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KNOWLEDGE…INNOVATION…ACTION

Sustainable co-innovation Model for Environmental Innovations

Submission to the Garnaut Review Forum: Research and Development: Low Emissions Energy Technologies

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Declaration of interests and affiliations

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EXECUTIVE SUMMARY

This submission responds to the call for participation in the Garnaut review of R&D-low emissions energy technologies. My submission deals with the following aspects:

1) Innovation is a process that goes beyond theoretical conception, through technical invention to commercial exploitation. Therefore, R&D is an element of innovation.

2) One key distinction between R&D and innovation is that in the former, we don't necessarily know the outcomes. To create an innovation, the desired outcome must be known before tackling the problem with R&D.

3) A new "sustainable co-innovation" (SCOI) model is proposed for the development of environmental innovations. The model is similar to the Forward Commitment Procurement model, but the concepts of co-innovation and innovation networks have been added.

4) The SCOI model requires a central overseeing organisation, which we call NEIS. However, it is proposed that the organisation becomes a joint venture between private and public partners. This organisation would:

    a. Provide a strategic framework for national environmental innovation, from a market-led, supply chain perspective.
    b. Coordinate the activities required to introduce new technology in the marketplace
    c. Coordinate government-led environmental innovation activities (e.g. grants and strategic directions for public R&D), from a supply and value chain perspective. This would avoid the lack of supply chain focus and would increase critical mass in the initiatives undertaken.
    d. Enable the commercialisation stages in the innovation process, including assistance in seeking for venture / equity capital.
    e. Provide timely competitive and technical intelligence to all stakeholders about the particular innovation areas targeted, bringing attention to current and emerging technologies and innovation trends in the targeted markets.

5) The SCOI model also requires the following types of consortia:

    a. A buyer consortium, formed by two or more supply chain partners that establish an alliance to contract/purchase the new process/ product/ service developed by a supplier consortium.
    b. A supplier consortium, formed by two or more organisations that seek to deliver the innovation at the specifications (e.g. cost, time, performance) set by the legislative consortia.

c. A legislative consortium, which aims to increase the receptiveness of the market to new technologies/processes/products by introducing standards, regulations and laws that increase performance targets in certain areas.

6) In the SCOI model, a buyer consortium (which may or may not include a public sector organisation) commits to purchase a pre-defined quantity of a product\ technology\service, currently under development but not yet available as a commercial offering. NEISC and the buyer consortium agree in the performance sought for the innovation. The supplier consortium is formed and solutions are sought, based on past innovations or completely new concepts. Meanwhile, the legislative consortium develops standards, regulations and certification processes that enable fair competition and enhance the chances of the uptake of new solutions at the agreed performance specification. When the innovation has been developed, meeting all performance criteria, the buyer consortium purchases the product at a specified volume and cost, at levels that encourage other supplier consortium to enter the market. The private sector would react by freeing investment to search for innovations that respond to those specifications.

7) In the context of SCOI, I do not necessarily advocate for the government to become the early market buyer that executes the forward commitment options, although, a public organisation buyer may be the most effective means to ensure private investment for new products, new markets or new processes in the energy areas.

8) I propose that energy supply chain players form alliances that commit to buy the new product / service/technology when this is developed. The drivers for such commitment could be based in (a) superior value proposition (including financial, environmental and social performance); (b) new regulations encouraging the uptake of the innovation; and (c) a demonstrated increase of competitiveness in the marketplace if the innovation is adopted.

CONTENTS

1 INTRODUCTION

It is fair to say that R&D is not a synonym of innovation. Innovation is a process that goes beyond theoretical conception, through technical invention to commercial exploitation. Therefore, R&D is an element of innovation. This view is supported by the recent report "Public support for science and innovation"[1], which defines innovation as:

> *"deliberative processes by firms, governments and others that add value to the economy or society by generating or recognising potentially beneficial knowledge and using such knowledge to improve products, services, processes or organisational forms. From the perspective of this study, these improvements may be specific to the entity, to the industry, country or world, and could be incremental or novel."*[2]

Historically, public R&D organisations have been an integral part of the Australian innovation system. However, it has become clear that these organisations alone are not capable of providing the full spectrum of activities required to commercialise inventions. One key distinction between R&D and innovation is that in the former, we don't necessarily know the outcomes. Therefore R&D endeavours are always a success, as they always increase knowledge. However, new knowledge may not deliver commercial outcomes, at least in the short term. To create an innovation, the desired outcome must be known before tackling the problem with R&D. Furthermore, innovation is fallible. As stated by DTI and DEFRA, "innovation can always be accurately targeted to a commercial outcome but unlike research it can fail"[3].

