Policy and Systems Embeddedness

Evaluating Strategies for Complex Systems

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Background Assumptions:

- **Current systems of energy production, distribution, and consumption are not environmentally sustainable.**

- **A transition to sustainable energy systems needs to be managed. Shale gas *may* be a transition energy source.**

- **Energy systems are part of a system of interdependent complex adaptive systems—e.g., infrastructure, transportation, industrial, and environmental (built and natural) systems.**

- **The design, implementation, evaluation, and adaptation of policies must be viewed in the context of a *system of systems* and account for *cumulative causation* and *path dependence*.**

- **To be effective in facilitating transitions to sustainable energy systems at various spatial scales, policies adopted at different jurisdictional levels will likely need to involve and enjoy the support of a broad cross-section of stakeholders and be complementary.**

- **Supporting effective transition policies will entail performing environmental, economic, and social impact analyses and developing tools to support visioning capabilities.**

- **Given the complexity of the issues involved, and the interdependence of numerous decisions made by public and private actors, *innovations in public education and policy discussion may be needed*, in addition to empirical research.**

Some Fundamental Questions:

- **What are the short-term ('boom and bust') and long-term (e.g., 'resource curse') *economic impacts* of unconventional drilling in the Marcellus Shale likely to be?**

- **What are the short-term and long-term *environmental impacts* likely to be?**

- **What are the short-term and long-term *social impacts* likely to be?**

- **How does the *timing* of when decisions are taken condition future choices and decisions?**
- **E.g., how does the *piecemeal buildout* of gas pipelines effect future development options?**
- **Once a 'transition technology' has been invested in, how do we break out of path dependence?**
- **What types of information are needed to address questions about complex systems?**
- **How can we improve understanding by stakeholders of complex adaptive systems and stakeholders' roles in their evolution?**

- **How do we get people to entertain a more 'realistic' and longer-term view of the future?**

- **How do we discuss issues so as to tap into shared value systems and build on good will, instead of alienating or threatening different stakeholder groups?**

- **What kinds of research are needed to develop information that can be used to answer fundamental questions such as these?**