

APEC Workshop on Roadmapping Future Fuels Technologies

Introduction

With the worldwide demand for energy expected to grow rapidly in the near future, and with the Asia-Pacific region expected to be the world's largest consumer of fossil fuel energy by 2010, there is considerable demand to determine ways to allocate fossil fuels more wisely and to develop means to diminish existing dependencies and vulnerabilities.

With this as background, the APEC Industrial Science and Technology WG has initiated a Technology Foresight/Technology Roadmapping (TRM) project on Future Fuels. This study combines two world-class capabilities- that of Technology Foresight established at the APEC Centre for Technology Foresight in Bangkok and of Technology Roadmapping developed by Industry Canada in Ottawa- and is being carried out in close collaboration with the APEC-Energy WG. It is the first time these two powerful methodologies have been combined in a single study.

Technology Roadmaps (TRMs) are generally recognized as a practical technology forecasting tool. Technology roadmapping is a planning process that gives decision-makers a means to identify, evaluate, and select among strategic alternatives for achieving technological objectives. TRMs are business led initiatives to develop strategic information on future technological requirements based on an assessment of market demand, with time horizons that respect the terms of investment decisions. By contrast, other methodologies, such as technology foresight, provide expert validated estimates of future technological capabilities and potential impacts according to the application of various forecasting tools. They factor in uncertainties associated with business and cultural trends and societal changes as key variables in positioning several possible outcomes or timelines for technology applications.

Technology Roadmapping Workshops in 2005

APEC's Industrial Science and Technology Working Group has initiated a Technology Foresight/Technology Roadmap project focussing on future fuel technologies within the Asia-Pacific region. The first part of this project was a December 2004 Technology Foresight workshop held in Krabi, Thailand. In 2005, the Technology Roadmapping portion of the project begins with workshops in Vancouver on April 27-29, 2005, and a second in Chinese Taipei in August, 2005.

Vancouver Workshop. Based on the theme of improving energy and fuel security, with a focus on biofuels, hydrogen, and unconventional hydrocarbons, the Workshop will introduce Technology Roadmaps, and show how the development of these can help to provide specific recommendations for increased energy security of supply.

To make the best use of the time in Vancouver, preparatory work will be done. An assessment of regional needs and regional priorities (in terms of technologies) will be undertaken. This information will serve as baseline data for the roadmapping process. With regional needs and key technology priorities identified, participants at the Vancouver Workshop will examine the accessibility of identified technologies; begin the technology roadmapping process of mapping out where countries are now in relation to where they want to be in 10 years (visioning exercise); and lay out the more general technology issues and challenges they anticipate in the 10-20 year time frame.

At the moment, there are three key technologies identified as being important for energy security - hydrogen, unconventional hydrocarbons, and bio-fuels. Teams of countries will be formed to address issues related to each of these technologies (if countries wish, they can participate in more than one group). An individual from each of the teams will be identified beforehand as the spokesperson for the group. They will be asked to provide an initial presentation on the technology, and the needs of the countries working on that file.

After participants are introduced to the concepts and techniques of technology roadmapping, they will develop a strategy for the construction of a roadmap for their technology. The workshop will finish with the groups explaining how far they have progressed, and what their plans are for future work. It is vital that all participants understand that Vancouver is not a one-off workshop; rather it is a continuation of what was started in Krabi and will be continued in Chinese Taipei.

Chinese Taipei workshop. The Chinese Taipei workshop will be used to present and discuss the three roadmaps. Between the Vancouver and Chinese Taipei workshops, technology alternatives will have been determined to help bridge the gulf between what countries want and what they have at present. Roadmaps will be completed for each of the groupings, and the workshop will finish up with a linking together of the roadmaps into one document.

There will be an APEC conference in Thailand in December, 2005, to complete the project. The Future Fuels Roadmap will have been completed prior to the conference. An explanation and description of the Roadmap will be presented at the conference. This will provide an APEC-wide description of the energy security future, and what can be done to provide energy and fuel security for APEC members.