Science in the innovation continuum

All research has a purpose. However, a commercialising purpose is very different from a knowledge-seeking purpose. Past Government systems seemed to focus on the transformation of public R&D organisations into innovation "factories". This may well be what it is required, but the roots of public R&D organisations are closer to knowledge-seeking endeavours than to innovation. Public R&D organisations and universities will require a clear mandate on the balance between funding for curiosity driven science and science targeted to bring commercial outcomes. A possibly more important issue is that the Government investigates what is the right funding split between the two.

Figure 1 shows a conceptualization of (a) what the innovation continuum encompasses; (b) how science can feed into innovation; (c) how the market can influence science; and (c) how scientific endeavours are successful even if they don't produce an immediate innovation. In the proposed concept, we assume that all ideas that progress into an innovation continuum, either supported by

[1] Productivity Commission. 2006. Public Support for Science and Innovation, chapter 1: Introduction. Draft Research Report. Productivity Commission, Canberra. p. 7- Introduction.

[2] DEST 2005c, p. 9

[3] DTI & DEFRA, 2006. Bridging the gap between environmental necessity and economic opportunity. 1st report of the Environmental Innovations Advisory Group.

private of public funding, are worth exploring[4]. New theories or knowledge (either born out of curiosity/creativity or market driven needs) lead to basic research, which in turn could lead to developing a close-to-market application, or not. A reason for the latter may be that present technology limits commercial application (e.g. Einstein's theory of relativity was developed in 1905, but its application for the development of global positioning systems occurred 68 years later). Or perhaps the phase of applied research shows that the new product/service/technology will not be able to compete in price with current substitutes. Or perhaps the innovation infringes other's patents. There are several reasons why innovations fail. But in this context, it is the implementation, rather than the new idea, what fails.

The model presented implies that, for every research that fails to deliver an innovation in a particular application field (e.g. electronics), there may be *n* different fields that may benefit from the same research (e.g. instrumentation). This multiplicative effect is further illustrated in Figure 1a. This effect explains why one of the ways to assess the impact of patented inventions is to quantify the citations of the original patent, either in the same area of application or in different areas.

