel Cell technology for stationary and mobile energy applications by considering**:
  - **Research landscape** and technology capability
  - Current / future Hydrogen **infrastructure and energy resources**
  - Needs of **communities** that may be early adopters

Deliverables

- **Support to the Commission**, HFP and other stakeholders
- **Reports and presentations of key data** with high relevance to planning future activities
- **Web-based information** and databases
- **Training manuals and dissemination** directed at the wider community of interested stakeholders and communities

Project Partners

- **Roads2HyCom is a consortium of 29 key stakeholders** from industry, research institutes and academia**.** Core Group:

RICARDO, ika RWTH INSTITUT FÜR KRAFTFAHRWESEN AACHEN Univ.-Prof. Dr.-Ing. Henning Wallentowitz, PLANET GbR, ie Institute for Energy, ifp, KAПE CRES, College of Europe Collège d'Europe Brugge Natolin, AIR LIQUIDE, NTDA Energía, ECN Energy research Centre of the Netherlands, DAIMLERCHRYSLER

Roads2HyCom brings together mappings of RTD, infrastructure and communities, and analyses this information to develop strategic recommendations

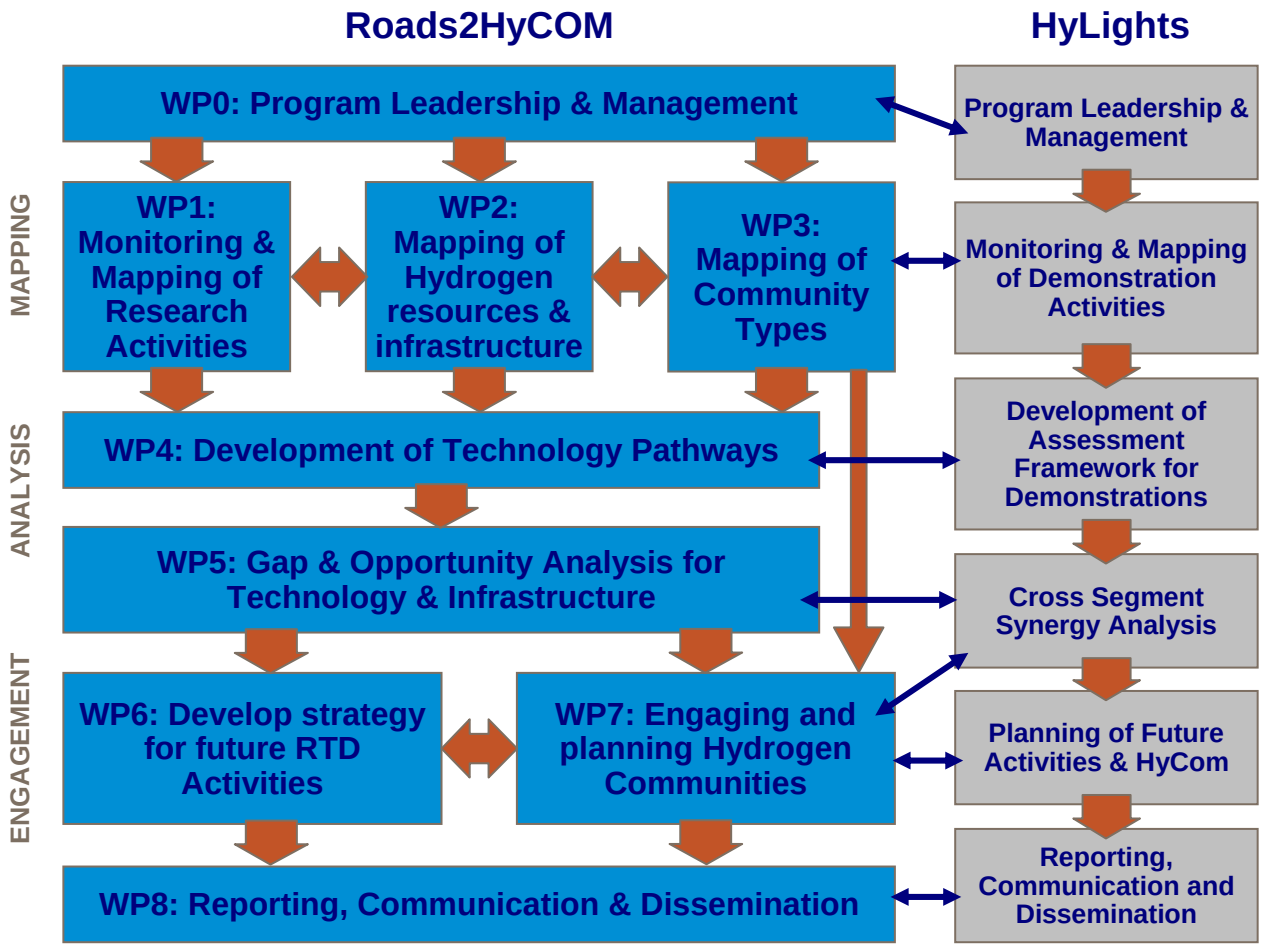
Overview of Activity

Mapping Stage
- Online surveys
- Collation of Databases
- State of the Art analysis

Analysis Stage
- Future Scenarios
- Evolution of technology in context
- Opportunities & Synergies

Engagement Stage
- Outputs to Commission & HFP
