Logic Models for a Diverse Portfolio of Research, Technology, and Deployment Programs

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Office of Energy Efficiency and Renewable Energy (EERE)

- EERE accomplishes its mission through 10 Technology Development (TD) Programs and the Office of Technology Advancement and Outreach (TAO):
  
- The 10 TD Programs are:
  - Fuels & Vehicles
    - Vehicles Technologies
    - Biomass/Biofuels
    - Hydrogen
  - Power Generation
    - Wind
    - Solar
    - Geothermal
  - Energy Efficiency
    - Building Technologies
    - Industrial Technologies
    - Weatherization
    - Federal Energy Management

- These research, development, demonstration, and deployment R&D that accelerates the development of advanced clean energy technologies and practices that may be either currently available or in the R&D pipeline for future deployment.
The Performance Measure Challenge

Improve current performance measures by defining a relatively small set of meaningful measures that:

- Respond to multiple stakeholder perspectives
- Link performance in multiple levels of the organization
- Capture more performance
- Reduce proliferation of measures
- Increase consistency across diverse portfolio
- Link activities to outcomes (the magic in the middle)
A Basic Logic Model

Inputs
• Budget
• Expenditures by others

Activities
• Key
• Project

Milestones
• Annual
• Critical Path
• Graduation

Outputs
• Interim
• Final

Outcomes
• Interim
• Final

External Influences

Needs

Customers
The Logic of Performance Management

Budget Formulation
- Inputs
  - Budget
  - Expenditures by others
- Activities
  - Key
  - Project
- Milestones
  - Annual
  - Critical Path
  - Graduation
- Outputs
  - Interim
  - Final

Planning
- Outcomes
  - Interim
  - Final

Budget Execution

Monitoring

Evaluation
Wanted: Goals and Metrics That Cascade

**DOE, Congress**

**EERE Corporate**

**Program**

**Sub Program/Technology**

**EE Project**

<table>
<thead>
<tr>
<th>Ultimate Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market size &amp; share</td>
</tr>
<tr>
<td>Environmental benefits</td>
</tr>
<tr>
<td>Energy benefits</td>
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<tr>
<td>Economic benefits</td>
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<tr>
<td>Security benefits</td>
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<tr>
<td>Spillovers in market</td>
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</table>

Clean energy supplied, Increased efficiency
Attractiveness of technologies & markets
(renewable & energy efficiency for homes, business, industry, transportation, low income, federal sector)

Technology systems performance/cost
Market size & acceptance

Contributions to systems performance/cost, to market domain/actor readiness

Related technical milestones, Deployment milestones

Market size & share
Energy benefits
Environmental benefits
Economic benefits
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Technology systems performance/cost
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Related technical milestones, Deployment milestones
Measurement framework includes 5 interrelated areas that will provide useful data

External Factors

Program Management

Technology Readiness

Market Readiness

Outcomes & Impacts

(Feedback loops not shown)
**Program Management measures address Program Assessment Rating Tool**

<table>
<thead>
<tr>
<th>Program Development with Stakeholders</th>
<th>Strategic Planning &amp; Budgeting</th>
<th>Program Implementation Management</th>
<th>Program Results/Accountability (Evaluation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder involvement in planning &amp; doing</td>
<td>Performance-based planning - Meaningful and linked performance measures - Prioritize funding</td>
<td>Progress on PMA areas (e-gov’t, etc.)</td>
<td>Analysis and evaluation - Extent of</td>
</tr>
<tr>
<td>Industry cost share</td>
<td>Program delivery infrastructure is robust - Testing facilities, R&amp;D collaboratives, Partners are conduits, advocates</td>
<td>Financial Management</td>
<td>Adaptations made due to review</td>
</tr>
<tr>
<td>Portfolio description ($ by program, Needs addressed)</td>
<td></td>
<td>Measures of efficiency</td>
<td>Demonstrated progress toward long term goals</td>
</tr>
<tr>
<td>Effectively targeted</td>
<td></td>
<td>Measures of coordination with related programs</td>
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<td></td>
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<td>Maintain Quality</td>
<td></td>
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</tbody>
</table>

**Increased potential impact and likelihood of success**

**Shortened time between bench results & introduction of new product and/or volume production**
Generic Readiness Structure

