

What should government do to advance the hydrogen economy?

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It used to be said that there were only three tools of public policy: greed, sex and fear; and the second of these was awfully hard to deploy. Consequently, the three ways governments in fact use to get people to do specific things -- regulation, suasion, and bribery – actually map into greed and fear. Regulation is all about the fear created in the mind of the economic actor if he does not conform. Greed calls on all the tools of suasion and bribery.

Regulation invokes the coercive power of the state to order by statute that something must not be done, or more rarely, that in certain circumstances, only a narrow range of techniques is permissible. Like all matters of law in public policy, this is best invoked only when a social consensus has already formed. Law is the most conservative tool of public policy, and when applied in advance of the necessary consensus usually fails. Examples include the firearms registry or the 1980-84 national energy program. It is far too early to mandate any specific approach to hydrogen. The technical alternatives are too many, and the probability of freezing technology prematurely too great.

But if “hard” regulation is premature, there are several “soft” approaches that might be used with care. One is standards development. Under the authority of the Standards Council of Canada, organizations like the Canadian Standards Association will convene all stakeholders, when requested by government, industrial or more rarely consumer groups, to hammer out a standard. By codifying industrial best practices, technological risk is reduced and manufacturing processes can begin to take advantage of scale. A useful feature of standards development is that it can concentrate on some small part of a large enterprise where a technical consensus has formed, or where the new practice is a fairly straightforward extension of the old, and thus reduce uncertainty to a useful degree while avoiding premature fossilization. The process is, however, slow and not inexpensive, and tends always to proceed with a view to international harmonization, thus adding further viscosity.

Not much has happened so far with respect to hydrogen standards, as most of the relevant processes have yet to experience the large-scale trials that allow players to exclude some alternatives in favour of clearly superior ones. Exceptions are the CSA’s FC1-2004 and FC3-2004, both dealing with fuel cells. An interesting exception has to do with hydrogen embrittlement of zirconium, a problem that has arisen in the nuclear industry. It is possible that the hard-won experience of Candu reactor operators will be of benefit to the hydrogen economy of the future, since the standards represent the crystallization of their many years

of work and disappointment, but there is some question of whether the work is too specific to Zr.¹

This is an area where some cautious work by government might pay results. NRC and the CSA, working together, might begin to consider whether the time is yet ripe to codify practice with certain elements of a future hydrogen economy – for example, the avoidance of materials known to have embrittlement,

In the hydrogen area, the federal government's R&D efforts have arguably been overly concentrated on fuel cells. Very early on, technically informed enthusiasts in the federal government found an industrial champion, a firm that had, it was thought, at least a small chance of being a global winner in one of the industries of the future. That the firm was located in a province whose perennial complaint was that federal technology expenditures always went to central Canada only accelerated this premature concentration. NRC, NRCan, Industry Canada, and even the Business Development Bank of Canada piled on. This is not to say that the firm in question and the technology it was inventing was unworthy: far from it. But a little diversification in a high-risk portfolio is always a good idea.

There are some signs that a broader view may be emerging. One of the classic functions of the Industry department's sector branches has always been to take a long view, and an overview, of particular sectors of interest. Last year it published the first of what one hopes will be a periodic series of profiles.² The scientific literature is beginning to take a broad and synoptic view of the system-wide consequences of a shift to hydrogen as a motive fuel,³ as well as publishing specifics. Governments can create a substantial public good by sponsoring research, and the adaptation of technological developments from abroad to Canada's climatic particulars. In Canada, a larger investment into work done in-house and in the universities would be a no-regrets decision.

The federal government also gets close to the "choosing winners" syndrome through NRC's IRAP program and more particularly through Industry's Technology Partnerships Canada program.⁴ IRAP, at least, keeps its cash subsidies small, well diversified, and accompanies them with advice from knowledgeable case officers. TPC is more like a venture capital fund in its approach, but one that has low expectations of a return on investment. It has a special window for hydrogen called the "h₂ Early Adopters Program" – h₂ea for short – aimed at:

- "Integration of hydrogen and hydrogen-compatible technologies;
- Development of hydrogen infrastructures;
- Development of skills and supply chain in the hydrogen industry;
- Development of codes and standards for the hydrogen industry;
- Increased performance, reliability, durability, and economic viability of hydrogen and hydrogen-compatible technologies; and

² Industry Canada, Fuel Cells Canada, and PriceWaterhouseCoopers, "Canadian hydrogen and fuel cell sector profile 2004," ISBN 0-662-37227-1, 2004

³ For instance, M.Z. Jacobson, W.G. Colella and D.M. Golden, "Cleaning the air and improving health with hydrogen fuel-cell vehicles," *Science* 308 (24 June 2005):1901-5

⁴ TPC was differentiated from its predecessor DIPP principally through rhetorical means, and there is every indication this time-honoured tradition will continue with its successor.

- Increased public, consumer and investor awareness and acceptance of the hydrogen capability.”⁵

This is certainly an ambitious set of goals, a set moreover difficult to accomplish solely through investment in private companies. It is hard to assess performance, however, as all specifics are cloaked in a veneer of commercial confidentiality. Markets are stimulated by the wide availability of good information. Subsidizing the creation of proprietary information is not so unambiguously good.

Of course suasion operates at the level of public communications as well. The degree to which actual investment is catalyzed by political figures extolling the virtues of any particular course of action is debatable, especially if some government-in-waiting feels constrained to take an opposing view, but statements from persons thought relatively more authoritative and objective may carry weight. More generally such statements may indicate a level of social approbation that would have the effect of reducing, for example, certain regulatory risks. There is little harm in political figures taking an advocacy position vis-à-vis hydrogen, but the good ones will be careful, since skeptics will quickly ask for the substance behind the ur

a means of accomplishing goals as narrow as stimulating a particular industrial sub-sector.

Bottom line, what might be a good program for the federal government in present circumstances? One set of choices might be as follows:

- **Technology assessment and evaluation:** an external advisory panel, assisted by a small team of scientists, engineers and information specialists at NRC/CISTI, should continuously comb the world literature for advances in hydrogen