- Outputs to Communities & Stakeholders

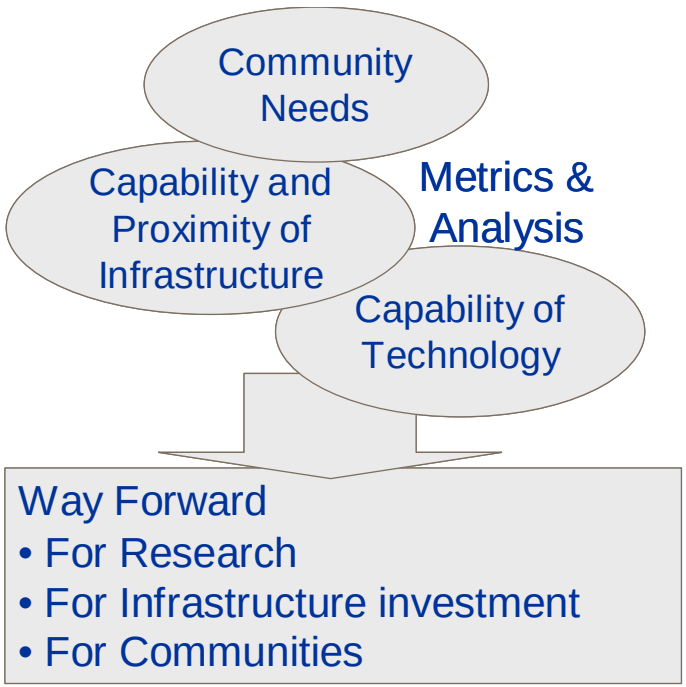
Year One has consisted of Mapping activities and significant "Dynamic Agenda" support to the Commission



Project was conceived together with HyLights, which examines Transport Demonstration projects

The project has developed a Methodology for evaluating and comparing information on Technology, Infrastructure and Communities

- **Based on objective quantification against "metrics" (measures)**
  - But not a "mathematical formula" approach
  - Use of objective comparisons to highlight key issues or trends
- **Adapted to each situation in order to characterise or classify data**
  - Technology SOTA, Community profile, Resource capability



Metrics	Example Definition
Technology Accessibility	Product availability, IP restrictions
Global Environmental Impact	Life-cycle CO_2 or resource use
Local Environmental Impact	Impact on local air quality, noise, etc
Efficiency	Efficiency of system relative to benchmarks
Capacity & Availability	Percent up-time of a system, capacity of infrastructure
Cost	Purchase, operation, life-cycle costs
Safety	Safety in use relative to benchmarks
Public Acceptance	Public attitude toward technology / infrastructure
Political Will	Availability of funding, enabling legislation
Security and Sustainability	Energy chain security or sustainability
Potential for Growth	Ability to reproduce application in another area

