Tallying the Benefits & Costs of Demand-Side Management

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Resources for the Future, 9 April 2008
Question:
- How much “efficiency”,
- And what type?
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• And what type?

Part of the answer:
• Economic Benefits, Costs
• Environmental Benefits

Some challenges in quantifying these
B/C Analysis of DSM

- Developed during the “IRP Era”

- IRP ≡ Integrated consideration of a …
  … full range of resources (demand, supply, …) …
  … as part of investment planning
  … considering societal benefits and costs and their distribution (dollar & otherwise) …
  … in consultation with stakeholders…
Classic IRP

The Planner

Consultation

The Plan

Stakeholders

Regulator

Generation Planning

Gen 1

Gen 2

Gen 3

Gen 4

Transmission Planning

System Operation

Environmental Planning

Demand-Side Planning

Prices, DSM, Power

Consumers
Is such IRP hopelessly dated?
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- S.M.D. R.I.P. (long live W.M.P.)

⇒

- Regulated vertical integration lives on
- "Resource adequacy"
- programs in many states = IRP
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- S.M.D. R.I.P. (long live W.M.P.)
- Regulated vertical integration lives on
- “Resource adequacy” programs in many states = IRP
- States picking up the DSM planning and subsidization responsibilities that some utilities have dropped
• Benefit-Cost analysis:
  – A program is efficient if “winners” could in theory compensate “losers”

• Three alternative paradigms in IRP:
     = Minimize cost of meeting “fixed” energy service requirements
     = Minimize bill
Economic Benefits

• Benefit-Cost analysis:
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• Three alternative paradigms in IRP:
     = Minimize cost of meeting “fixed” energy service requirements
     = Minimize bill
  2. “Net Value”
     = Maximize benefits of consumption minus costs
  3. “Rates Test”
     = Market test: if beneficiary can pay enough of its costs so that no one else is worse off
Shortcomings of “Least Cost” Framework

“Least Cost” says the following are all undesirable because they increase generation costs:

- *Demand increases due to rate decreases or “real-time pricing” (demand elasticity)*
- *Rebound/takeback of savings from energy efficiency programs*

  = More energy services consumed because effective price↓
Shortcomings of “Least Cost” Framework

“Least Cost” says the following are all undesirable because they increase generation costs:

- Demand increases due to rate decreases or “real-time pricing” (demand elasticity)
- Rebound/takeback of savings from energy efficiency programs
  
  = More energy services consumed because effective price↓
- Load building / valley fill programs, such as fuel switching
- Reliability increase
"Net Value"

- Consistent framework for evaluating $\Delta$ energy services
- Recognize willingness to pay (consumers surplus)
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• Recognize willingness to pay (consumers surplus)
• Examples:
  – *If rates* ↓:
    • $P>MC \Rightarrow$ Net social benefit to new consumption
    • $P<MC \Rightarrow$ Net social cost
  – *If significant rebound*:
    • Value of additional services $> P$, can be quantified via demand elasticity
    • *Increases the value of a particular efficiency measure*
  – *If “real time pricing”*
    • Value of changed consumption can be compared to costs
“Net Value”

- Consistent framework for evaluating \( \Delta \) energy services
- Recognize willingness to pay (consumers surplus)
- Examples:
  - *If rates* ↓ :
    - \( P > MC \) ⇒ Net social benefit to new consumption
    - \( P < MC \) ⇒ Net social cost
  - *If significant rebound*:
    - Value of additional services > \( P \), can be quantified via demand elasticity
    - Increases the value of a particular efficiency measure
  - *If “real time pricing”*
    - Value of changed consumption can be compared to costs
- These can be large relative to program costs
Example: Two Utility-Sponsored Programs (Northern Ohio)

- **Residential lighting**
  - *Shows value of rebound (@ use elasticity = 0.25)*

- **Add-On residential heat pump promotion**
  - *Conserves in summer, builds load in winter*
  - *Shows effect of benefits of rate changes, gas displacement*

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Hard-to-Quantify Benefits

- **Market transformation**
  - *Will program affect buying habits of nonparticipants?*
  - *Will its effects extend beyond the time horizon of the program?*

- **Health impacts of changes in energy prices / use**
  - *E.g., LIHEAP program (J. Aldy, RfF)*
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- Programs impacting multiple fuels
  - E.g.,
    - heat pumps ⇒
    - less gas used ⇒
    - \( \Delta P_{gas} \downarrow \) ⇒
    - more gas use elsewhere

- Valuing GHG emissions reductions
  - Damages?
  - Revealed preference? (P of offsets or permits; shadow price in other programs?)
Emissions Benefits

• **Emissions uncapped?**
  - Change in emissions & damages
  - E.g., natural gas weatherization
Emissions Benefits

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• Emissions capped?
  – Less consumption doesn’t change emissions (except timing & location), only lowers cost of compliance
  – Unless cap is regional and “leakage changes”
  – Political economy: lower compliance cost makes it easier to adjust cap downward
Conclusion: How Much and What Type?

• Depends on how you tally B’s & C’s
• Be careful!
  – Should consider value of consumption
  – Environmental benefits affected by emissions rules