# SESSION 27

## R&D EVALUATION

*Moderator: Jane S. Peters, Research Into Action, Inc.*

PAPERS:

**Monitoring Energy Innovation During its Growth to Maturity: Better Appreciation of Innovation in Evaluations**

Dirk Both, NL Agency

**An Impact Evaluation Framework for Public-Private Collaborations on Research, Manufacturing, Supply Chain, and Early Markets**

Gretchen Jordan, 360 Innovation, LLC, Jeff Dowd, U.S. Department of Energy, and Jonathon Mote, Southern Illinois University

**Incumbents in Transition: How the Natural Gas Regime Accelerates Radical Innovation in the Gas Supply**

Joost Koch, NL Agency and Geert Thijssen, NL Agency

SESSION SUMMARY:

Most modern governments recognize that innovation is a key component to economic growth. As the citizens of a country develop new ideas for products and services, the country benefits as the innovations lead to increased jobs and wealth for the countries inhabitants. Therefore, governments typically want to stimulate and encourage innovation. They sometimes reduce regulations, or offer incentives or other funding to stimulate innovation. Governments, by their nature, also manage the infrastructure of roads, education, and the like that are the backbone for innovation.

Research and development (R&D) is the broad area in which innovation occurs. Evaluation of R&D activities that governments invest in are often required as part of the statutory requirements of the funding. Yet, evaluation for energy typically means assessing energy production or savings. This is difficult for R&D. Evaluation can also track, and monitor innovations in target areas to identify when and what type of interventions can be useful to stimulate further innovation. These three papers discuss the approach and value of this type of evaluation for R&D.

The three papers in this session reflect both statutory requirements for evaluation and approaches for monitoring and tracking innovations. All three papers involve a systems approach to R&D evaluation. Two of the papers use a common monitoring approach within the Netherlands, the other paper discusses the evolving framework for evaluation of energy R&D activities in the United States.

Dirk Both of NL Agency focuses our attention on how to monitor innovations. In particular, describing a systems approach to monitoring innovation in The Netherlands. The approach is a combined sector and technology innovation systems approach. The sector is the renewables and energy efficiency sector. The technology innovation systems (TIS) framework builds on the commonly understood steps of development from innovation to maturity that we think of as the S-curve.

The TIS sensor tracks a limited set of key dimensions during the early stages of development. The TIS enables visualization of the dynamics, outputs, progress, and trends throughout the innovation process. This permits assessment of strengths and weaknesses in the system and has been particularly useful in facilitating communication and cooperation among stakeholders as they review the results.

Gretchen Jordan, Jeff Dowd and Jonathon Mote report on an impact evaluation framework developed for the U.S. Department of Energy (USDOE). This framework specifically applies to the public-private investments made through the USDOE in manufacturing and supply chain for energy technologies, which is the middle part of the R&D product life cycle.

The framework is grounded is a theory of change aimed at accelerating the degree of innovativeness of R&D and advanced manufacturing. Jordan and her coauthors note that the theory suggests both the larger questions for the evaluation as well as the specific questions that require a particular data collection method. It also suggests measures and indicators of progress and success.

The paper lays out a theory of change with four elements: the supply chain, knowledge production, connections, and finally the general context and infrastructure. These are clear areas for observation of interim outcomes: supply chain development, connections within and across the supply chain and knowledge production, and throughput including technology, manufacturing, and market readiness.

Jordan and her coauthors suggest a series of indicators and questions that can be asked to identify progress. Used in conjunction with network analysis and supply chain analysis (Netchain analysis) this approach permits and assessment of the connection across the networks. This permits the USDOE project managers to determine if, and when to implement mid-course corrections are needed.

The third paper, by Joost Koch and Geert Thijssen, with NL Agency, applies the TIS framework to a specific energy area to monitor the roles of incumbents and innovators. The TIS framework was used n the Netherlands to monitor biogas innovations since 1974. This paper focuses on the period from 2004 to 2011. The key question that Joost and Geert address is the role of incumbents and innovators.

In 2004, the Dutch government introduced a public-private partnership called Platform New Gas to increase the integration of green gas (bio-SNG or upgraded biogas) into the natural gas system for the country. The goal is to substitute 8-12% of natural gas supply with green gas by 2014. To follow this process, Joost and Geert used the TIS to map the dynamics of the biogas innovation from 2004 to 2011.

The innovators were small firms and farms while the incumbents were large waste/energy companies with years of experience and large investments already made. Using the TIS to track and monitor activities, the graphics demonstrate slow but steady growth in production as well as in the numbers of people working on the green gas issue. Government support including a feed-in tariff and coordination opportunities, which brought innovators and incumbents together, and adjustments in the feed-in tariff to address changes in calculation methods that leveled the relationship between green gas, renewable electricity and heat, further contributed to changes in investment.

This real application of the TIS provides a complementary view for how evaluation is able to serve R&D programs. It is difficult to estimate the energy production value or energy savings value generated by R&D efforts. Yet, these papers demonstrate that with a sound framework and sufficient monitoring and tracking of the target energy sector, it is possible to assess the effectiveness of R&D, and is further possible to make recommendations to policy makers and government for next steps. Further, as each of the authors recognizes, the approaches discussed in this session, one at the specific technology level the other at the technology sector level each provide important evaluative value.