After a year, Roads2HyCom is now delivering a variety of outputs to stakeholders

- **"Review Days" reports on European and US H2/FC research**
- **Two sets of feedback to the HFP on their JTI Implementation Plan**
- **Two presentations to the EIB on the landscape of H2/FC technology development, to support the development of their new risk-sharing financing instruments**
- **Public domain reports on the first year of work**
  - **Landscape of H2 / FC research and development** (published)
  - **Technology Watch** - key future milestones (published)
  - **Technology State of the Art** (work in progress)
  - **Mapping of Hydrogen infrastructures** (about to be published)
  - **Mapping of Sustainable Energy resources** (about to be published)
  - **Analysis of Hydrogen production and distribution costs** (about to be published)
  - **Mapping and characterisation of early-adopting communities** (about to be published)

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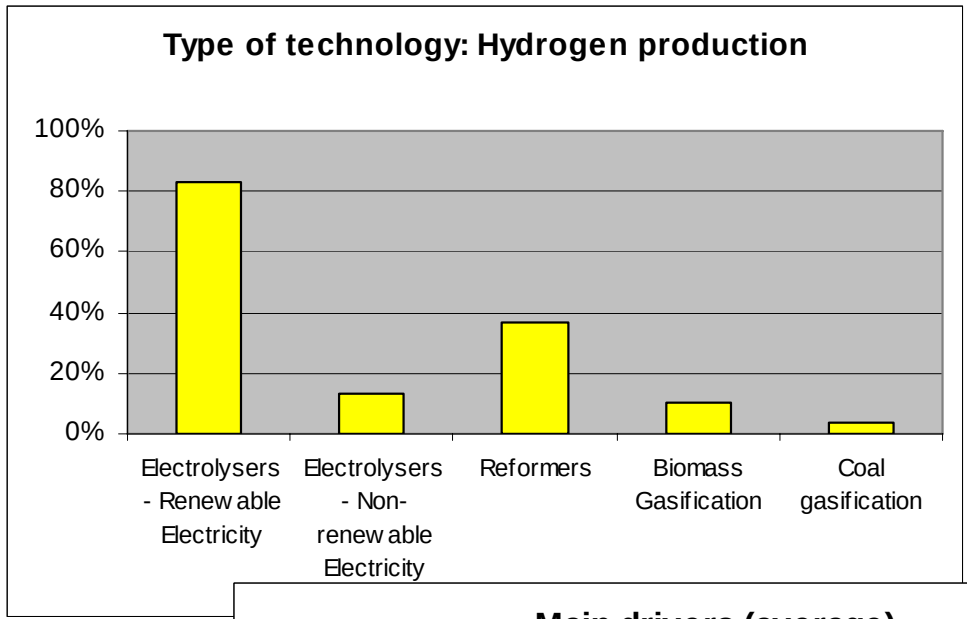
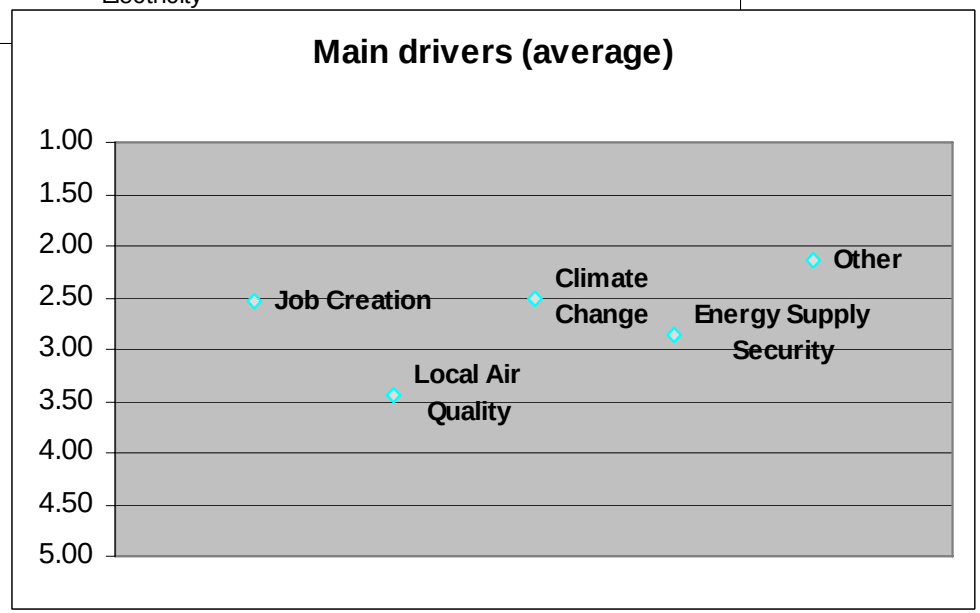
Interest in sustainable energy is one of the strongest drivers in "Hydrogen communities"

