

Hydrogen and fuel cells: a new take on financing

PHIL DORAN

Unlike the US, Europe is not good at nurturing its most promising technology developers. So what can be done to make things better for the region's hydrogen and fuel-cell start-up companies?



Developing markets: European Union institutions and corporations must grasp the nettle and rethink their support for hydrogen and fuel-cell technologies if Europe is to nurture its myriad independent developers.

HYDROGEN AND FUEL-CELL (H₂&FC) technologies are the subject of a global R&D effort, one that's funded to the tune of hundreds of millions of euros of public- and corporate-sector money every year. All of this collective endeavour is focused on one thing: the mass commercialization of a set of disruptive technologies that, by definition, will impact on the way societies both consume and produce energy in portable, stationary and automotive applications. From an economic perspective,

the successful transfer of the underlying technologies out of the laboratory and into mainstream markets is going to require billions of dollars of investment over a timeframe measured in years in some cases, decades in others. Yet the payback on that investment – in terms of economic growth, job creation and social welfare – could be significant to say the least.

All of which begs a leading question for Europe's policy-makers, investment professionals and technology developers:

Disruptive technologies



A disruptive technology is a commercially successful innovation that fundamentally changes how goods and services are manufactured and delivered, in turn creating new, unanticipated products and services, opportunities and benefits.

Examples of disruptive technologies include the printing press, Alexander Graham Bell's "electrical speech machine", gasification and electrification, and the introduction of computers. A defining feature of disruptive technologies, and one that's not always appreciated, is the fact that they are often delivered by new-entrant companies, to such an extent that many long-established businesses fail to survive the ensuing shakeout.

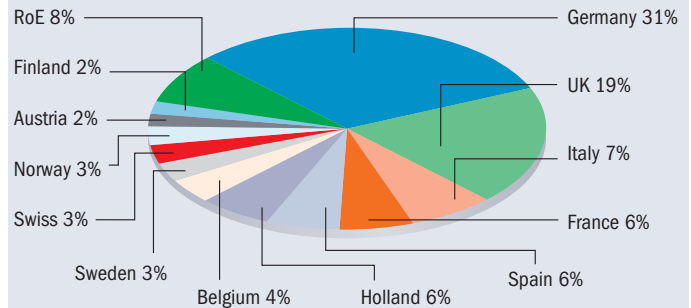
The family of technologies making up the H₂&FC "sector" displays all the characteristics of being disruptive. Portable fuel cells, regardless of how they are fuelled, look set to enable substantial growth across the full spectrum of personal consumer and military electronics devices. On the stationary front, fuel-cell systems can make use of the existing fuelling infrastructure, or operate as subcomponents in larger hydrogen systems, offering the prospect of carbon-free distributed energy generation. In the industrialized world, such systems would have potentially significant implications for the company-client relationship, with attendant implications and threats to the existing business models of utilities, not to mention the models of plant manufacturers.

At an appropriate price level, and with sufficient local maintenance capacity, the industrializing world may well represent the initial mass-markets for these technologies, where being a "first mover" could confer significant advantage. The introduction of fuel-cell-powered vehicles, potentially the largest single market, will, over the long term, result in the reshaping of the fossil-fuel and automotive industries. The cash value of these markets is forecast to eventually reach trillions of euros.

specifically, what chance does Europe have to take a proportionate (or better than proportionate) share of the emerging H₂&FC industry? While a definitive take is difficult so early in the industry's evolution, experience suggests that Europe's chances are not great. The reason for such a gloomy assessment is Europe's poor record in supporting seed and early-stage technology companies generally, a situation compounded by the relative failure of Europe's financial markets in this regard, particularly when compared with the US.

Another factor is poor "visibility" when it comes to the geographical distribution and corporate structure of Europe's H₂&FC activities – i.e. the types of enterprise developing the technology. Public studies erroneously conclude that Europe's fuel-cell industry is dominated by large, well capitalized industrial concerns. However, research here at Core Tec indicates the

1. How Europe's fuel-cell industry is divided



The data here represents a sample based on hundreds of European entities (excluding well capitalized and listed companies) developing fuel-cell-related hardware. Europe is awash with H₂&FC technologies being pioneered at independent SMEs and university groups. The latter are being held back, however, because of the difficulties would-be entrepreneurs experience when seeking finance outside the safety net of the academic research framework. Source: Core Technology Ventures Services.

opposite to be the case. In fact, Europe appears to be awash with H₂&FC technologies being developed by independent small/medium-sized enterprises (SMEs) and university groups, with the latter too often compromised because of the difficulties these would-be entrepreneurs experience when seeking finance outside the safety net of the academic research framework.