Technology C
Technology B
Technology A

Market C
Market B
Market A

Non-Stage Gate R&D Projects
Stage Gate R&D Projects

Applied R&D
Project Metrics

R&D Advances
Project Metrics

Technology Stage
Sub-component cost & performance metrics
Component cost & performance metrics
System cost & performance metrics

Component A
Component B

System

Outcome B

Outcome A

Ultimate Outcome A

Knowledge benefits
Options value

Technology Stage

Diffusion Stage

Market Readiness Projects

Market Readiness Projects

Market penetration of technology

Economic, security, environmental benefits

Technology purchased & installed correctly

Consumers confirm value, tell others

Supportive government policies, codes & standards

End users aware of technology, persuaded to try

TechnologyStage

Technology Stage

Commercialization

Commercialization

End Users

Market

Supportive government policies, codes & standards

End users aware of technology, persuaded to try

Businesses profitable

Consumers confirm value, tell others

Market penetration of technology

Economic, security, environmental benefits

Technology purchased & installed correctly

Technology purchased & installed correctly

Preliminary Investigation
Detailed Investigation
Development
Validation
Commercial Launch

Technology Stage

Component cost & performance metrics

Product cost & performance metrics

System cost & performance metrics

Knowledge benefits

Options value

Ultimate Outcome A

Diffusion Stage

Target population aware of and use knowledge product

Technology Stage

Sub-component cost & performance metrics

Component cost & performance metrics

System cost & performance metrics

Knowledge benefits

Options value

Ultimate Outcome A
Generic Technology Readiness Logic

Two tracks
- Stage-gate
- Non-stage gate

Track status, progress through, contribution to stages leading to commercial launch
- Sub components
- Components
- Systems

Describe
- Technical improvement opportunities
- Research pathways
- Performance and cost goals
Generic Market Readiness Logic

Track status, progress through, contribution to Diffusion stage (Rogers)
- by target group
- Adding replication, sustainability

Domains

Business Environment
- Manufacturing
- Distribution, installation, service
- Financing availability

Knowledge Environment
- Knowledge of technology, market
- Decision support tools
- Communication delivery mechanisms

Policy, Government Environment
- Incentives, assistance from
- Policy, codes
- Government entities

Technology End Users
- Adopter groups (innovator, early adopter)
- Market characteristics (who is served)

Jordan, Mortensen AEA 2007
Example of Logic Flow for a Program

Technology Readiness Projects

**Applied R&D**
- Materials & devices
- 3rd gen. PV
- Advanced CPV
- Solar hydrogen

**R&D on Disruptive Technologies**
- CSP Towers
- Solar hybrid lighting

**System Development**
- 1st & 2nd Generation PV
- Silicon PV
- CSP trough

**Testing & Evaluation**
- Techniques
- Facilities
- Validation

**Business Support**
- RD&D on
  -- Manufacturing
  -- Built in PV
  -- training

**Policy & Knowledge**
- Tech support for codes, policy, knowledge base

**End User Assistance**
- Tech support
- demos
- outreach

**Activities**
- Improvement in component/system:
  - Efficiency
  - Reliability
  - Lifetime
  - Capital cost
  - O&M cost

Components/systems moves thru stages:
- Preliminary investigation
- Detailed investigation
- Development
- Validation
- Commercial launch

**Assured performance and compatibility**
**Lower risk**

**Outputs**
- R&D advances (non-stage gate)
- Increasing industry cost share

- EERE knowledge transferred & utilized in further R&D or unintended products
- Options value of non-commercialized technologies

Market Readiness Projects

**Business Support**
- RD&D on
  -- Manufacturing
  -- Built in PV
  -- training

**Policy & Knowledge**
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**End User Assistance**
- Tech support
- demos
- outreach

**End users persuaded to purchase technology**

**Economically attractive technology available**

**Outcomes**
- Market penetration of technology
  - Early adoption
  - Replication
  - Growing demand
  - Sustainability

Utility-scale electricity generation (CSP, CPV)
Commercial electricity generation (PV)
Residential electricity generation (PV)
Solar lighting in homes & businesses

Fuel diversity, oil savings, load reduction, energy system cost savings, emission reductions, U.S. jobs

**External Factors**

Jordan, Mortensen AEA 2007
Summary and Conclusions

These generic logic models
- Cover all major aspects of EERE performance
- Show linkages from activities to outcomes
- Provide templates for comprehensive, more detailed logics at program level
- Suggest how to link performance within and across levels of the organization