- Current and near future demonstrations and pilot projects are strongly driven by local political will
- Often this includes environmental objectives
- Renewables - often wind power - seen as popular "greenest option", with pragmatic NG reforming in second place





This means that understanding the "sustainability" of CCS is essential in linking HYPOGEN and "HyCom" initiatives

- **CCS schemes need to be accepted by those creating the political will for Hydrogen Communities**
  - As a pragmatic interim solution or a step towards "full sustainability"
  - As a way of enabling the use of new Hydrogen and Fuel Cell technologies
- **There is a need to achieve stakeholder agreement on the credentials of CCS**
  - Environmental performance
  - Economics
- **Roads2HyCom is using its Metrics to assess broad status of Renewable and Nuclear options**
  - Could be useful to be able to compare to CCS-sourced Hydrogen on similar basis?

Metric	Nº.	Sub Metric
Technology Accessibility		Not applicable to WP2
Global Environmental Impact	2a	Source-to-user greenhouse gas emissions in setting up the site
	2b	Greenhouse gas emissions from running the site
	2c	Efforts of mitigation and minimisation of environmental impact
Local Environmental Impact	3a	Air quality impact
	3b	Noise impact
	3c	Land sealing impact
Efficiency	4a	Transport energy to/from/on site
	4b	Transport and storage losses to/from/on site
	4c	Energy investment in running site
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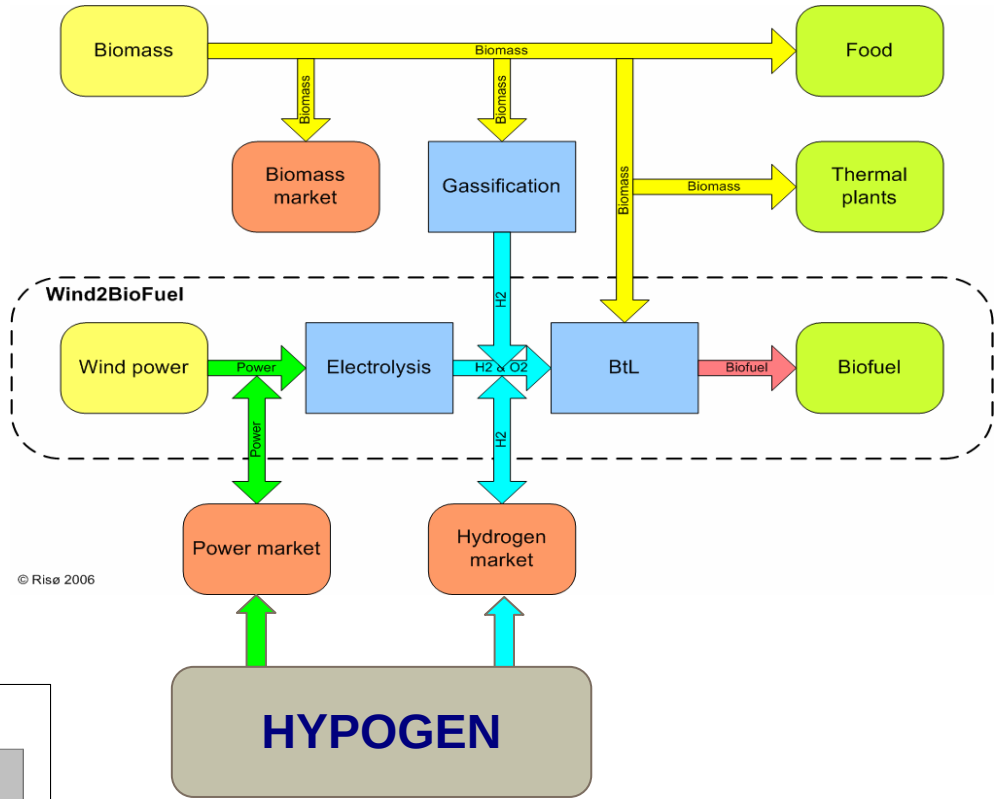
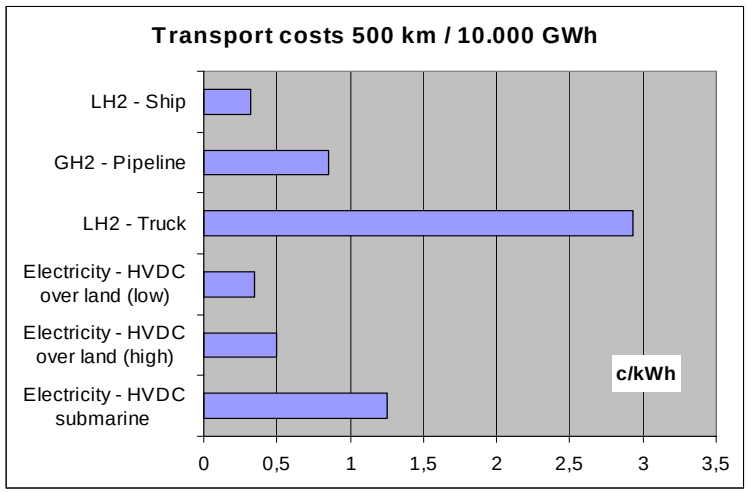
Costs	6a	Capital investment costs
	6b	Operational costs
	6c	Decommissioning costs
Safety	7a	Incident likelihood
	7b	Incident severity
	7c	Vulnerability
Public Acceptance	8a	Public perception and opinion
Political Will	9a	Direct financial subsidies
	9b	Political commitments
	9c	Obstructions and barriers
Security & Sustainability	10a	Depletion of critical resources
	10b	Dependency on imports to the EU
Potential for Growth	11a	Potential for general access
	11b	Potential for expansion
	11c	Potential for EU job creation
	11d	Time to commercialisation

HYPOGEN strategy needs to develop in the context of broader energy policy

- Location and capacity of HYPOGEN projects versus regional demand and other local resources
- Hydrogen versus Electricity as the chosen vector
- Distribution logistics and economics
- Local production vs Importation
- Optimum energy chains in terms of economics, environmental impact, job creation etc