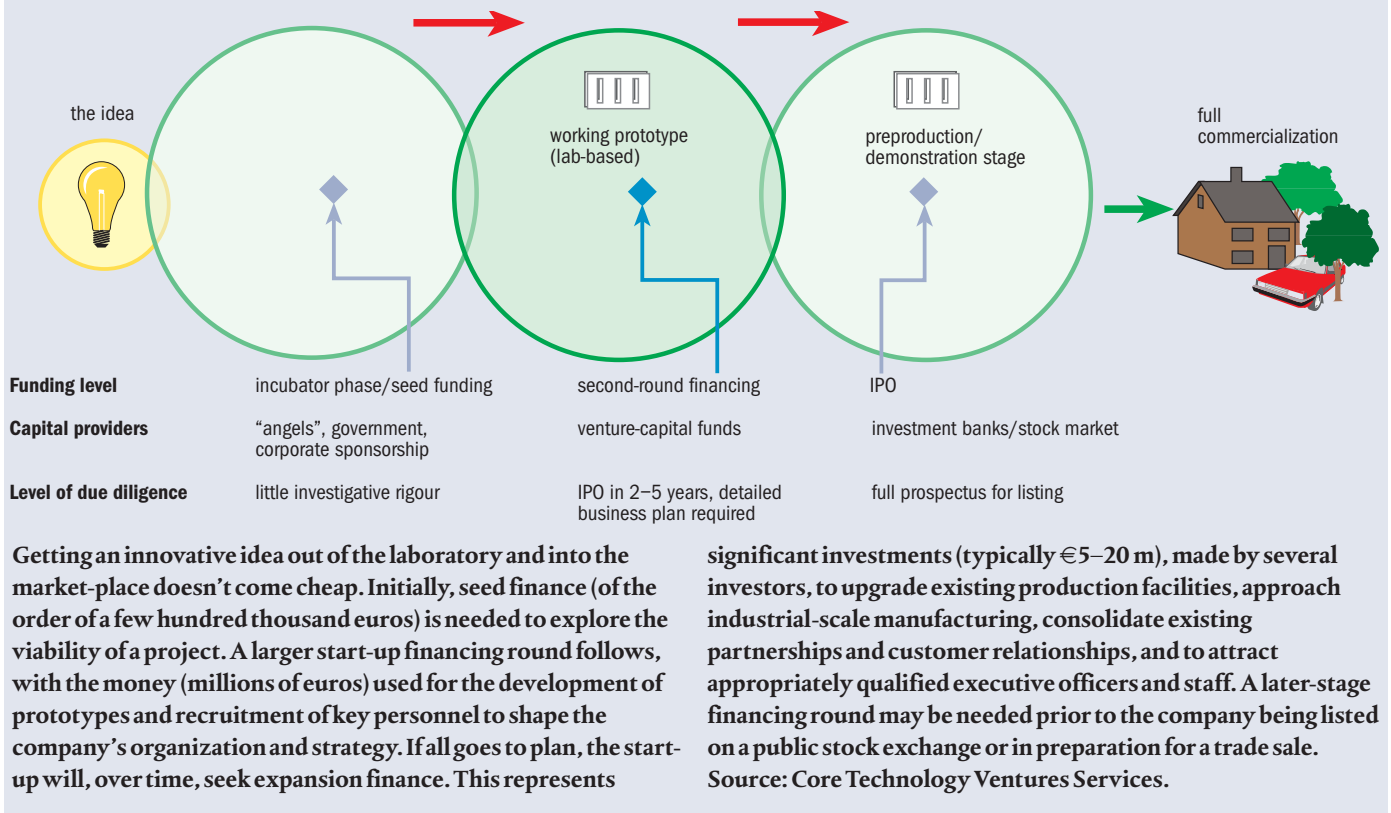
Market failure

Europe's relative inability to nurture its most promising H₂&FC technology developers is nothing short of a market failure. That failure can be traced to imperfections in the market mechanism – ranging from inadequate information (for policy-makers and investors), formal and informal limitations on the movement of labour and capital, through to cultural attitudes to risk, which more or less characterizes the European scene.

Market failures are bad news because they can have significant negative implications for current and future economic growth and hence social welfare. A good example is pollution. Where pollution is allowed to be produced at less than the full cost to society, a firm will overproduce, given its ability to avoid the full cost of production. In the same way, if the full benefits of R&D cannot be appropriated by the developer – in this case, the H₂&FC developer – then too little R&D will be "produced" and society as a whole suffers.

Consequently, the existence of market failures supports the case for European Union (EU) action directed at improving economic efficiency and the workings of the fragmented European market. In truth, the failure of European policy-makers and industrialists to understand the European H₂&FC landscape not only needs to be swiftly addressed, it also needs to be recognized that the financial "instruments" currently available – principally, subsidies in the form of R&D grants and tax breaks – are wholly

2. Funding: from innovation to market-place



unsuited to independent SMEs and seed companies.