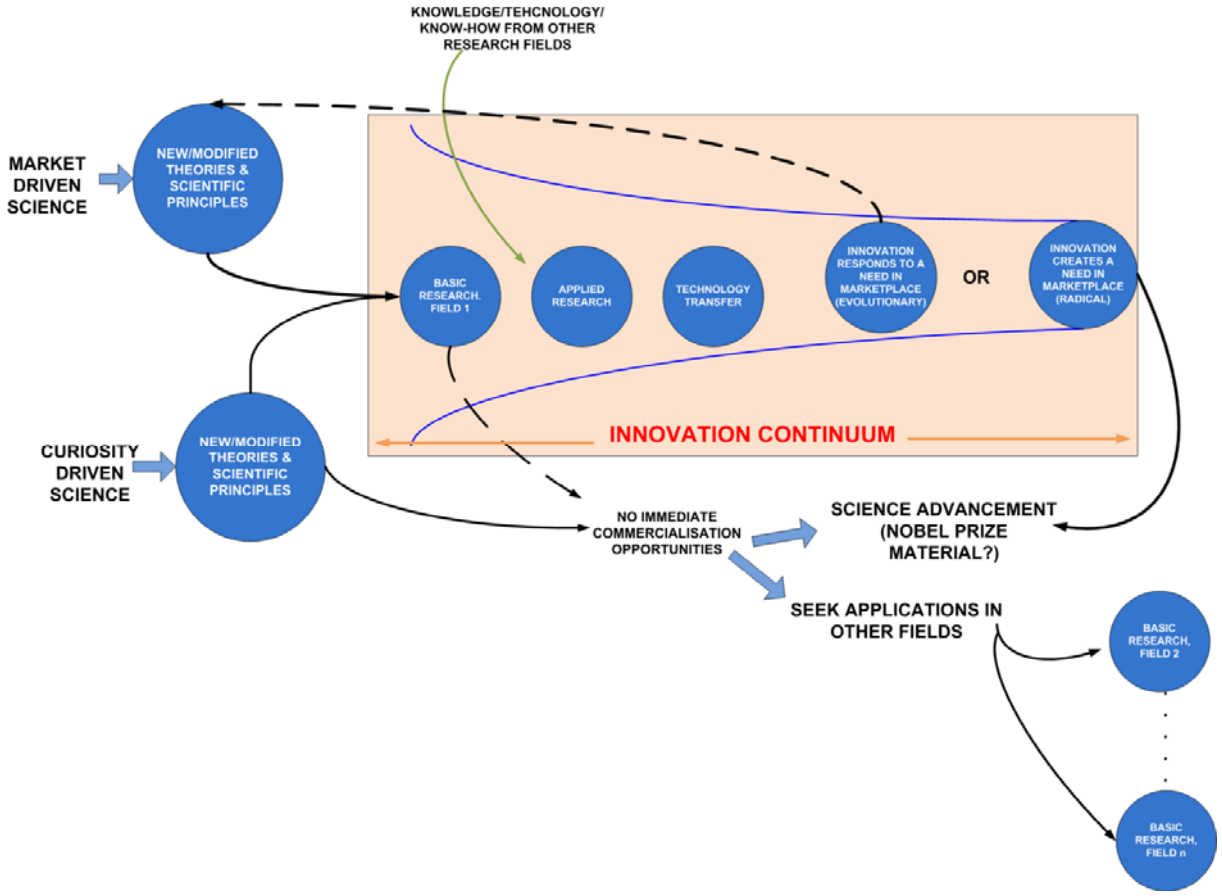


Figure 1. The innovation continuum and sources of innovation.

It is clear that some industries will benefit from a market push innovation model than from a technology push innovation model. In the following pages, I will focus on the application of an innovation model based on the "forward commitment procurement" concept, for the development of environmental innovations.

[4] The scientific community have quality assurance systems to ensure that this is the case (e.g. national and international peer reviews, strict use of the scientific methodologies, guidance by senior researchers and other mechanisms).

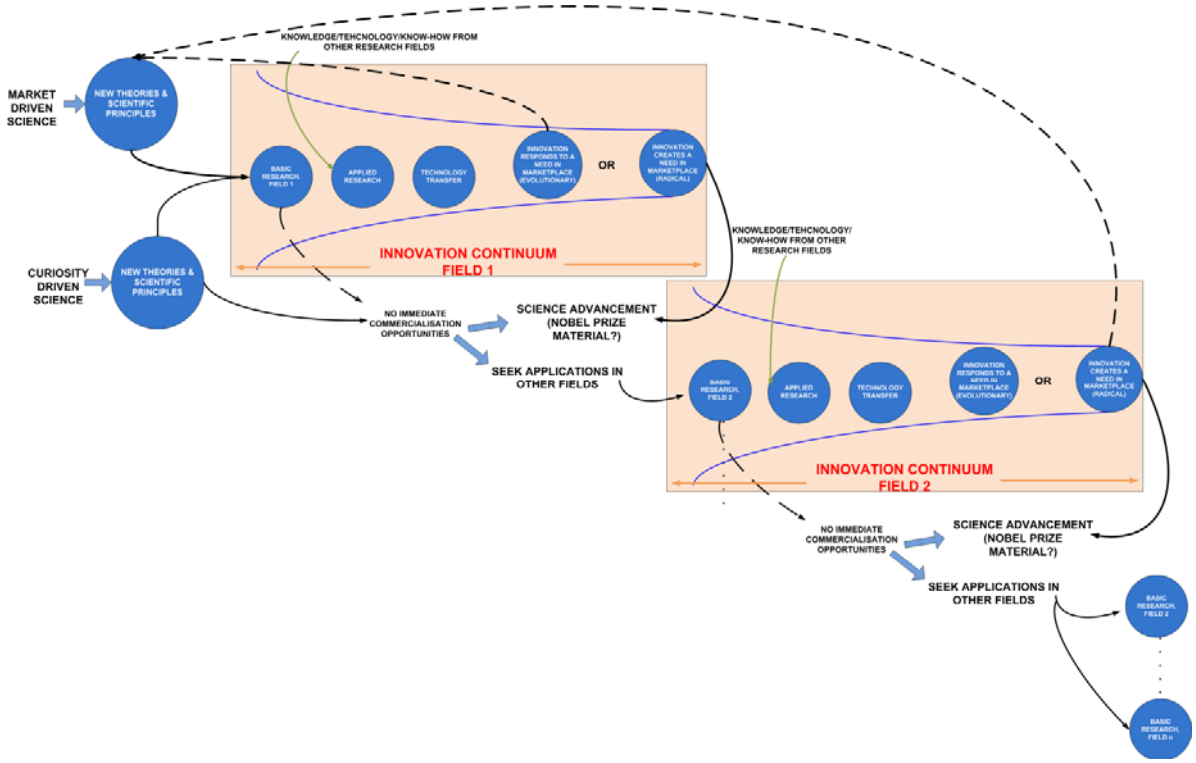


Figure 1a. The multiplicative effect of science and innovation.

Forward commitment procurement model

Forward commitment procurement (FCP) is a type of demand side driven innovation, specifically led by the Government. It is defined as "a commitment to purchase, at a point in the future, a product or service that does not yet exist commercially, against a specification that current products do not meet, at a sufficient scale to enable the investment needed to tool up and manufacture products that meet the cost and performance targets in a specification"[5].

