



CORE TECHNOLOGY VENTURES LLP

Eighth Grove Fuel Cell Symposium

Building Fuel Cell Industries

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Outline

- ❖ Industrial Structure:
 - Supply chain, Core Technology Ventures' view
 - Players
 - European market structure

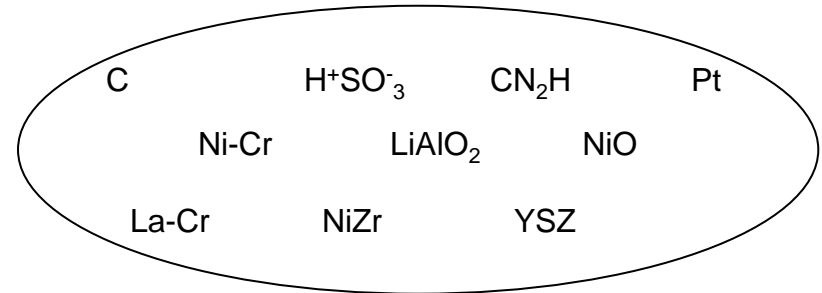
- ❖ Product Maps: Installed Capacity:
 - United States
 - Europe, Germany and the UK
 - Country score sheet

- ❖ European Policy & Finance: Equity and Research
 - A multiplicity of policy drivers
 - Company valuations; closer to reality
 - Access to capital; A blot on the European landscape
 - EU RD&D funding