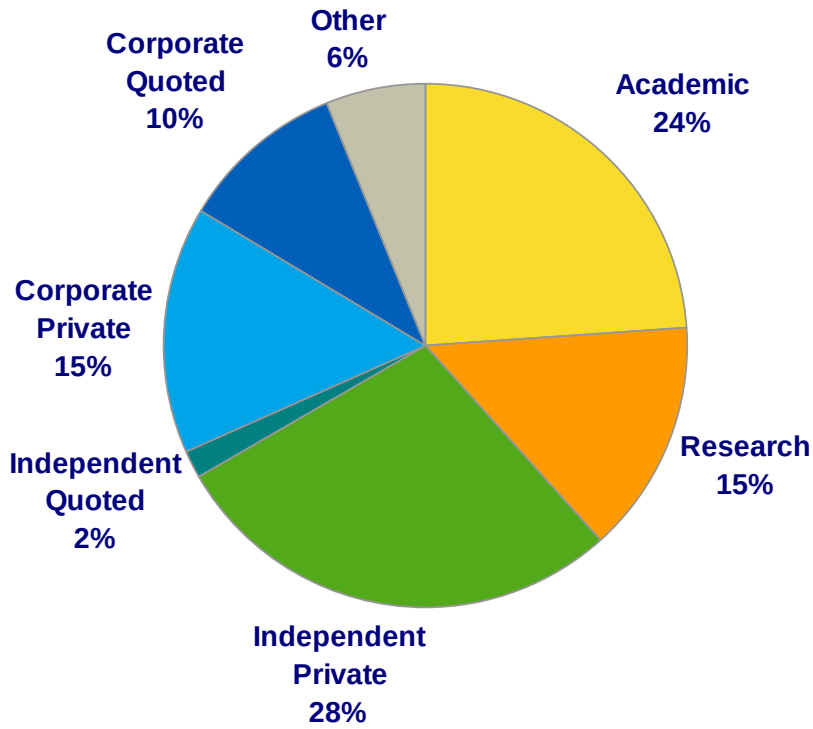


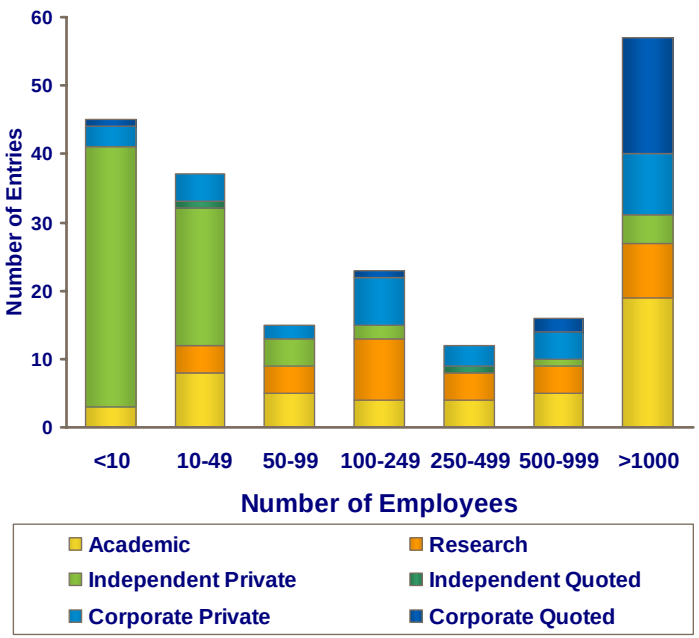


Can DYNAMIS outputs be integrated with other pathway & policy studies?
To what extent will market find best solutions?

The H2/FC technology development landscape is quite fragmented, with many small players and a few large ones

- **Numerically dominated by academic institutions, research organisations and SMEs / start-ups**
  - This type of organisation can be a rich source of innovation, but often lacks resources to co-invest in major undertakings



