Utility R&D as a Public Good

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Topics

- Definition of public goods
- Examples of public goods
- The Case for Operations Safety & Integrity R&D
- The Case for End-Use Efficiency R&D
- Where do we Stand?
- Example of Shale Gas R&D
- Benefits and Conclusions
Definitions of Public Goods

> Classic Definition\(^{(1)}\): 
  
  — Joint and non-rivalrous consumption  
  > One individual’s consumption does \textit{not} prevent another individual from consuming the same good  

  — Non-excludability  
  > The good cannot be withheld from others

> Examples: lighthouses, national highway system, drinkable water, national defense, pure physics, running trails, clean breathable air
Definitions of Public Good (cont.)

> California Definition$^2$:

- Public interest RD&D activities are directed toward developing science and technology the benefits of which accrue to (California) citizens and that are not adequately addressed by competitive or regulated entities.

- Regulated RD&D activities are directed toward developing science and technology, the benefits of which are related to the regulated functions of the entity making the investment.

- Competitive RD&D activities are directed toward developing science or technology, the benefits of which can be appropriated by the private sector entity making the investment.
R&D in the Electric and Gas Utility Industries \(^{(3)}\)

> Where the benefits of public-interest R&D may be important are health, safety, environment, energy efficiency, and “pre-commercial” technical information.

> Examples:

- Combustion science (benefits: lower NOx without sacrificing efficiency)
- Residential heating and cooling ducts (benefits: reduction in wasted energy)
- Venting technology (benefits: safety, reduction in furnace corrosion)
Operations/Midstream R&D

> Examples: distribution and pipeline safety and integrity R&D

> Who benefits: Gas consumers, the general public, utility
  — Enhanced safety, deliverability, and more effective Distribution Integrity Management Programs (DIMP), reduced emissions
  — Reduction in the escalation of O&M costs (avoided costs), shared with consumers in the next rate case

> Manufacturer benefits?
  — Yes, but … it would have been impossible for a manufacturer to recover decades of R&D costs selling, say, 100 plastic pipe locators a year
End-Use R&D

> Examples: venting safety and end-use efficiency R&D

> Who benefits: Gas consumers (all consumers through reduced demand; high-efficiency equipment users benefit the most)
  
  — Venting safety is a pure public benefits play

> Utility (dis)benefits?
  
  — Loss of load due to energy efficiency, at best utility is neutral even with decoupling (mostly gas-to-gas replacement)
  
  — Maybe some minimal load switching if higher-efficiency equipment is available vs. the competition

> Manufacturer benefits?
  
  — Yes, but, with few exceptions, U.S. appliance manufacturers do not fund R&D for increased efficiency above and beyond regulatory requirements
  
  — And appliance manufacturers for the most part produce both gas and electric equipment and are indifferent to type of fuel used
Delta Map

Company and Regulatory Approval (# of companies)
Pending filings + approval

> Approved States = 29
Energy R&D: GTI R&D is One of the Best Deals!

Utility R&D Cost per Customer

Ref:
2. PERC and NORA, based on GTI analysis, April, 2015.
Free Rider Issue Defined (4)

> Public goods provide a very important example of a potential market failure, in which market-like behavior of individual gain-seeking does not produce efficient results.

> Production of public goods results in positive externalities which are not remunerated. If private organizations do not reap all the benefits of a public good which they have produced, their incentives to produce it voluntarily might be insufficient.

> Consumers (or states) can take advantage of public goods without contributing sufficiently to their creation. This is called the free rider problem,

> If too many consumers (or states) decide to "free-ride", private costs exceed private benefits and the incentive to provide the good or service through the market disappears. The market thus fails to provide a good or service for which there is a need
Challenges

> Free rider issue: do we restrict the sale and use of technologies and scientific knowhow only to those state and gas utilities that are funding the R&D?
  
  – We do not restrict sales
  
  – Scientific data and technical reports available to funders only, with safety-related exceptions (like the cross bore best practices report)

> Funding mechanism: Utility R&D funding is entirely ratepayer based, and approval process is adversarial and takes time, and R&D can be “settled out” of the rate case
GTI/DOE Research Investments Sowed the Seeds of Unconventional Natural Gas Production Into The Future

Sources: GTI, EIA, DOE Department of Fossil Energy

Shale expected to exceed 50% of U.S. gas production by 2035
Huge Benefits to Gas Consumers of R&D

For gas shale R&D, based on 2006 prices and 2013 prices, national savings for R, C, I customers of $53 billion per year, compared to 30-year R&D costs of $744 million total.

Typical benefit/cost ratio for end-use plus operations R&D ranges from 4/1 to 8/1 for gas consumers:

- World’s first high-efficiency furnace
- Highest-performing industrial boiler
- Plastic pipe locator
- Crossbore prevention guidelines
End-Use R&D Value to Utilities & Consumers

- Save consumers money and save energy
- Provide a pathway for innovative natural gas solutions
- Enable efficient fuel choice
- Minimize environmental impacts
- Integration with renewable energy sources
- Allows cofunding with DOE and state R&D agencies; tremendous leverage
Operations R&D Value to Consumers and Utilities

- Enhance safety
- Create operating efficiencies
- Meet and exceed evolving regulatory mandates
- Minimize environmental impact
- Supplement and grow utility technical expertise
- Substantial Leverage of dollars to cofund DOE, PHMSA projects
Conclusions

> Substantial consumer benefits:
  - Enhanced consumer and public safety and enhanced system integrity, increased deliverability and reliability
  - Lower energy costs through supply R&D and increased-efficiency efficiency appliances
  - Environmental benefits: lower NOx, reduced methane emissions, reduced CO$_2$
References


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<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>NRECA CRN</td>
<td>National Rural Electric Cooperative</td>
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<td>UK RIIO NIC</td>
<td>U.K. RIIO Network Innovation Competition</td>
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<td>CA CES-21</td>
<td>California 21(^{st}) Century Energy Systems Research project</td>
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<td>EPRI</td>
<td>Electric Power Research Institute</td>
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<tr>
<td>UKRIIO NIA</td>
<td>UK RIIO Network Innovation Allowance</td>
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<td>CA PIER</td>
<td>California Public Interest Energy Research Program</td>
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<tr>
<td>NYSERDA T&amp;MD</td>
<td>New York State Energy Research &amp; Development Authority Technology and Market Development Program</td>
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<td>CA EPIC</td>
<td>California Electric Program Investment Charge</td>
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<td>GTI UTD &amp; OTD</td>
<td>Gas Technology Institute Utilization Technology Development &amp; Operations Technology Development Programs</td>
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<td>PERC</td>
<td>Propane Education &amp; Research Council R&amp;D surcharge</td>
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<td>NORA</td>
<td>National Oilheat Research Alliance surcharge</td>
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