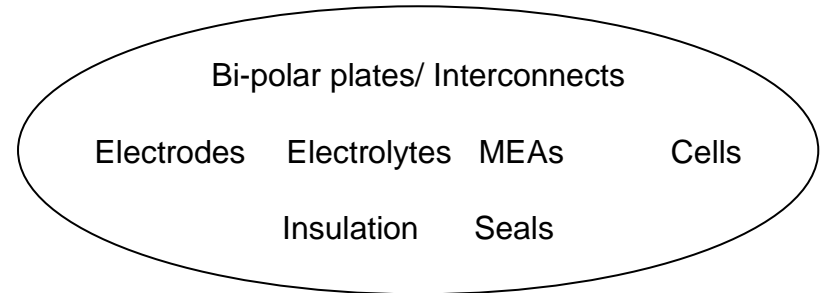
- ❖ Conclusions

A Supply Chain

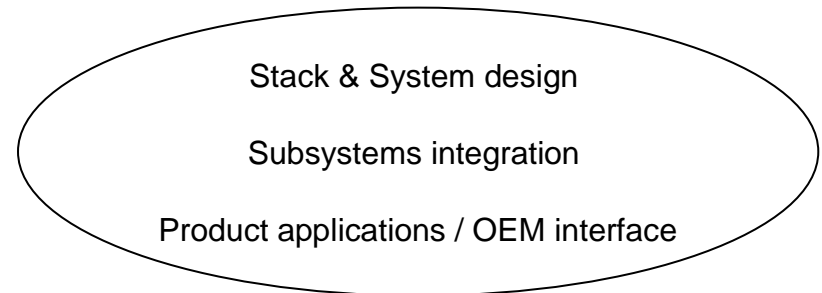
If basic materials
form the letters



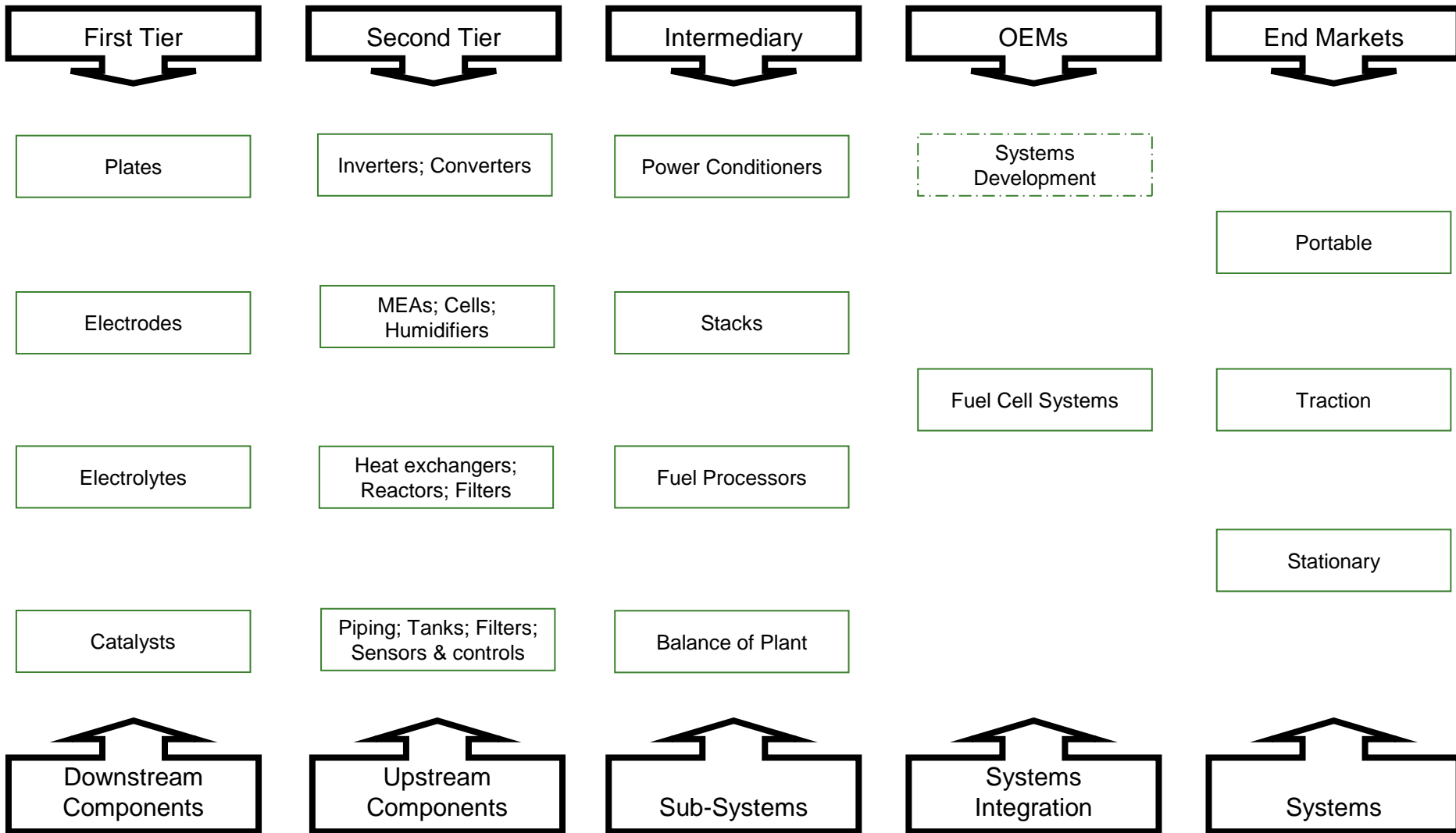
And components
form the words



Then systems developers
write the text



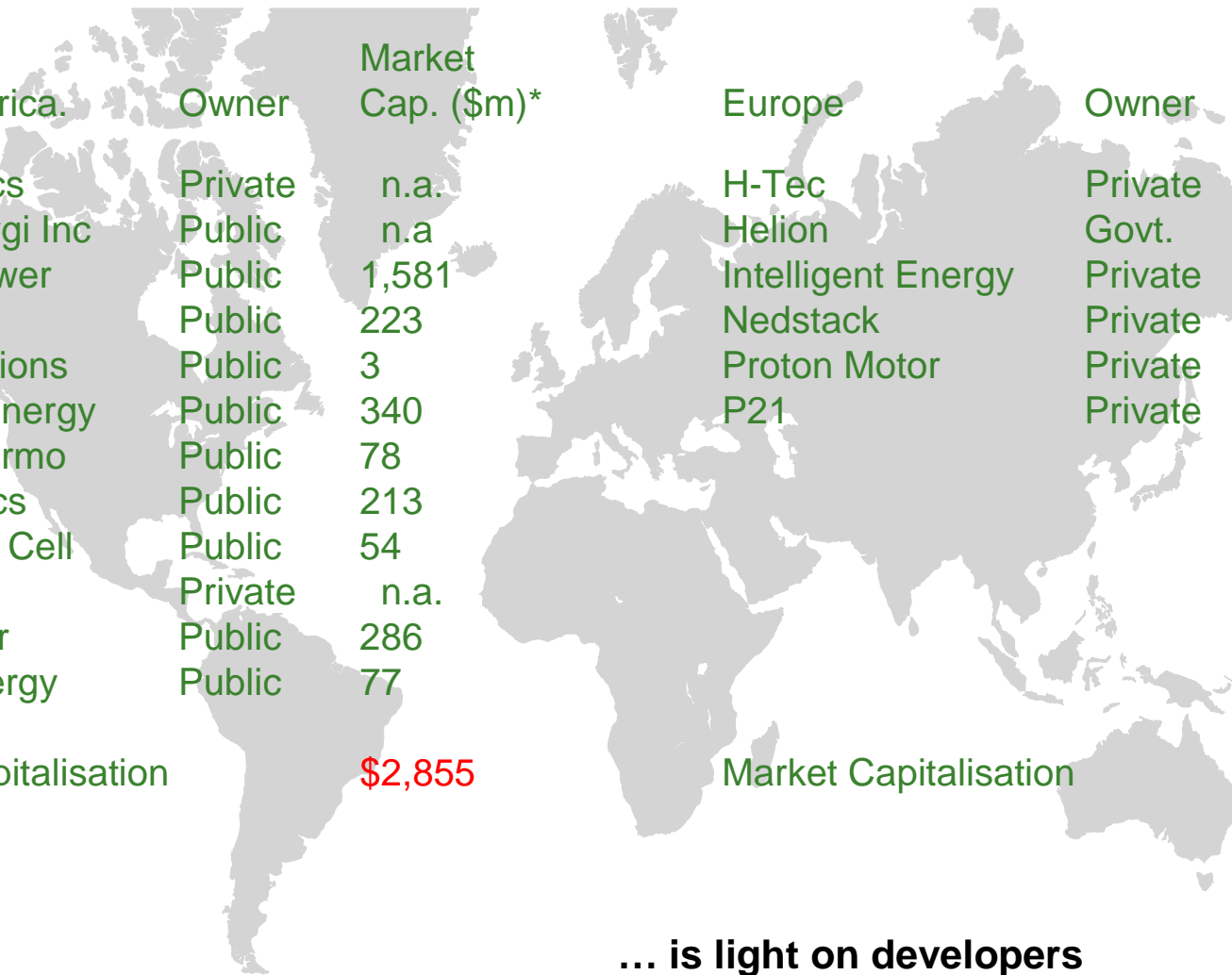
Simplified Fuel Cell Supply Chain



Major Fuel Cell Components Suppliers



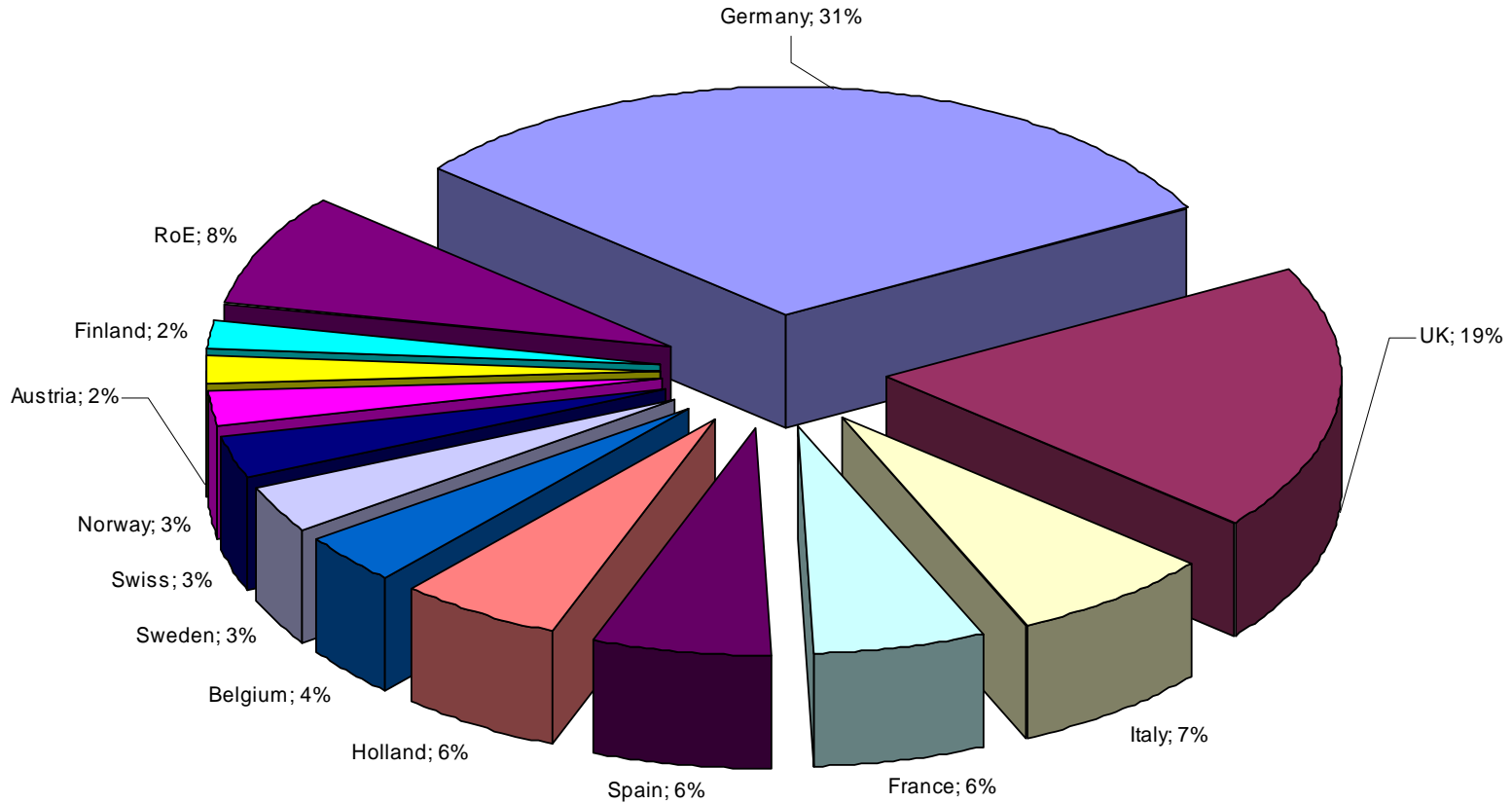
Independent Fuel Cell Systems Developers



North America	Owner	Market Cap. (\$m)*	Europe	Owner	Market Cap.
Acumentrics	Private	n.a.	H-Tec	Private	0
Astris Energi Inc	Public	n.a.	Helion	Govt.	0
Ballard Power	Public	1,581	Intelligent Energy	Private	0
