Integration Prioritization Preliminary Results

Commercial Buildings Integration - Building Technologies Office

April 2019
Integration Technology Prioritization Status

Process:

• HIT technology scan and screening process – COMPLETE 12/20/2018
• Stakeholder listening webinars – COMPLETE 3/22/2019
• Final prioritization of technologies – CURRENT 4/8/2019
• Develop Roadmap for chosen technologies – April/May 2019

Four Technologies recommended:

• Smart City IoT
• AI-Enabled Energy Management Platform
• DC Power in Buildings
• High-Efficiency, Integrated Equipment with Advanced Controls for Indoor Agriculture
Integration Technology Prioritization Process

Initial Screen (energy performance, integration focus, suitable technology readiness)

Secondary Screen (stakeholder interest, importance of DOE investment, manufacturing R&D needs, cost, grid/utility value)

Broad Technology List
- Drawn from:
  - RFI
  - Tech Analysis Tools
  - Inter-Agency Input
  - Manufacturers
  - Market
  - EERE emerging technologies
  - Utility programs

Start: 450+ technology areas

Screen: 75 technology areas

High Potential Technologies

Priority List
- Peer Discussion:
  - 21 organizations
  - 50+ participants
  - 26 technology areas

Next: Integration R&D Roadmap

3-4 technology areas with additional external/peer review
Evaluating Integration Technology: Process

Phase 1: The **Integration Technology Matrix** is a compilation of a comprehensive list of technologies including:

- information on technologies developed through literature review and GPG RFI;
- national energy savings potential values, TRL and integration opportunity;
- In total, over **450 measures** were evaluated.
- The Matrix includes two screens for: 1) quantitative factors; and 2) qualitative feedback and factors, i.e. various R&D pathways (manufacturing, other investment, grid benefits).

Phase 2: **Peer Discussion** via webinars provide perspective on external factors and feedback on priority technologies identified in the Matrix:

- Academia, Federal and State Agencies, Utility, Regional Energy Organizations, Labs, Owner/Operators,
- 21 unique organizations and more than 50 individuals participated,
- Four opportunities to join and share throughout February and March 2019.
Continued and growing interest in technology groupings, systems applications and packages rather than specific technology types; address the synergies between technologies.

Controls and computer intelligence need to be easier to use, i.e. plug and play, to enable affordability within current thresholds. Platforms, protocols, etc. should truly integrate across systems rather than controlling each system discretely (HVAC, lighting, plugs, etc.). End users are still confused by claims, frustrated with integration expense, continue to be afraid of technology obsolescence; they need better, easier, cheaper solutions.

Generally, stakeholders expressed concern with areas of load growth including indoor agriculture and vehicle charging. R&D solutions can yield results that provide both peak and efficiency benefits.

Many, disparate entities are working towards similar multi-building optimization goals, DOE can convene these entities as we identify and plan for specific R&D opportunities (which should be bigger role than tools like UrbanOpt).

Validation of direct current design, evaluation and product solutions were overwhelmingly popular with diverging feedback on needs.
## Preliminary Prioritization Results

<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Description</th>
<th>Primary Energy Savings Potential (Tbtu/Yr)</th>
<th>Integration Criteria</th>
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</table>
| **Multi-building IoT Platforms**                 | Systems for multi-building optimization; enables integration and coordination across multiple buildings, including large systems (e.g., district heating) and individual equipment pieces (e.g., aggregated across a portfolio)                   | 500-1,000                                | • Enables integration of, and communication between, systems across multiple buildings to optimize efficiency and help manage operating costs  
• Enables enhanced approaches to buildings as a system, e.g., Waste heat from one building can be used in another                                             |
| **AI-Enabled Energy Management Platform (BEMS)** | Enhanced BEMS that integrate and control HVAC, lighting, and other building systems based on parameters set by building manager with the added layer of machine learning to provide predictive capabilities, dynamic controls, and automated energy efficiency. | 500-700                                  | • Easy integration of equipment and data from internal and external sources to learn and improve energy consumption based on desired optimization criteria, set by facility managers and businesses  
• Continuously adapts to dynamic operating conditions due to weather, occupancy, tariffs, consumption and peak loads |
| **Direct Current (DC) Power in Buildings**       | The use of DC power distribution within buildings instead of traditional AC distribution, which enables savings from reduced AC/DC conversions for solar PV, battery storage, and DC-based equipment. | 500-700                                  | • Maximizes power output from PV and battery systems through holistic design/integration of building systems; optimal savings come with high penetration of DC-powered loads, sources, and controls                                                                                   |
| **High-Efficiency, Integrated Equipment with Advanced Controls for Indoor Agriculture** | Packaged controls for high-efficiency lighting, ventilation, space conditioning, and water supply systems for growing indoor agriculture facilities; widely applicable across crop and building types (supplemented greenhouses, vertical farms, non-stacked farms) | 50-100                                   | • Provides comprehensive controls of systems, designed with sector-specific considerations  
• Promotes active management of utility costs for new entrants and complex strategies to optimize unique conditions for agriculture                                                                                   |
Integration Metrics: Scoring

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<tr>
<td>3 =</td>
<td>Clear opportunity for DOE support to drive substantial impact</td>
<td>Significant opportunity for manufacturing-related R&amp;D or technical support or to provide access to rapid manufacturing</td>
</tr>
<tr>
<td>2 =</td>
<td>Other programs are investing, but DOE support would provide increased capacity or reach</td>
<td>Some opportunity exists for DOE to support manufacturing R&amp;D</td>
</tr>
<tr>
<td>1 =</td>
<td>Existing investment is substantial &amp; the path for the tech is clear</td>
<td>Little opportunity for improvement via DOE support</td>
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<tr>
<td>3 =</td>
<td>Costs are not well understood; potential exists for DOE-to identify and create significant cost reductions</td>
<td>Extensive benefits to the grid in the form of increased reliability, resiliency, or flexibility (timing of loads, power [or reactive power], or energy source)</td>
</tr>
<tr>
<td>2 =</td>
<td>More techno-economic analysis is required to understand costs and the potential for cost reduction</td>
<td>Moderate benefits to the grid (excluding efficiency)</td>
</tr>
<tr>
<td>1 =</td>
<td>Costs are well understood and there is no opportunity for DOE</td>
<td>Little or no benefits to the grid (excluding efficiency)</td>
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Integration Technology – Next Steps

**Draft Roadmap**
Deep dive on key sectors/applications, current offerings, relevant work by others.

**BTO/Internal Review**
Review the process, feedback, results, seek additional feedback on work and needs by other federal programs.

**External Peer Review**
Share our focus and offer the opportunity to provide comment and feedback.

**Phase II Kick-Off**
Use logic models to identify the most effective R&D path:
- Validate R&D Needs
- Techno-economic analysis and target setting
- Product/software development)and testing methods
- Data standardization