In an FCP model, a public sector organisation commits to purchase a pre-defined quantity of a product\ technology, currently under development but not yet available as a commercial offering. The commitment is for a future date and is based on a specified product performance being achieved. When the product has been developed meeting this performance specification within the agreed timeframes and framework, the organisation purchases the product at a specified volume and cost, at levels that encourage supplier investment to ensure economies-of-scale. The private sector would react by freeing investment to search for innovations that respond to those specifications. Once the product/service has entered the market, normal market conditions will determine competition and price[6].

The FCP model has been highlighted as the most promising model to encourage environmental innovations, where the government itself acts as an early adopter. The procurement process is also supported by regulations that enhance the market conditions to create a demand for the innovations. A key aspect of FCP is the focus on needs and outcomes, rather than placing the focus on the product.

[5] http://www.cambridgenetwork.co.uk/news/article/default.aspx?objid=16135

[6] http://www.endsdirectory.com/index.cfm?action=articles.view&articleID=200704

The European Commission investigated the FCP model for driving innovation in 2005[7]. The major advantages that the EC has noted about FCP are:

- Firms are given the incentive to spend money on research in the knowledge that an informed customer is waiting for the resulting innovations and thus the risk of investing in R&D is reduced.
- Competition is shifted from a sole focus on price to the provision of solutions which offer the greatest advantage to users over the whole life use of the purchase.
- FCP opens up opportunities to improve the quality and productivity of public services offered to the citizens through the deployment of innovative goods and services.
- Technologies launched in this way may then move on to further deployment in private sector markets. Other policy objectives (e.g. Kyoto protocol targets) may also be achieved by procurement of innovative solutions.

Recently, the European Commission published a second document outlining the pre-commercial procurement process in the EU, reflecting their intention to use this approach for their strategic sourcing of innovation. Two European FCP models are shown in Figures 2 and 3.

The Australian Government is extremely knowledgeable about procurement strategies. However, there is a lack of guidance in regards to the use of procurement to drive innovation. Bridging this knowledge gap through enhancing public knowledge on the role of procurement to drive innovation is the first key step towards using FCP.

I raise the issue of the roles of CRCs and RDCs in regards to the role of “innovation procurers”: although RDCs align closely to what FCP is about, CRCs do not quite match this profile. CSIRO has a role as an R&D provider in basic areas of research, but it may well be that CSIRO can have a role as a procurer in seed/incubations stages. In any case, CSIRO could not sit in both (supplier and procurer). The role of public R&D organisations needs to be discussed in the light of any FCP initiatives in the future.

A crucial element of the FCP model is the identification of market needs and the translation of these into specifications for the tendering process. The needs may arise from policy changes, budget structures, operational/efficiency reasons or other sources.

[7] EC 2005. Public procurement for research and innovation. Developing procurement practices favourable to R&D and innovation.