Put another way, if Europe wants to encourage and profit from its talent pool in H₂&FC technologies, it must apply existing financing instruments more aggressively, while at the same time developing new, more creative funding routes. The big danger for the EU is that it sits on its hands, does nothing and waits for market-pull to take care of H₂&FC deployment. Meanwhile, the financial community will invest directly in those areas where total risk – including policy, regulatory and technology risk – is seen as being lowest (i.e. not in the European H₂&FC arena). Such a scenario would represent the worst of all possible worlds for the EU's nascent H₂&FC development community.

From failure to success

Back in 2000, EU ministers set themselves the ambitious goal of transforming Europe, within a decade, into 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". With five years left in which to deliver on that promise, the grand vision looks no nearer to becoming reality.

In this context, it's evident that H₂&FC technologies, when considered together with renewable energy sources, have the potential to meet several EU policy goals simultaneously, especially with respect to economic development, energy security and environmental issues. Worryingly, though, this linkage is not reflected in the EU's H₂&FC policy statements, which make

no mention of financial support for the industry outside the regime of partial subsidies represented by the EU's Framework programme (a multibillion-euro pan-European R&D programme run by the European Commission in Brussels).

Leaving aside the issue of whether the financing made available in this way is sufficient or not, there is the more fundamental issue of whether such an instrument (subsidies) can serve to promote an independent European H₂&FC industry. Start-up and seed companies, in the main, cannot take advantage of such support, owing to the fact that they have neither the manpower to handle the exhaustive application procedure for Framework money, nor the necessary capital to match the subsidy in the event of an award. What these entities need in place of (or alongside) subsidies is equity, reinforced by the professional support provided by a dedicated venture-capital (VC) community.

The view here at Core Tec is that the EU must, as a matter of priority, address the shortage of risk capital faced by Europe's many independent seed and early-stage H₂&FC players. Policy-makers can be proactive on this score by promoting financial (i.e. equity) support from within appropriately authorized EU institutions to specialist European VCs. These VCs would seek out, at a European rather than national or regional level, the best of Europe's independent H₂&FC developers. Further, the EU could also consider directly supporting its independent H₂&FC industry by establishing a European H₂&FC investment trust, similar to the UK's Carbon Trust. Such a vehicle, charged

The role of the venture capitalist

Venture capitalist (VC) firms are a key link in the financial intermediation chain, channelling capital into high-risk innovative seed and early-stage companies. VCs finance their investment activities by raising funds from a limited number of sources, principally institutional investors (such as pension funds), financial institutions (mainly banks) and corporations. In return for financing – usually over a period of five to seven years – the VC takes a stake in a start-up's equity.

Venture-backed companies contribute to job creation, provide a key source of R&D spending and, in some cases, can create entirely new industries (as with Amazon and eBay). In their early stages, however, most start-ups have no access to traditional forms of finance, which include bank loans or debt, bond issues or the selling of company shares (equity) on public markets. The reasons such channels are closed is that early-stage companies often have no revenues with which to pay interest on debt and embody too high a risk for traditional equity investors. This is how VCs earn their money, managing the considerable risk that emerging companies represent.

As well as providing risk capital, a capable VC will offer a range of value-added services to its portfolio companies. In the provision of these services, the VC brings financial and strategic expertise to bear, provides expert knowledge of the wider industry, and puts its network of contacts with potential commercial and research partners and potential customers and company managers at the disposal of the developer. This allows the company founders to focus

on the technology and product development.

Over time, however, the combination of capital and non-financial services loses its rationale for both parties. As the start-up companies move along their development paths, through seed and early-stage to expansion and, ultimately, to commercial sustainability, they acquire the professional managers they require at appropriate stages of development and simultaneously shed the technical and commercial risk such that traditional forms of finance become available. At this stage, VCs divest their interests and recycle their profits into other emerging companies.

Clearly, a VC's activity is dependent on the ability to exit from its investments, which typically takes the form of initial public offerings of its portfolio companies on listed stock markets. In this respect, the US provides a much more accommodating environment than Europe. That's largely because the US public equity market accounts for around 50% of the value of all publicly listed companies worldwide, making it approximately twice the size of the combined value of all EU quoted companies. It also helps that the US financial system functions under a single regulatory regime and has a largely homogenous culture with a greater tolerance for risk-taking.

It is therefore no surprise that, relative to the US, Europe's financial markets consistently fail to nurture seed and early-stage technology developers. Europe's VC industry is around five times smaller than its US counterpart, and displays significantly greater variation in its sources of funding, a sign of its relative immaturity.

with supplying equity to independent developers and specialist VCs, could be managed, for example, by the European Commission's Directorate General for Enterprise.