ECD	Public	223	Nedstack	Private	0
Energy Visions	Public	3	Proton Motor	Private	0
Fuel Cell Energy	Public	340	P21	Private	0
Global Thermo	Public	78			
Hydrogenics	Public	213			
Millennium Cell	Public	54			
Nuvera	Private	n.a.			
Plug Power	Public	286			
Proton Energy	Public	77			
Market Capitalisation		\$2,855	Market Capitalisation		ZERO

... is light on developers

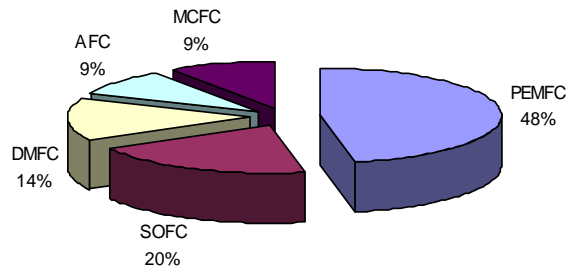
Distribution of the European Fuel Cell Industry: Sample data



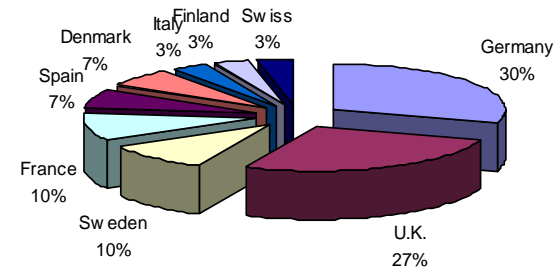
*Source: Core Technology Ventures LLP. Data, a subset of our database, refer to number of European entities developing fuel cell related hardware but excludes well-capitalised & quoted companies