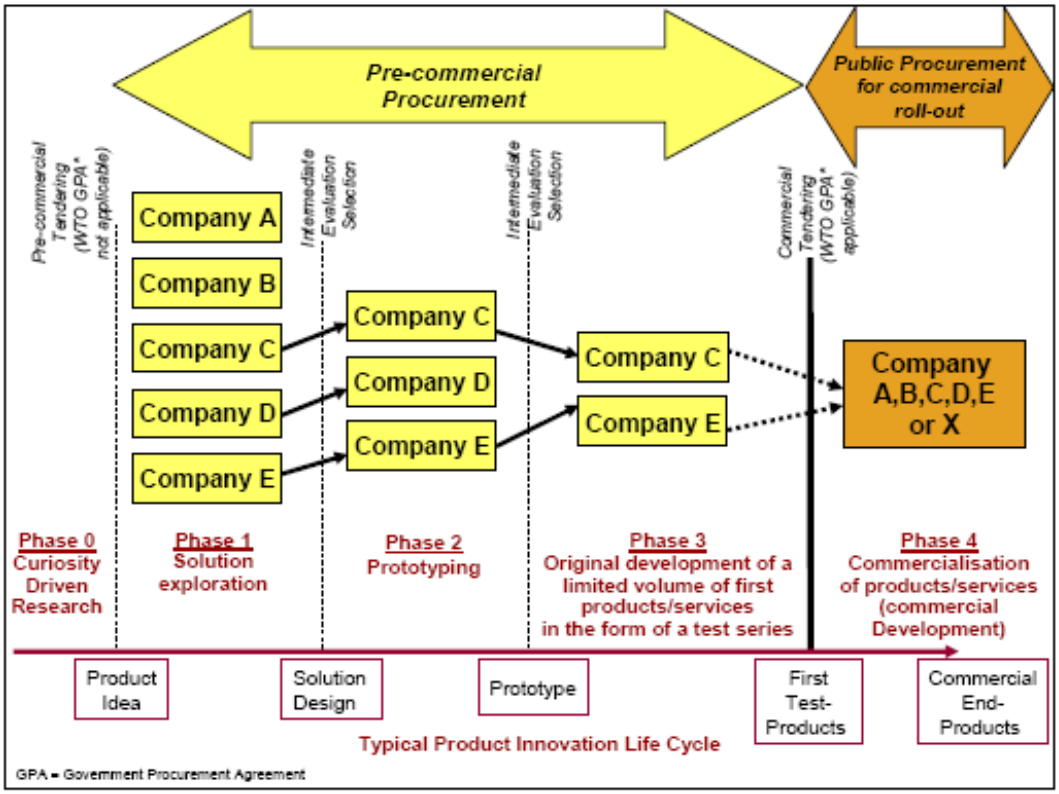


Figure 2. An European example illustrating a phased pre-commercial procurement process (Source: EC. 2007. *Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe.*

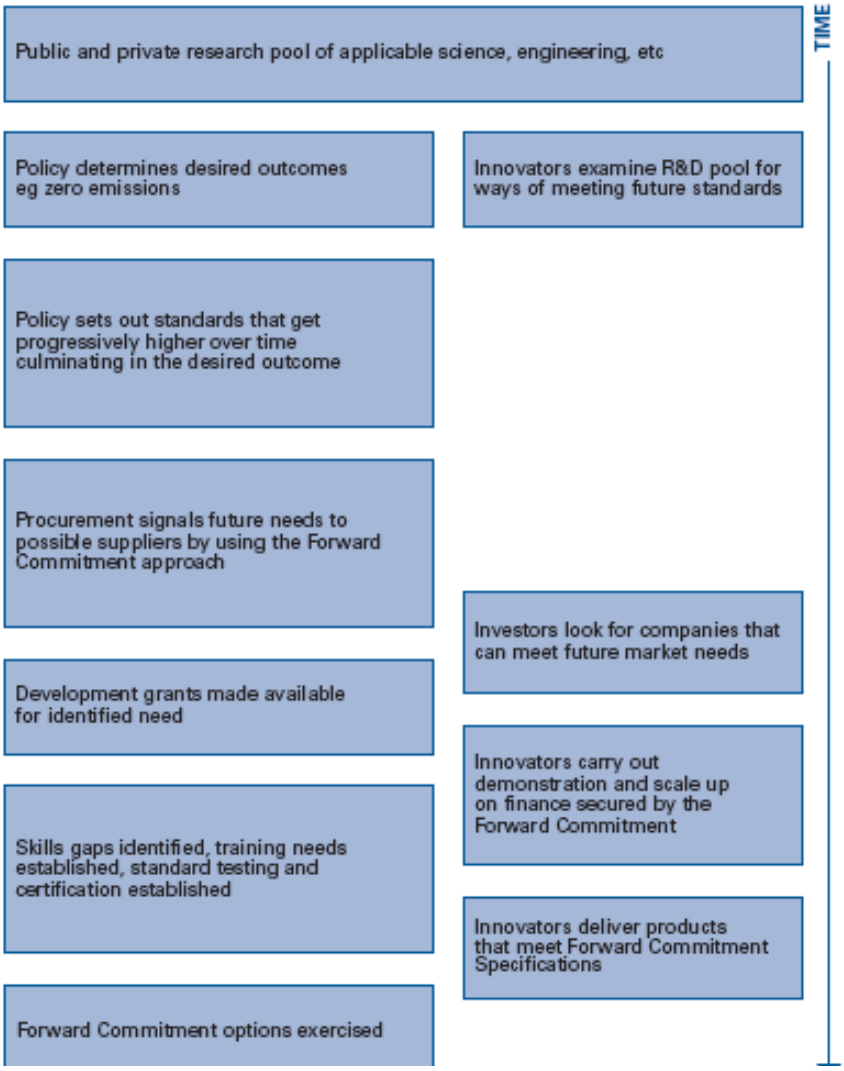


Figure 3. FCP model for environmental innovations (Source: DTI & DEFRA, 2006. Bridging the gap between environmental necessity and economic opportunity. 1st report of the Environmental Innovations Advisory Group. P.15)

A NEW MODEL: SUSTAINABLE CO-INNOVATION

In this section, I will develop a new innovation model, which I call "sustainable co-innovation" (SCOI) model to identify the proposed structure. The SCOI model follows closely the FCP model, adding the concepts of co-innovation and innovation networks.