The Vancouver Workshop on Roadmapping Future Fuels Technologies

1. Technology Roadmaps

Approach to Developing the Roadmap

The Vancouver and Chinese Taipei workshops are designed to facilitate the development of technology roadmaps. Questions drive the roadmapping process. The questions that will be consistently referred to in this process include:

1. **Present situation**- where are APEC countries now in terms of energy requirements?
2. **Future aspirations**- in 5-10 years, where do you want your countries to be?
3. **Barriers to progress**- what is stopping you from getting there?
4. **Solutions and the way forward**- what needs to be done to overcome the barriers?
5. **Issues in the longer term**- what energy and fuel issues do you see in the 10-20 year timeframe?

As there are different types of roadmaps (e.g., product roadmaps; science and technology roadmaps; program roadmaps), there are also different methods of developing roadmaps. For the APEC Future Fuels project, we will be using a workshop-based approach to engage the wider audience of government, industry, and research stakeholders. Customers' demands, defined as the energy needs of the participating countries, will drive the roadmap.

Content of the Technology Roadmap

A typical technology roadmap document presents the industry or company consensus on a number of topics: a vision of the industry at a set time in the future; what new types of products (or services) markets will require; the enabling technologies to create those products; the feasibility of creating the needed technologies; the technological alternatives for achieving the needed technologies; and how to address these technology needs through R&D. Because the concerns of industry run further than technology development, roadmaps also address such key issues as skills requirements, standards and regulations, and government and non-government barriers.

Although the contents of this roadmap will be similar to a typical roadmap, the roles of the stakeholders will be slightly different. While industry will participate, there will be a greater involvement of government in the development and execution of the roadmap. Steps in completing the roadmap will include:

1. Analyse regional needs and priorities in the energy (transportation) area, and the challenges and opportunities to meet these. This includes identifying how regional needs will change over time, and projections of how technologies will be able to meet them.
2. Identify the key technologies and skill competencies in which the individual countries have a competitive advantage.
3. Identify key opportunities for technological innovation.
4. Identify barriers related to development or acquisition of the technology (could include such things as skills requirements; standards and regulatory requirements).
5. Identify the critical qualities that the product or technology must possess. These are the critical attributes of the future system (e.g., a Roadmap focussing on fuel cells might consider as critical attributes for a future system: cost-effectiveness, energy efficiency, safety, and reliability).
6. Specify when the technology will be needed and potentially available. There might well be a gap between demand and being able to meet that demand.
7. Quantify performance targets to inform the implementation plan. These targets are in reference to the critical attributes the final product or technology must possess.
8. Recommend technology alternatives to be pursued, based on an evaluation of cost, time lines, performance and other factors.
9. Define the actions necessary to develop the technologies for implementation.
10. Map out a logical, prioritised sequence of technology acquisition and/or diffusion.
11. Identify appropriate roles for the public and private partners in the process.

2. The Vancouver Workshop

The Workshop Approach

- *A strategy detailing how the roadmaps will be produced.* This addresses the process questions for the workshop. Who will be participating in the Workshop? What priorities have they identified? What type of facilitation/assistance will be provided to help develop the roadmaps? What type of questions will be addressed at the workshop? What will the agenda be for the workshop?
- *The vision and strategic goals.* The roadmap will build on the Foresight workshop, where it was decided that the key theme was the desire for energy security for APEC economies. As APEC economies differ in various ways- energy needs, economic development, technology infrastructure and usage- the vision and strategic goals of each of the countries will differ. The *vision* is a description of a desired future in a certain timeframe. *Goals* are statements that are measurable and describe what needs to be done to achieve the vision.

- *Regional situations.* An objective assessment of where each region stands in relation to its desire for energy security will be prepared. This will also include a determination of the current and future technologies that the regions believe are critical for them to achieve energy security. The assessments will be completed prior to the first workshop in Vancouver.

