



**BUILDING A BETTER UNDERSTANDING OF  
INFORMATION AND KNOWLEDGE GAPS: AN ANALYSIS  
OF THE STATE OF IMPACT ASSESSMENT RESEARCH  
FOR LOW CARBON POWER PRODUCTION**

**OAIA Conference, Toronto, 2019**

**KEVIN HANNA, ERIN MCGUIGAN, BRAM NOBLE, JOHN PARKINS  
CENTRE FOR ENVIRONMENTAL ASSESSMENT RESEARCH AT UBC**



# A PROBLEM FOR IMPACT ASSESSMENT



We can't assume that all aspects of new low carbon power sources and systems can simply be plugged into current electricity systems.

New infrastructures and production facilities will be required, and these may entail environmental, social, and economic impacts distinct from the known and arguably well-understood effects of existing systems that regulators are most familiar with — often fossil-fuel based power technologies.



So, what do we know?  
And what do we need to know?

# ENERGY TRANSITIONS



- Energy transition entails socio-technical transition.
- It will change and reshape the institutions that govern and regulate energy provision, markets, and the implementation of new technologies.
- **Transition theory** provides a way of classifying knowledge.
- It can help us know if knowing if the body of research is inclined to have concentrations, and the extent to which knowledge exists across key dimensions of energy transition.

# TRANSITION THEORY



**Strategic:** A set of broader societal, economic and environmental objectives, long-term goal formulation, and impact estimation and projection.

**Tactical:** The interest-driven directing activities that relate to the dominant structures of a system including rules and regulations, institutions, organizations and networks, infrastructure, and routines.

**Operational:** The activities, tests and actions (innovations too) that have a short-term horizon and support implementation. When thinking about innovation we consider all societal, technological, institutional, and behavioral practices that implement and operationalize new systems.

**Reflexive:** Those activities that relate to monitoring, assessments and evaluation of ongoing strategies, operations and change (social, economic, cultural and biophysical).

## WHAT WE DID

- We conducted a knowledge synthesis (a scan) of the state of impact assessment (IA) research for low carbon power production.
- It was part of a federally-supported study on policy needs for low carbon power development in Canada.
- The synthesis concentrated on four low carbon power sources:
  - small-scale hydro,
  - wind,
  - solar, and
  - small modular nuclear reactors.



## RESULTS

The scan identified 840 publications and reports that focus on the impacts of the four alternative power production and the measurement and management of impacts.

- 47 small-scale hydro,
- 17 SMRs,
- 89 solar power, and
- 656 works that address the impacts of wind.
- 31 papers address more than one alternative source; e.g. considering the impacts of both wind and solar in a combined technology energy proposal

## SMALL MODULAR REACTORS 17



- Most focused on safety and risk. Cost follows in frequency.
- Little work seems to have been done on impacts, social acceptance, and community capacity issues.
- In terms of a transition characterization, the SMR literature is largely strategic.
- The state of SMR research reflects the need to build the policy case for developing what is seen as a costly technology with potentially significant public concerns.
- The attention to the GHG reduction contributions of the technology, was the focus of just one paper in our sample, is also reflects a strategic quality, and indicates a gap.

## SMALL SCALE HYDRO 47



- The literature includes several analyses and case studies of environmental assessments, but over half of the works focus on the effects of small-scale hydro on the aquatic environment—including water quality and flow, sediment and fish species.
- Most work is site specific. There were few that examined cumulative effects.
- Few explicitly looked at the benefits and impacts of, the technology; especially for remote and rural areas.
- Most work fits into the reflexive realm, and the research relates mostly to monitoring and assessment. But there is less attention given to social/cultural or economic issues

## SOLAR 89



- The literature addresses the effects of large scale (utility) and small-scale installations (residential and commercial building) and the effects of solar technology production in general, with a significant emphasis on photovoltaic technologies, and less on concentrated solar power.
- There is little research on the biological, ecological, and landscape level impacts of large-scale solar installations.
- Work on photovoltaic technologies mainly addresses worker health and safety (during production of units) and end-of-life waste management, recycling, and upgrading existing installations.

# SOLAR



- The solar research focuses on the reflexive qualities that relate to activities to prevent inertia and support exploration of new production models and materials innovation, and on system and product design.
- There is less focus on the reflexive qualities that address broader social dimensions of the technology and its use.

## WIND 656



- Wind is the only one of the four with a large and well-established body of impact assessment research.
- The coverage is broad and includes papers that discuss the varied effects of onshore and offshore wind power on the environment, radar infrastructure, methods of assessment of impacts, comprehensive literature reviews, strategic papers, theory-based research, and case studies.
- The most widely examined direct environmental effects associated with wind power are effects of onshore wind energy development on birds and bats and the effects of offshore development on marine mammals.
- Some of this work addresses cumulative effects, especially for offshore development.

## WIND



- Human health effects are also addressed. The measurement and mitigation of noise-associated impacts was a crosscutting subtheme.
- Given the frequency with which this issue comes up in project siting and approval decisions, it would have been surprising if this were not the case.
- 16%(108 papers) of the papers identified explore public and stakeholder perception addressing issues that include visual values, conflict, and planning and community engagement.
- Only 5% directly addresses the Canadian context.
- It is 90% reflexive.



## TRANSITION QUALITIES

- The results are both surprising, and not.
- Apart from the SMR field, the IA research identified is mostly reflexive.
- Less than 20% of research explores primarily operational, tactical or strategic themes.
- The overwhelming reflexive qualities are not unexpected given the focus on typical assessment qualities (monitoring and evaluation), and a tendency to frame research within the needs of assessment, or to analyze projects or technologies relative to their impacts.
- But, because all four of these energy technologies are arguably emergent, we might also expect to see more literature associated with “vision development... long-term goal formulation, and norm setting” related to strategic thinking.

## NEEDS AND GAPS



- Connecting international examples to the Canadian context
- Impacts on indigenous communities
- Economic and financial feasibility
- Climate change mitigation contributions
- Cumulative effects

## ACKNOWLEDGEMENTS



- Social Sciences and Humanities Research Council
- The University of British Columbia
- Kelechi Nwanekezie and Lauren Arnold



THE UNIVERSITY OF BRITISH COLUMBIA

THE UNIVERSITY OF BRITISH

Centre for Environmental Assessment Research  
[kevin.hanna@ubc.ca](mailto:kevin.hanna@ubc.ca)