The SCOI model requires a central overseeing organisation. This organisation which I will call "National Environmental Innovation Strategic Council" (NEISC), should receive funding from private and public partners (e.g. joint venture). NEISC would:

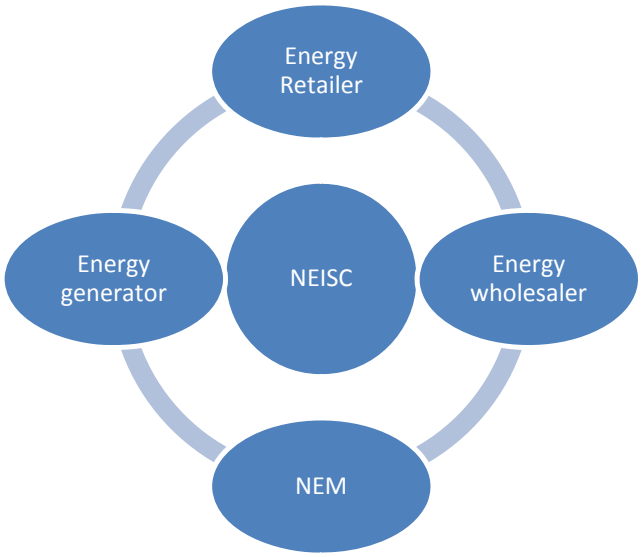
(a) Provide a strategic framework for environmental innovation in Australia, from a market-led, supply chain perspective.
(b) Coordinate the activities required to introduce new technology in the marketplace, following an FCP approach.
    - Engage with Government departments and energy supply chain players to develop the buyers needs into specifications for tenders

- Act as a technology broker, bringing venture/equity capital and innovator companies together
- Coordinate legislative activities that provide adequate market conditions for adopting innovations in the wider industry.
- Promote technology demonstrations and case studies to show the business case.

(c) Coordinate government-led environmental innovation activities (e.g. grants and strategic directions for public R&D), from a supply and value chain perspective. This would avoid the lack of supply chain focus and would increase critical mass in the initiatives undertaken.

(d) Provide timely competitive and technical intelligence to all stakeholders about the particular FCP projects targeted, bringing to the stakeholder's attention current and emerging technologies in the targeted technology markets.

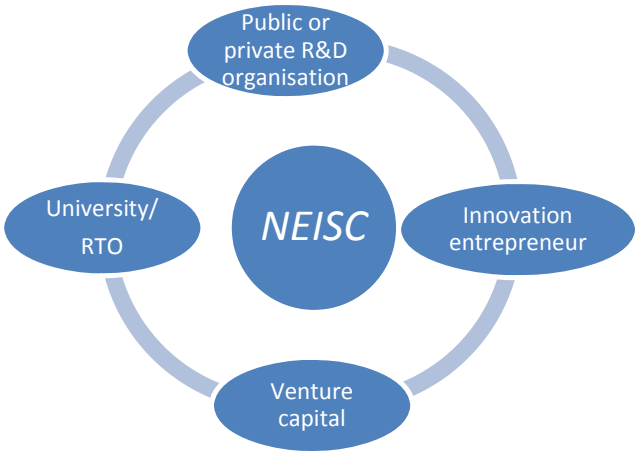
The NEISC role is crucial in the SCOI model, which is based on the development of three types of consortia:



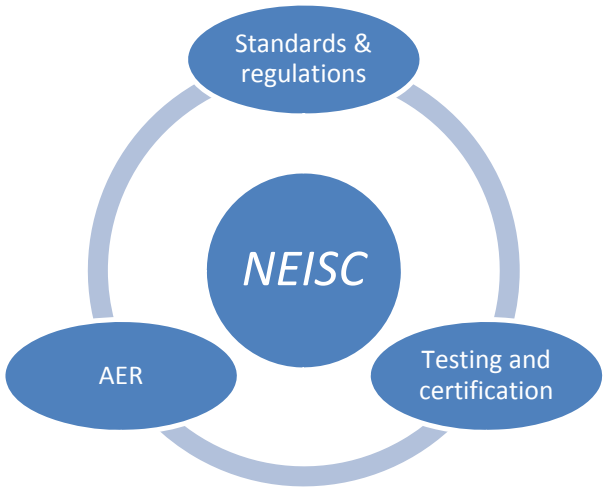
The buyer consortia

A *buyer* consortium is formed by two or more supply chain partners that establish an alliance to contract/purchase the new process/ product/ service developed by a supplier consortium. An example of an alliance is illustrated in the left. This type of consortia becomes effectively a supply chain innovation network.