As well as addressing the European market failure at the seed and early-stage level, such action would send a clear signal to the private investment community that the EU is putting up the risk capital to deliver on its policy statements. The provision of equity financing in this way would have two other implications for European H₂&FC technology. First, it would afford SMEs access to more conventional financial support, as is the case in the US. Second, it would give comfort to and encourage that part of the industry currently locked in universities and research establishments to spin out their inventions. Developers in the academic sector face the dilemma that they are under pressure to commercialize their inventions, yet on leaving the academic environment they face the prospect of their funding drying up.

The role of the corporate sector

If the case for greater intervention from national governments and Brussels is compelling, the same can be said about the role of the private sector, though for different reasons. If the H₂&FC industry proves a commercial success, companies that stand to benefit directly – suppliers of materials and components, for example – may lose out if they have not acquired enough "coal-face" experience to make the relevant strategic and capital com-

mitments to stay ahead of their competitors. Equally, those companies whose business models will be adversely affected by the widespread introduction of H₂&FC technologies – e.g. suppliers of conventional energy systems – will also lose out should they fail to acquire direct and relevant experience of H₂&FC industries as they unfold.

The question both parties face is how best to manage the market risk – which by definition they cannot avoid – and what price to pay in the process. The view here at Core Tec is that, with very few exceptions, most EU companies have either not reacted at all, or have sought to manage their market risk by acquiring specific H₂&FC companies. But the acquisition of specific risk, as all portfolio managers know, is a poor insurance policy against market risk, which can only be insured against via a portfolio approach (i.e. spreading your bets by the acquisition of stakes in a group of companies/technologies).

Analytically, there is no difference between those companies faced with positive or negative risk: a failure to respond adequately could severely damage future commercial prospects, or even put the company out of business in the long run. Consequently, on the industrial front, it is crucial that well capitalized companies, regardless of the nature of the risks they face, manage their market risk by pooling resources with other companies via the adoption of a portfolio approach, facilitated by specialist VCs. While such investments must be based on potential financial return, they should also pay due consideration to the contri-

bution the information flow makes to the timing of future corporate actions, and the achievement of wider strategic goals.

Do the right thing

Europe is not the US. It does not support innovation particularly well, having neither the financial markets nor the culture to do so. But while Europe suffers from a general market failure in providing the necessary equity finance to emerging technology companies, EU policy-makers, executives and investment professionals need to recognize – and sooner rather than later – that the H₂&FC industry is too compelling an opportunity to get wrong. For starters, H₂&FC developers are pushing an inter-related set of disruptive technologies, any one or all of which could mature into multibillion-euro markets. At the same time, those same technologies can meet a number of important policy goals, particularly pertaining to energy supply and security, the environment and economic growth.

The problem is that the existing framework of financial support in the EU is not conducive to the achievement of these goals. Current public support is predicated on an idealized industry, one populated by large, well capitalized companies, whose needs are in part being met with R&D grants, demonstration aid, tax breaks and capital allowances. Furthermore, policy is being executed in the absence of real knowledge of the corporate structure and technical and geographical distribution of Europe's H₂&FC companies.

To sum up: if Europe fails to implement appropriate support mechanisms tailored to meet the needs of its independent H₂&FC sector, it's going to be hard, more than likely impossible, to build a coherent technology base to support this emerging industry. That scenario, in turn, will surely herald further migration of human capital, intellectual property and jobs out of the EU to more receptive market-places elsewhere. ●

Further reading

1. K Campbell 2003 *Smarter Ventures: a Survivor's Guide to Venture Capital Through the New Cycle* (Prentice Hall).
2. L Bottazzi and M Da Rin 2002 Venture capital in Europe and the financing of innovative companies *Economic Policy* **17** 229.
3. B S Black and R J Gilson 1998 Venture capital and the structure of capital markets: banks versus stock markets *Journal of Financial Economics* **47** 243.
4. D Rankine, G Stedman and M Bomer 2003 *Due Diligence: Definitive Steps to Successful Business Combinations* (Prentice Hall).
5. G Spooner 2001 *Venture Capital and Private Equity: A Practitioner's Manual* (City & Financial Publishing).
6. P Doran *et al.* 2003 Finance and the fuel-cell industry: a review of the current financing climate *International Journal of Hydrogen Energy* **28** 713.

Phil Doran is a partner and co-founder of Core Technology Ventures Services. Based in the UK and Germany, Core Tec provides bespoke consulting services to industry, finance and government stakeholders in the H₂&FC sector. It is also working to raise a fund for H₂&FC investment. See www.coretecventures.com.