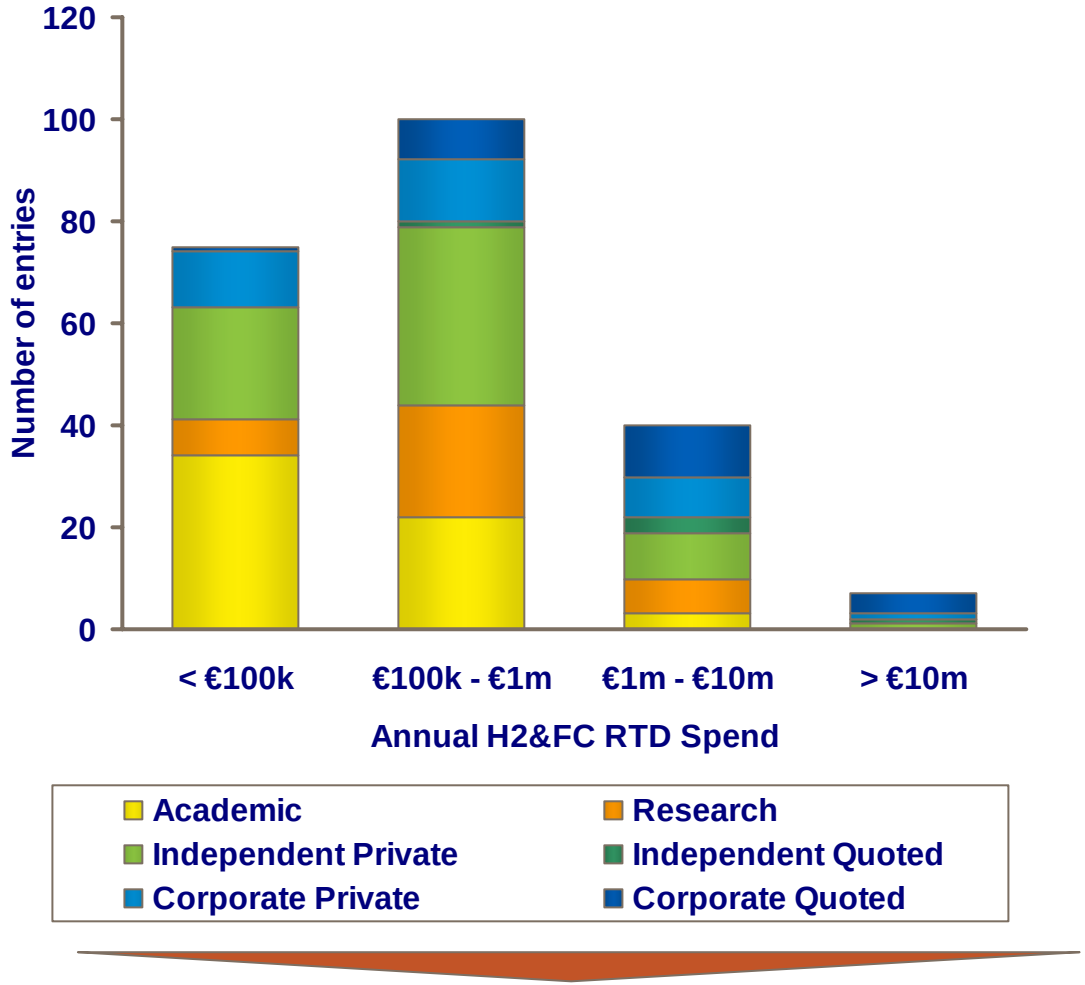


- **Modal split between very large and very small organisations**
  - Risk of poor technology flow between the two, unless framework for good co-operation is established