The supplier consortia



A *supplier* consortium is formed by two or more organisations that seek to deliver the innovation at the specifications (e.g. cost, time, performance) set by the legislative consortia. Public and private R&D organisations supply solutions and showcase their R&D to innovation entrepreneurs looking to develop the new product/ technology, either as a start-up company or as a product in an established company. Universities and RTOs contribute with gap analyses of required skills and deliver training and education programmes to address these gaps. Venture capital is sought to help innovation entrepreneurs to start the company, continue R&D in collaboration with the public/private R&D organisations and prepare case studies highlighting the business case. A crucial aspect of this consortium will be the willingness of public R&D organisation to transfer intellectual property rights to the innovation entrepreneur. We may well question why a public R&D organisation wants to own patents, given that the organisation itself is unlikely to commercialise inventions in many cases. Fair arrangements and payments should be negotiated to ensure that inventors and developers are rewarded.



The legislative consortia

A legislative consortium aims to increase the receptiveness of the market to new energy technologies/processes/products by introducing standards, regulations and laws that increase performance targets in certain areas. For example: we would expect increased innovation in the use of renewable energy resources if the government ruled that a minimum percentage of the retailed energy is to be produced by these means; innovation in energy efficiency of refrigeration systems would be increased by limiting the energy rating of commercial and domestic appliances even further.

In the SCOI model, a buyer consortia (which may or may not include a public sector organisation) commits to purchase a pre-defined quantity of a product\ technology\service, currently under development but not yet available as a commercial offering. NFISC and the buyer consortia agree in the performance sought for the innovation. The supplier consortium is formed and solutions are sought, based on past innovations or completely new concepts. Meanwhile, the legislative consortium develops standards, regulations and certification processes that enable fair competition and enhance the chances of the uptake of new solutions at the agreed performance specification. When the innovation has been developed, meeting all performance criteria, the buyer consortium purchases the product at a specified volume and cost, at levels that encourage other supplier consortium to enter the market. The private sector would react by freeing investment to search for innovations that respond to those specifications.

In the context of SCOI, I do not necessarily advocate for the government to become the early market buyer that executes the forward commitment options. However, in some cases the Government may not the ideal buyer Otherwise, other supply chain players could form alliances that commit to buy the new product / service/technology when this is developed. The drivers for such commitment could be based in (a) superior value proposition (including financial, environmental and social performance); (b) new regulations encouraging the uptake of the innovation; and (c) a demonstrated increase of competitiveness in the marketplace if the innovation is adopted.

The SCOI model is further detailed in Figure 4. Figure 5 shows a potential framework for analysis of the environmental innovation areas that would be able to compete in the marketplace.

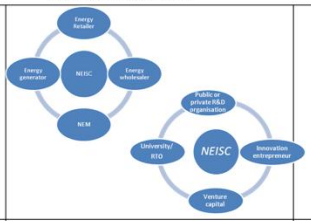
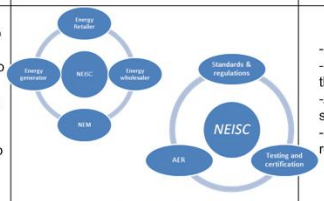
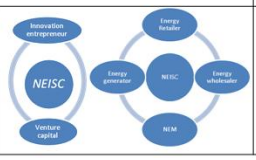
PROCESS	WHO DRIVES THE PROCESS	INPUTS TO THE PROCESS	WHO IS CONSULTED	OUTCOMES
OUTCOME SETTING, SPECIFICATION AND AWARD CRITERIA		-Competitive and technical intelligence -Risk management procedures -Potential structures to manage contracts, IP and other business areas -Appropriate development time and human resources (this is critical) -Analysis and assessment of the innovation potential and cumulative effects		-Development of precise, tight performance specifications and selection criteria -Promotion of networking and supply chain partner selection
POLICY SETTING		-Screening of current regulations to identify domains in which to integrate a performance based approach -Certification bodies and laboratories to develop testing methods and standards for the criteria established	-Relevant associations, companies interested in developing the innovation as a product, companies interested in the uptake of the product	-Improve legal certainty and consumer confidence -Adopt an initiative to promote application and Enforcement of specifications -Develop voluntary performance targets to enable the implementation of incentives and other policy measures to promote the innovation -Establishment of the legislative transition from voluntary to mandatory measures
SEED-TO-MARKET ENTRY STAGE		-Mobilization of private parties to place an expression of interest -Mobilization of R&D providers to link them with venture capital -Support access to R&D funding for those consortia selected for the next round -Transfer of knowledge and IP to innovation entrepreneur company		-Development of pilot plant/prototypes -Development of case studies to show the business case -Anticipate the future qualifications and skills needs to uptake innovation -Deliver the innovation at a commercial-ready stage to the FC buyers
COMMERCIAL ROLL-OUT		-Revisited competitive and technical intelligence -Reviewed risk management procedures -Innovation developed as per specifications in tender -Approved certification and testing processes		-Forward commitment options excersised

Figure 4. SCOI model.