European Systems and Components: sample data

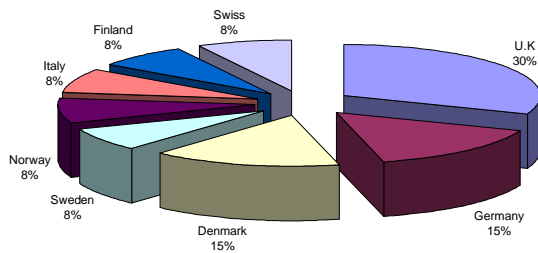
Systems Developers



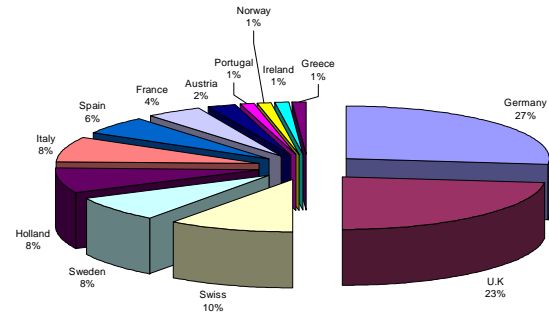
PEMFC Systems Developers



SOFC Systems Developers



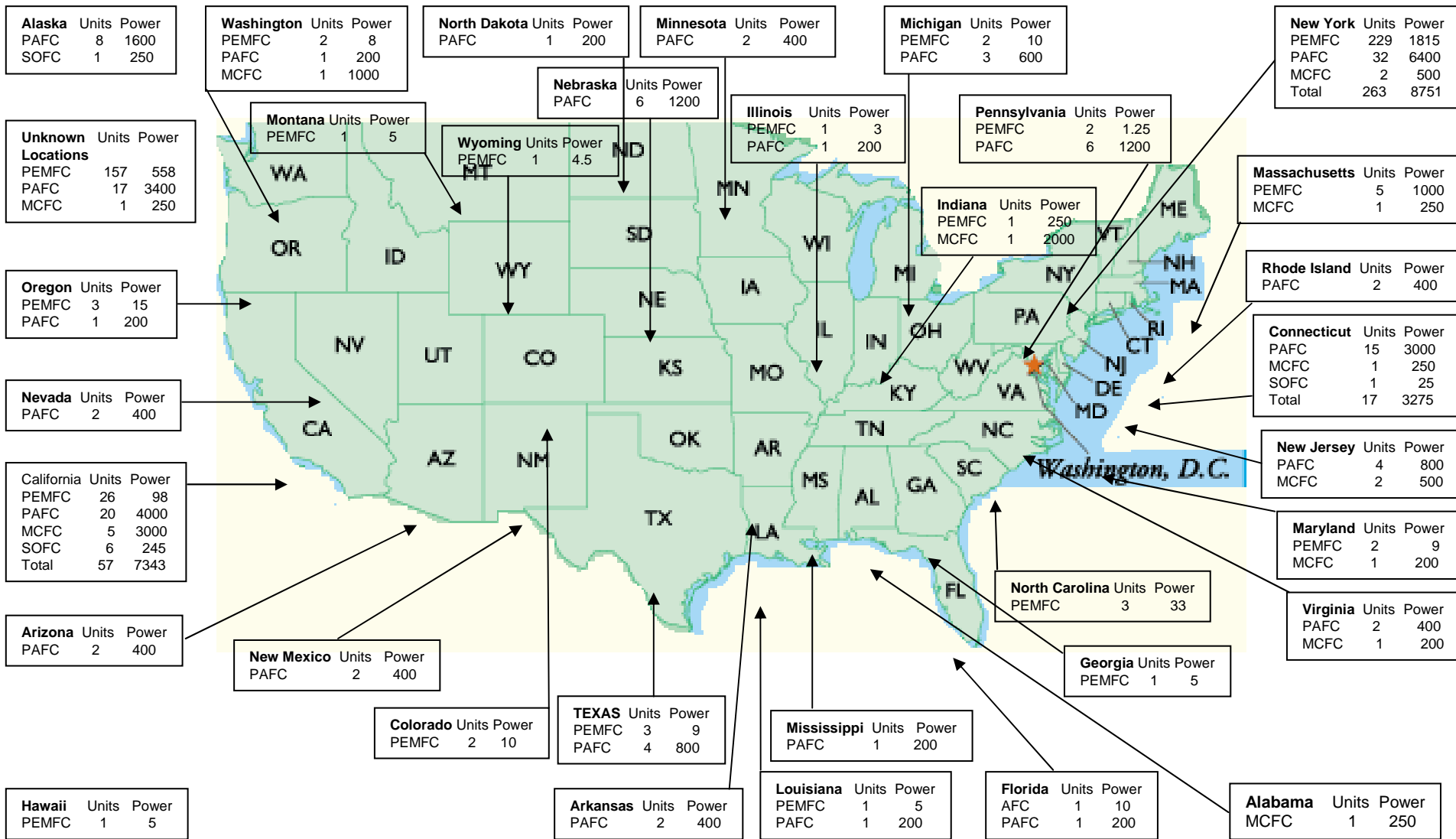
Components



*Source: Core Technology Ventures LLP. Data, a subset of our database, refer to number of European entities developing fuel cell related hardware but excludes well-capitalised & quoted companies