These issues need to be understood in establishing synergy with HYPOGEN

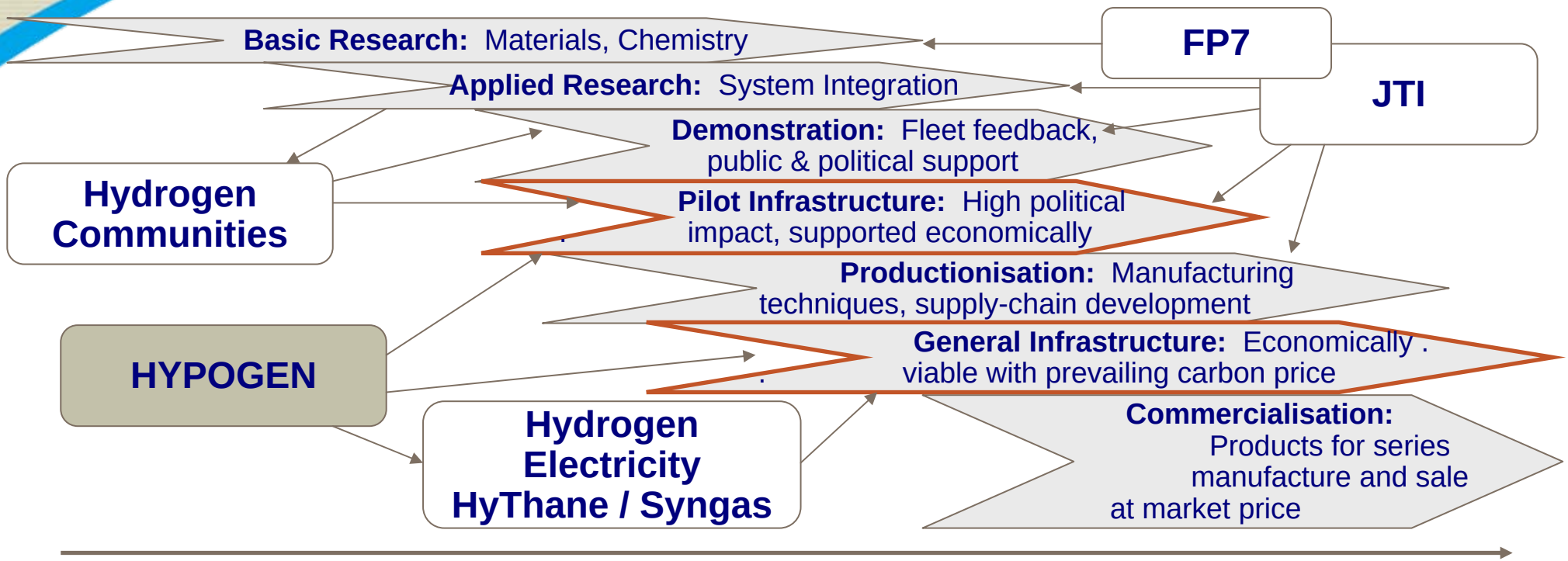
Current investment levels per organisation are more aligned to basic and applied research than genuine commercialisation

- **The typical Hydrogen / Fuel Cell technology organisation invests a few €100k's per year**
  - Data indicates that grants are a dominant funding source
- **">10m€" players were:**
  - **5** Suppliers of Fuel Cells & key Fuel Cell parts
  - **1** Automotive OEM
  - **1** Electrical Sys' & Products supplier
- **Typical production-program investment for a mass-produced device** (e.g. Automotive powertrain, Domestic CHP unit with *existing* tech) **is €50m - €1000m** over 5 years



Synergy with HYPOGEN creates an opportunity to lower the financial barriers to commercialisation

As Hydrogen and Fuel Cell technologies mature, access to cost-effective infrastructure for larger scale uptake is a vital enabler



- **Critical issues now:**
  - **Ensuring that HYPOGEN / CCS and Hydrogen stakeholders reach consensus on energy pathways**
  - **Addressing the 'Sustainability' issue - acceptance of CCS by sceptics**
  - **Creating frameworks for appropriate collaboration and interfacing between CCS projects and Hydrogen Communities**
  - **"Making things happen" in the JTI and beyond**

Thank You

Information on the project is available at www.roads2hy.com

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- **Backup**

Roads2HyCom metrics - Energy Resources & Infrastructures (1 of 2)

Metric	No.	Sub Metric
Technology Accessibility		Not applicable to WP2
Global Environmental Impact	2a	Source-to-user greenhouse gas emissions in setting up the site
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	3c	Land sealing impact
Efficiency	4a	Transport energy to/from/on site
	4b	Transport and storage losses to/from/on site
	4c	Energy investment in running site
	4d	Fossil energy investment
Capacity & Availability	5a	Unscheduled down times
	5b	Scheduled downtimes
	5c	Unattended operation
	5d	Purity of H_2 used
	5e	Physical state
	5f	Logistical capacity
	5g	Lifetime of the demonstration

Roads2HyCom metrics - Energy Resources & Infrastructures (2 of 2)

Metric	No.	Sub Metric
Costs	6a	Capital investment costs
	6b	Operational costs
	6c	Decommissioning costs
Safety	7a	Incident likelihood
	7b	Incident severity
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