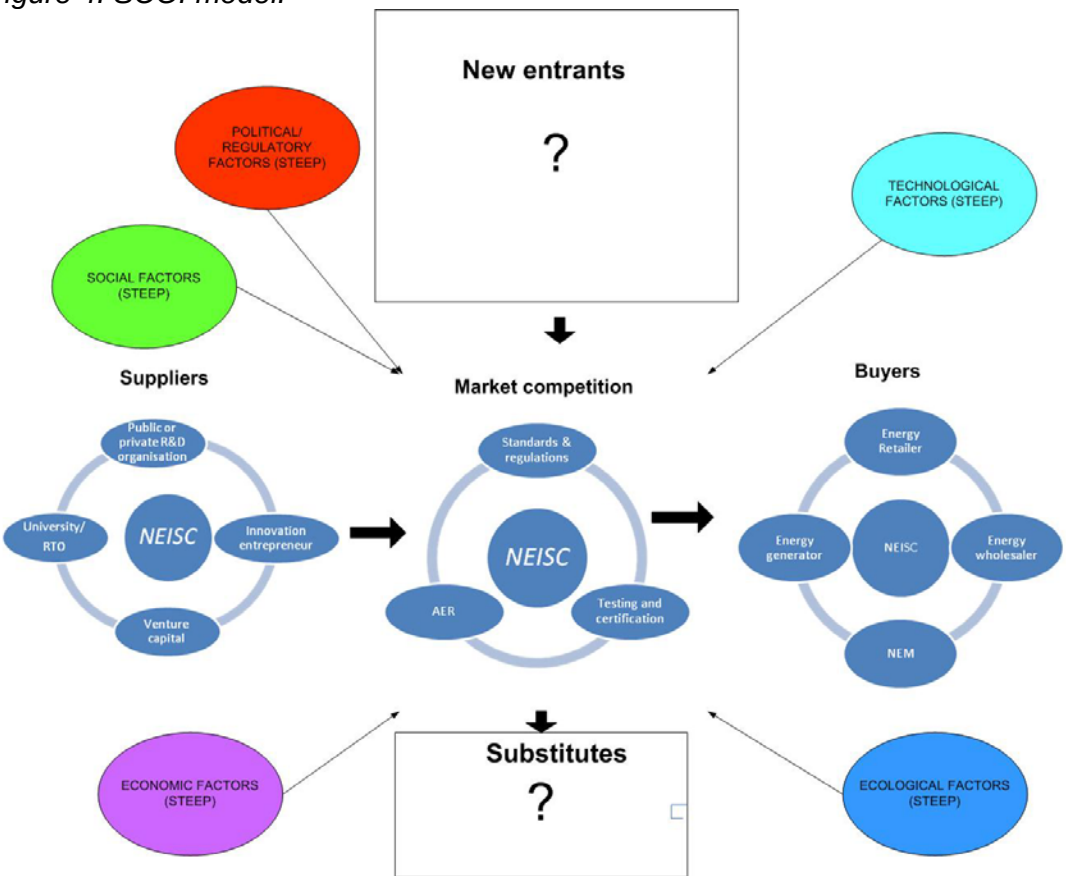


Figure 5. "Five forces" framework for the analysis of future innovation areas

I also propose that funding should be available to establish "innovation networks" in key areas affecting the energy supply chain environment. For example: economics of global supply chains, consumers and markets, social impacts and guidelines for industry-specific applications. The innovation networks should be created in an '*ad hoc*' basis and should serve a specific purpose.

For example:

- Brainstorming on particularly challenging issues affecting the Australian energy industry (e.g. effect of renewable energy on financial markets, cost effectiveness, labour) and possible innovative solutions.

- Sharing learnings and insights in discussion forums around particular industries in a secure environment.

- Providing guidance to energy supply chain players, in the form of workshops, seminars and competitive intelligence reports.

These networks should be dismantled as soon as their goal is accomplished.

TO SUMMARISE....

1) Innovation is a process that goes beyond theoretical conception, through technical invention to commercial exploitation. Therefore, R&D is an element of innovation.

2) One key distinction between R&D and innovation is that in the former, we don't necessarily know the outcomes. To create an innovation, the desired outcome must be known before tackling the problem with R&D.

3) A new "sustainable co-innovation" (SCOI) model is proposed for the development of environmental innovations. The model is similar to the Forward Commitment Procurement model, but the concepts of co-innovation and innovation networks have been added.

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