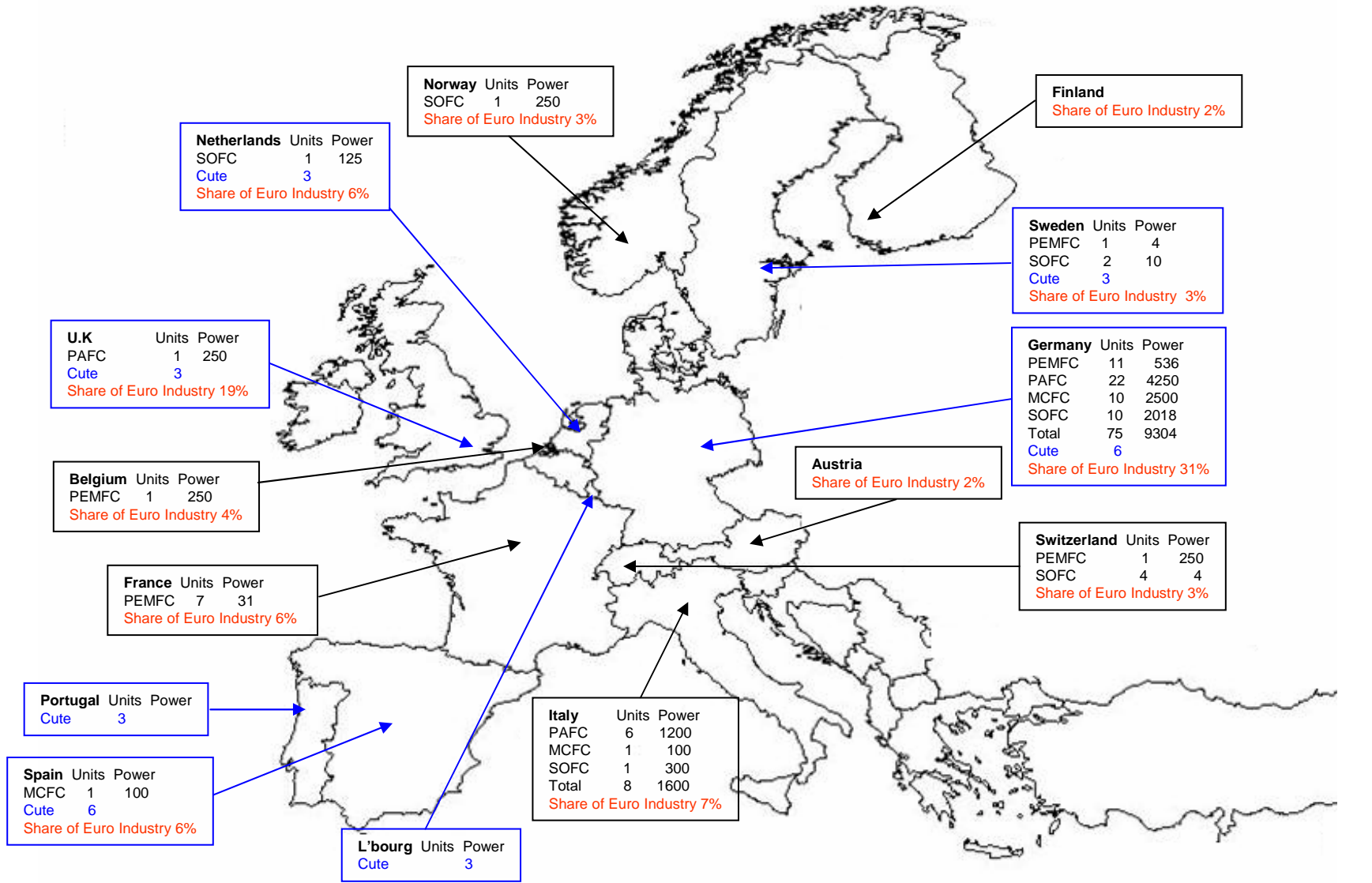
Stationary Fuel Cell Product: Installed Capacity

US Fuel Cell Demonstrations: 40MW Stationary



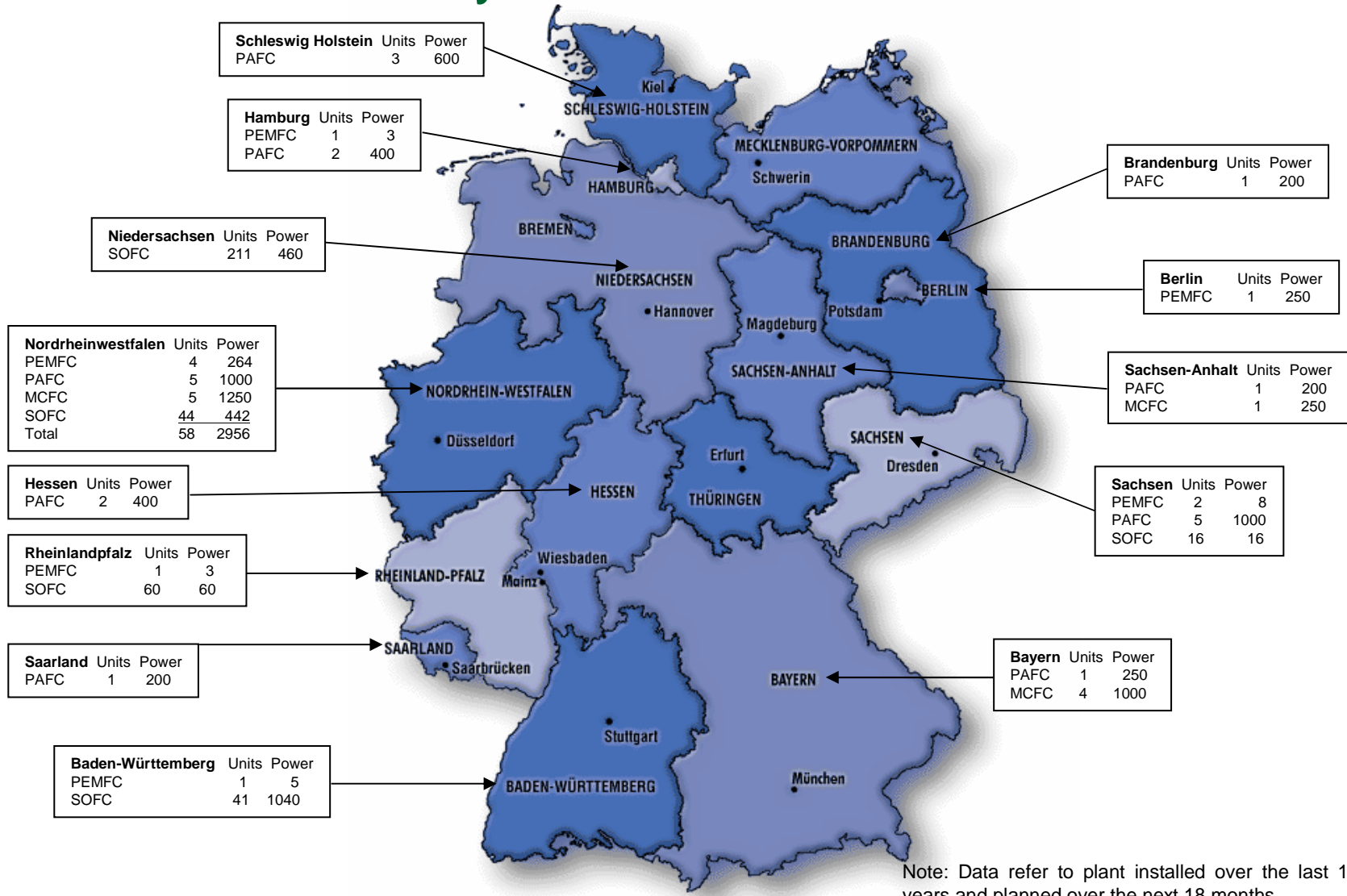
Note: Data refer to plant installed over the last 10 years and planned over the next 18 months

