Valuing the Non-Market Impacts of Energy Infrastructure

Patrick Lloyd-Smith
University of Saskatchewan
December 2018
Are externalities of energy infrastructure important?

How can we incorporate these non-market impacts into economic analyses?
Growing demand for including environmental impacts in economic analysis

- Benefit-Cost Analysis (BCA)
- Compensation Payments in Pollution Incidents
- Environmental Costing/ Liabilities
- Setting Green Taxes
- Green National Accounting
Economic theory says consumer surplus plus producer surplus.

Interested in valuing changes from baseline (Willingness-to-pay/willingness-to-accept)

What impacts are not valid welfare measures?

Change in GDP (GDP is not a metric of welfare).

Increased household expenditures (expenditure change does not measure welfare)
Why are economic values useful?

- Consistent means to quantify and compare changes in outcomes, in terms of their values to people

- Credibly estimated economic values are (Johnston, 2016):
  - Quantified in units with clear meaning (i.e. dollars),
  - Comparable to project costs and market values quantified in monetary units,
  - Of consistent interpretation across projects and methods, and
  - Directly comparable across individuals, regions, impacts, etc.

- One piece of complementary information to help make decisions
The non-market valuation challenge

- For market goods, we generally have a good understanding of the dimensions/attributes that affect value
  - The result of years of market observations and everyday “cost-benefit” decision making by individuals

- What's different about environmental goods/services?

- Practitioner needs to define the unit of measurement (quantity or quality) and the prices (willingness-to-pay/willingness-to-accept)

- Just because something doesn’t have a market price ≠ zero value
Different types of economic values

Total Economic Value (TEV)

Use values
- Direct use values
  - Food supply (e.g., fishing)
  - Recreational (e.g., wildlife watching)
  - Educational (e.g., research opportunities)
- Indirect use values
  - Property protection (e.g., flood risk)
  - Pollination
  - Climate regulation (cooling by urban trees)

Non-use/passive values
- Existence values
- Bequest values
- Altruistic values

Non-market valuation as one part of larger assessment

Energy infrastructure project

Change in ecosystem

Ecological/health production function

Change in ecosystem service/health endpoint

Preferences & value

Change to human well-being

Natural sciences
(ecology, epidemiology, etc)

Social sciences
(economics, etc)
The non-market valuation toolbox

- Choice of methods depends on specific change, values, and available data

- Primary valuation methods
  1. What trade-offs did people make? (revealed preference)
     - Learn about preferences/values through past choices
     - Examine house prices, recreation trips, drinking water choices, etc.
  2. What trade-offs do people say they will make? (stated preference)
     - Structured conversations with people

- Flexible set of methods that have been refined over last ~40 years
Benefit transfer

- We always prefer primary valuation, but...
  its time consuming, expensive, and require specific expertise

- **Benefit transfer** uses economic value estimates from existing research to approximate the value of a similar but separate change elsewhere

- Very (too?) popular, but...
  Not always possible, or proper, to transfer values between study areas
  Not advisable if you need a precise estimate

- Best viewed as providing a quick ‘order of magnitude’ estimate
<table>
<thead>
<tr>
<th>Benefit Transfer Method</th>
<th>Mean Absolute Value Error</th>
<th>Median Absolute Value Error</th>
<th>Range of Absolute Value Errors</th>
<th>Number of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Value</td>
<td>140%</td>
<td>45%</td>
<td>0-7496%</td>
<td>1,792</td>
</tr>
<tr>
<td>Benefit Function</td>
<td>65%</td>
<td>36%</td>
<td>0-929%</td>
<td>756</td>
</tr>
</tbody>
</table>

Are we ok with a ~100% error?

Rosenberger (2015)
The need for accuracy depends on the purpose of the analysis.

- Advocate for conservation
- Advocate for specific programs
- Evaluate management consequences
- Prioritize management alternatives
- Inform ecosystem services markets
- Benefit cost analysis
- Green accounting

Increasing need for accuracy

The state of non-market valuation in Canada: Two stories

BP oil spill in 2010

- NOAA conducted two large-scale studies
  - Recreation use values ($660 million)
  - Non-use values ($17.8 billion)

Northern Gateway pipeline

- Comprehensive environmental assessment / economic impact analysis
- No formal non-market valuation study
- NEB tossed out a submitted benefit transfer study
Does valuing nonmarket impacts...

- Need to happen for all energy infrastructure projects?
- Replace economic impact analyses?
- Favor easy to quantify impacts?
- Require monetization of all impacts?
- Always change the outcome of a decision?
- Always generate high values?
Does valuing non-market impacts...

- Need to happen for all energy infrastructure projects? No
- Replace economic impact analyses? No
- Favor easy to quantify impacts? No
- Require monetization of all impacts? No
- Always change the outcome of a decision? No
- Always generate high values? No

But when credibly done, can provide useful information on people’s preferences/values for a broad range of impacts from energy infrastructure projects.
Concluding comments

- Non-market valuation quantifies well-being using economic theory
- We have a flexible set of methods that have been put through ringer
- Still lots of work to do to improve valuation methods
- Lots of opportunities to increase applications of non-market valuation in Canada
- Need to compare against analogous market welfare measures (i.e. not GDP)
- Economic values only one framework to interpret human-nature relationship
“non-market valuation methods are the worst means of assessing peoples’ economic preferences for goods and services traded outside the market except for all the other methods that have been tried.”