Game Plan for the TRM Workshops

For the facilitators and planners of the roadmapping activities, the Game Plan is the detailed strategy for conducting the workshop. It describes the method of facilitation that will be employed, the plenary and break-out sessions, the composition and organization of participant break-out groups, and the workshop agenda. For workshop participants, the Game Plan provides information about the purpose and method of technology roadmapping, describes the workshop structure, and explains what is expected of participants. This information will be forwarded to conference participants at least 30 days prior to the workshop.

A Game Plan would include:

- *Preliminary information* - information from each economy in relation to energy requirements for future fuel security. This will include a prioritised list of technologies most important for each region. Participants will select which of the technology groups they wish to work with.
- *Purpose of the Workshop* - to begin the development of a technology roadmap based upon the future fuels technology priorities for participating APEC countries. While there will be at least three groups working on different technologies, the work of the groups would be rolled into one final Roadmap.
- *Background information to the Roadmap* - identify the role for each level of participant and outline the workshop structure. Emphasize that the participants will be engaged in structured brainstorming sessions and that critical analysis will be used to identify issues and to build consensus on technology alternatives.
- *Workshop preparation* - invite participants to bring their personal experiences when considering the issues, barriers and potential solutions to the technology developments identified. Participants will be expected to participate constructively in discussions of future fuel technologies. As professional facilitators will assist with the development of the technology roadmaps, there is no need for experience in the development of roadmaps.
- *Follow-up* - advise participants that a draft report on the workshop discussions and results will be circulated to individuals for discussion and comment. The results of each workshop will be building blocks for the next workshop.

Content of the Workshop

In the workshop, there will be both plenary sessions, and also break-out sessions, spread over the duration of the workshop.

- *Plenary session* - covering overview of the roadmap process, vision for the regions, and strategic goals. Presentations might also include industry issues and technology concerns. Panel sessions might be really useful in plenary sessions. The Plenary session will also include instructions for the break-out groups and a description of the workshop process and expectations.

- *Break-out sessions* - participants will be broken into the three (perhaps four) technology-based groupings based on regional perceptions of the technology most important for their future energy security. There will be a facilitator for each of the break-out sessions.

Break-out sessions will happen concurrently, and will follow a suggested format.

- Reviewing regional goals, and regional circumstances
- Identifying key challenges that must be overcome to achieve the goals
- How can the technology help to achieve the goals- will changes need to be made to the technology to achieve the goals?
- Prioritise technology options according to their ability to meet the strategic goals and place into near and long-term time frames.
- Analyse highest priority options to determine their potential impact on the goals; and
- Clarify respective roles of governments, industry, and other stakeholders in helping to accelerate achievement of the goals.

Possible Questions for Breakout Groups

1. How do the regional priorities and strategic goals relate to available technologies and applications? Do the goals need to be modified?
2. What technology challenges (scientific/technical; institutional; and market barriers) stand in the way of achieving these goals?
3. How can the technologies be utilised to overcome these barriers? What can be done in the short, medium and longer terms?
4. What needs to be done, by when, and by whom to achieve the strategic vision?
5. How do we take these ideas and move forward?
- 6.

All workshop participants will convene to hear the concise summaries of the results from each of the breakout groups. Participants should discuss the findings of each group, identify common themes, note cross-cutting needs, suggest next steps and propose opportunities for collaboration.

After each presentation group members should field questions and engage in a discussion of the findings and next steps. Final issues should concern whether there were any surprises, anything important left out the discussions, and what were the cross-cutting issues.

Leaving Vancouver

Much of the final morning of the Vancouver Roadmapping workshop will be devoted to outlining the steps that will need to take place between Vancouver and the upcoming workshop in Chinese Taipei. The bulk of the work should be completed before Chinese Taipei, and the workshop there should be devoted to fitting the work components into a final document, the Future Fuels Technology Roadmap.

Communication and Dissemination Plan

It is the intent of this APEC study to produce a document rich in detail that can be a valuable reference for economies as they develop their own domestic strategies for ensuring their own fuel security. The document will be publicly available in PDF format. It will be sent to all politicians, heads of delegation of both the APEC-ISTWG and APEC-EWG and will be posted in a publicly accessible form on the APEC-CTF website.