European Map: 12MW Stationary, 27 Buses



Note: Stationary data refer to plant installed over the last 10 years and planned over the next 18 months

German Stationary Fuel Cell Demonstrations:

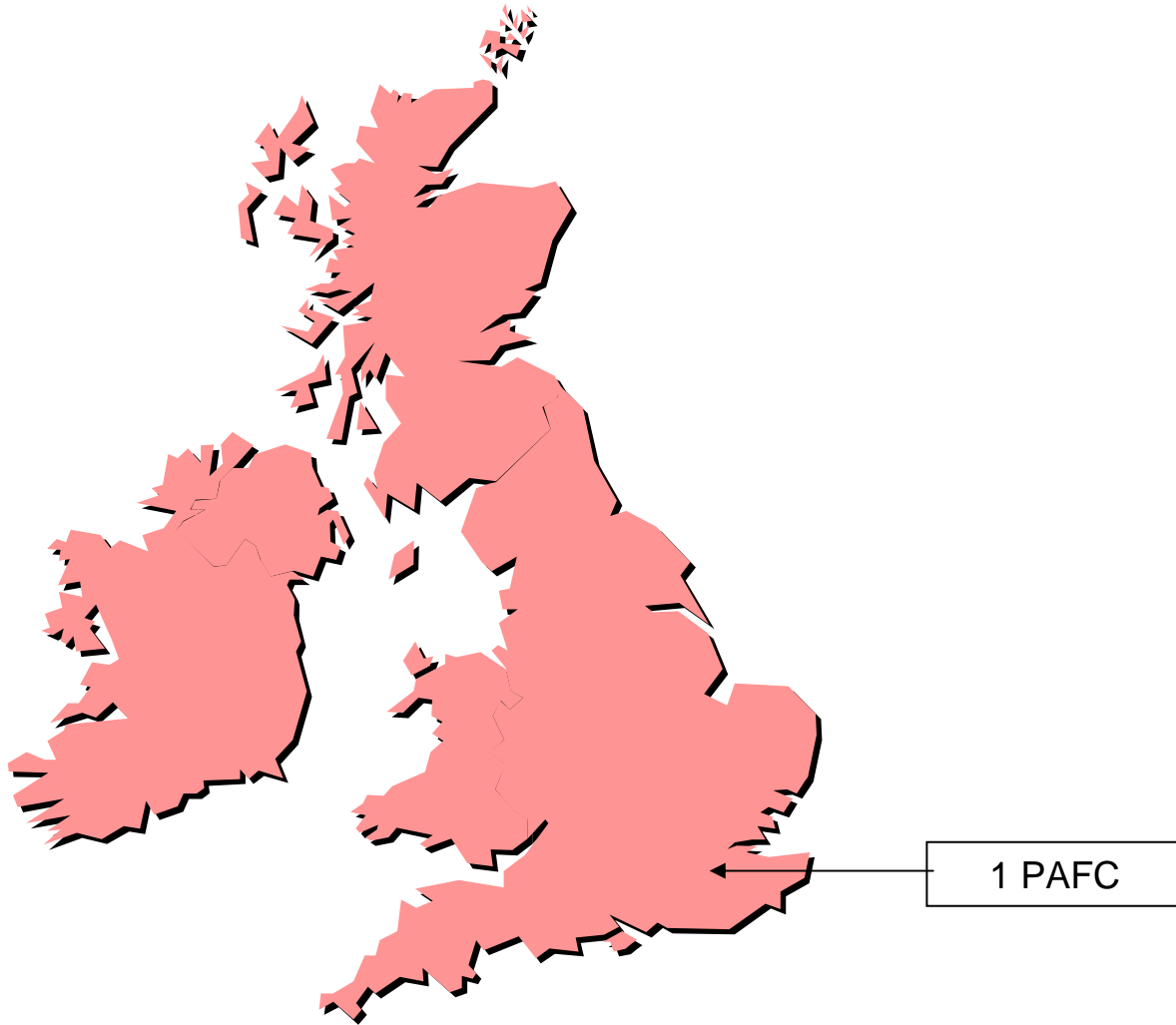


Note: Data refer to plant installed over the last 10 years and planned over the next 18 months

German Total 9.3MW

NRW Total: 3MW

UK Stationary Fuel Cell Demonstrations:



Country Score Sheet

	Installed Capacity (kW)	Share of Installed Capacity	Share of Euro Industry		Country Commitment Index
Germany	9,304	76.4%	31%		2.5
Italy	1,600	13.1%	7%		1.9
Norway	250	2.1%	3%		0.7
Switzerland	250	2.1%	3%		0.7
Belgium	250	2.1%	4%		0.5
Netherlands	125	1.0%	6%		0.2
Spain	100	0.8%	6%		0.1
U. K.	250	2.1%	19%		0.1
France	31	0.3%	6%		0.0
Sweden	14	0.1%	3%		0.0
Finland	0	0.0%	2%		0.0
Austria	0	0.0%	2%		0.0
Total Europe	12,174	100.0%	92.0%		



European Policy & Finance: Equity and Research

“Large increases in cost with questionable increase in performance can be tolerated only for race horses and fancy spouses.” Lord Kelvin (1824 – 1907)

European Policy Drivers: Squaring the circle

Environment

- Green House Gasses
- Pollutants

“The overall objective of the EU energy policy is to help ensure security of energy supplies for European citizens and businesses at competitive prices and in an environmentally compatible way”.

Source: European Union Energy Outlook to 2020, p9, DGTREN, Nov 1999.

Energy

- Security
- Sustainability

Renewable Energy Policy:
A multiplicity of drivers.
Credibility level?

Regional Policy

- Social Cohesion
- Local Employment

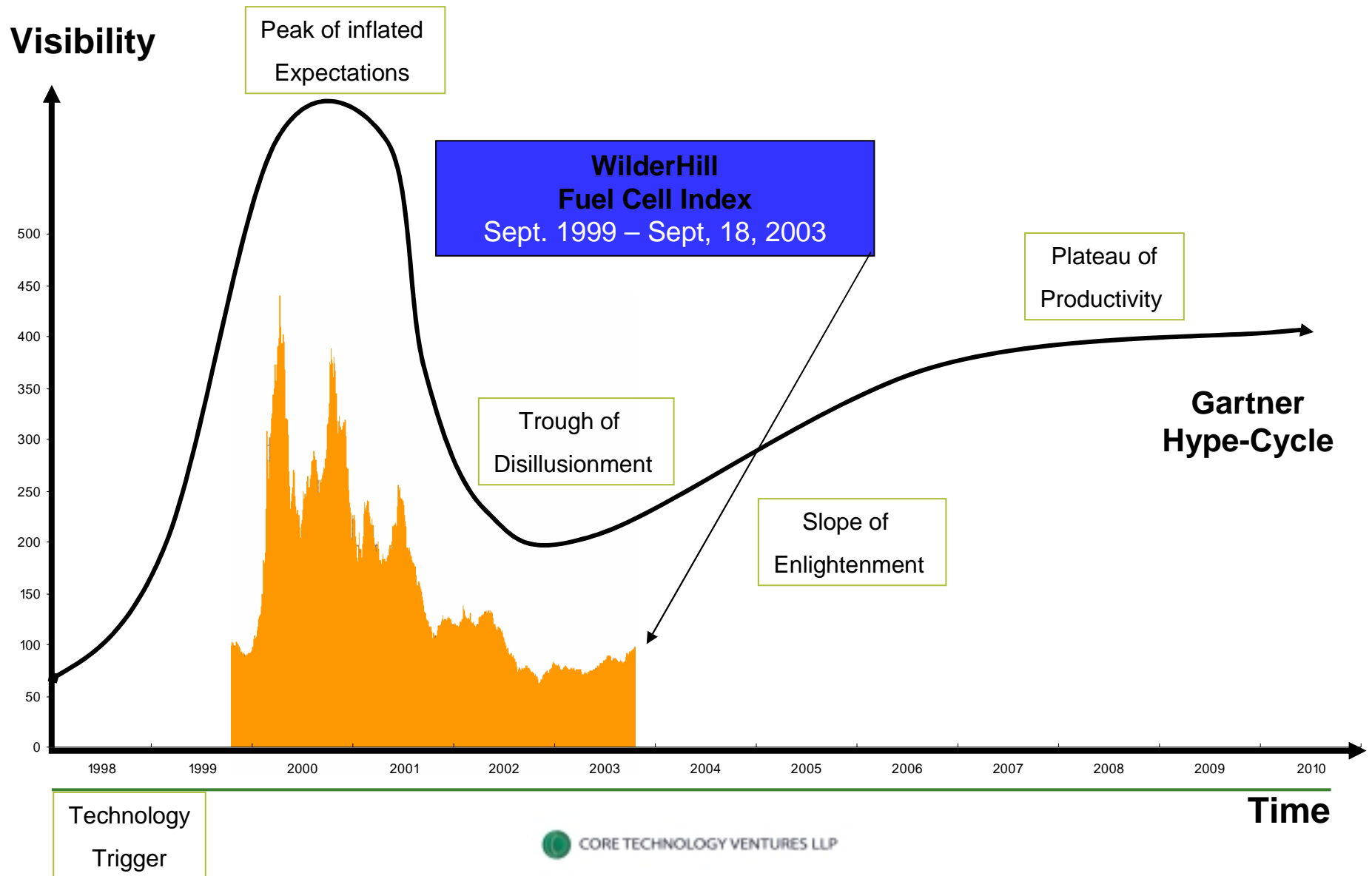
“The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion”.

Source: Presidency Conclusions, Lisbon European Council 23/24 March 2000.

Competition

- Technology
- Employment

Company Valuations: Using the Gartner Hype Cycle



Access to Capital: A blot on the European landscape

**Source of Funds:
The Balance Sheet**

Debt

Equity

**Subsidised
Loans**

**Bank
Debt**

**Issue
Bonds**

Public

Private

**Stock
Markets**

**Venture
Capital**

**Business
Angels**

Pre-production/
Stock market
listing

Early-stage/
2nd round
funding

Seed/
seed-corn
funding

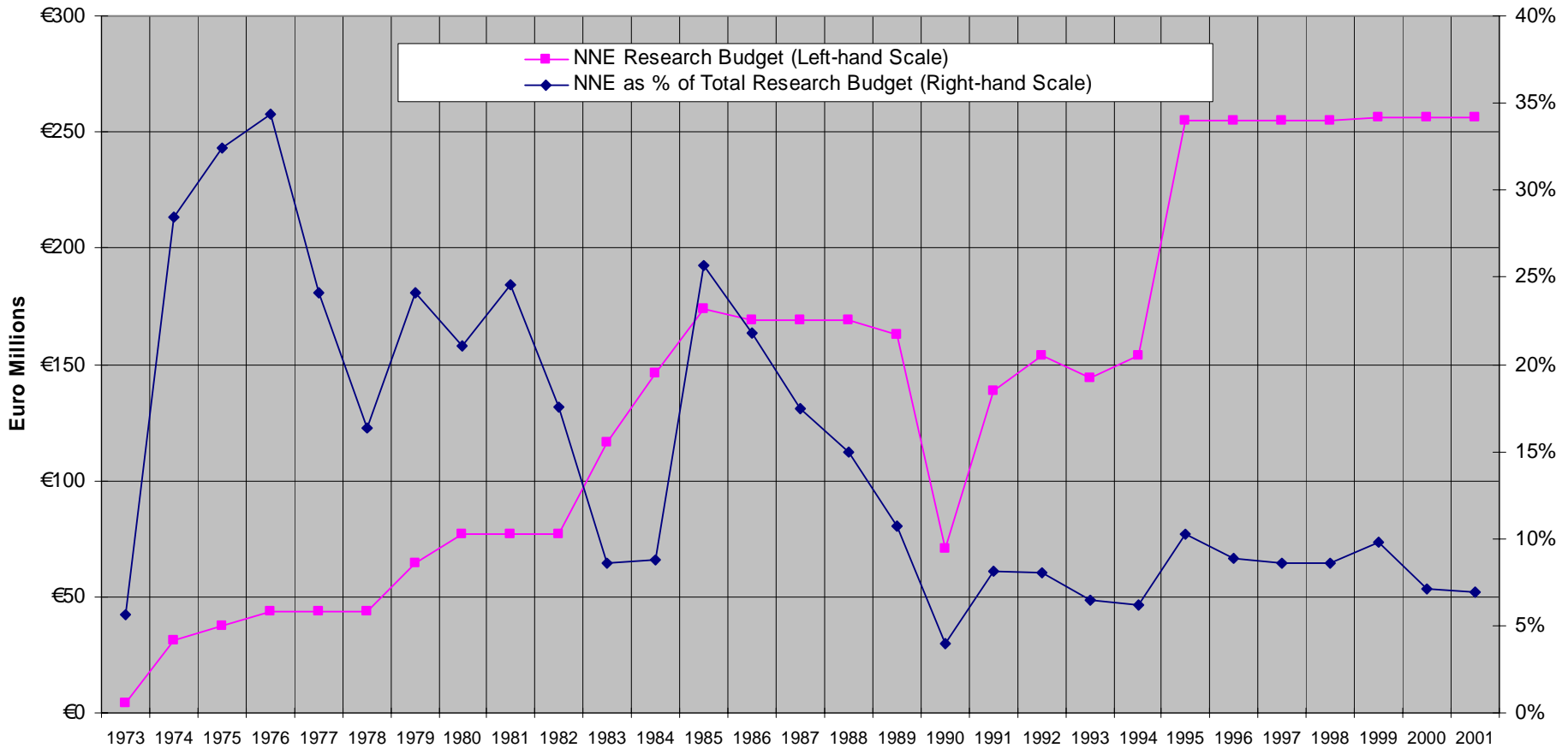
Start-up companies are essentially limited to seed and early-stage equity financing.

Owing to a shortage of private finance and the skills and disciplines financiers bring to seed and early-stage companies European fuel cell companies are financially disadvantaged relative to US companies.

This renders capital allowances and research grants inappropriate for many of Europe's seed and early-stage companies

EU Non-Nuclear Energy Research (NNE) Funding (1973–2001)

In spite of policy statements regarding the environment, energy security, technology and social cohesion, NNE research funding in € terms is flat and as a proportion of total EU research funding is falling *



* : Graph, Core Technology Ventures: Data Source EU Programmes from; http://dbs.cordis.lu/search/de/simple/DE_PROG_simple.html

Conclusions

- ❖ The structure of a fuel cell industry is taking shape
 - Europe is short on systems but long on materials and components
 - Germany and the UK dominate in terms of independent fuel cell 'entities'

- ❖ Product is in place, but cannot be described as commercial
 - In terms of installed plant the US is clearly ahead of Europe
 - Germany is clearly ahead within Europe, both in players and installed capacity
 - But Germany it is led by the its States, principally by North Rhine Westphalia, and not the national government
 - The UK is a clear anomaly with a significant number of players and a clear absence of installed plant

- ❖ A multiplicity of mutually reinforcing policy drivers exist, but lack credibility despite major statements

- ❖ Fuel Cell company valuations are more realistic
 - European seed and early-stage players, which are largely invisible, have extremely limited access to private finance
 - Europe lacks a quoted fuel cell sector which creates problems for non-specialist venture capitalists
 - This lack of private finance leaves many companies significantly under-capitalised
 - In turn this renders capital and research allowances useless for most independent fuel cell companies

- ❖ European funding is inadequate both in terms of research and equity financing
 - Yet Europe is teeming with independent fuel cell players
 - Company valuations are more realistic and thus present attractive opportunities