U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Integration Prioritization Preliminary Results

Commercial Buildings Integration - Building Technologies Office

April 2019

Integration Technology Prioritization Status

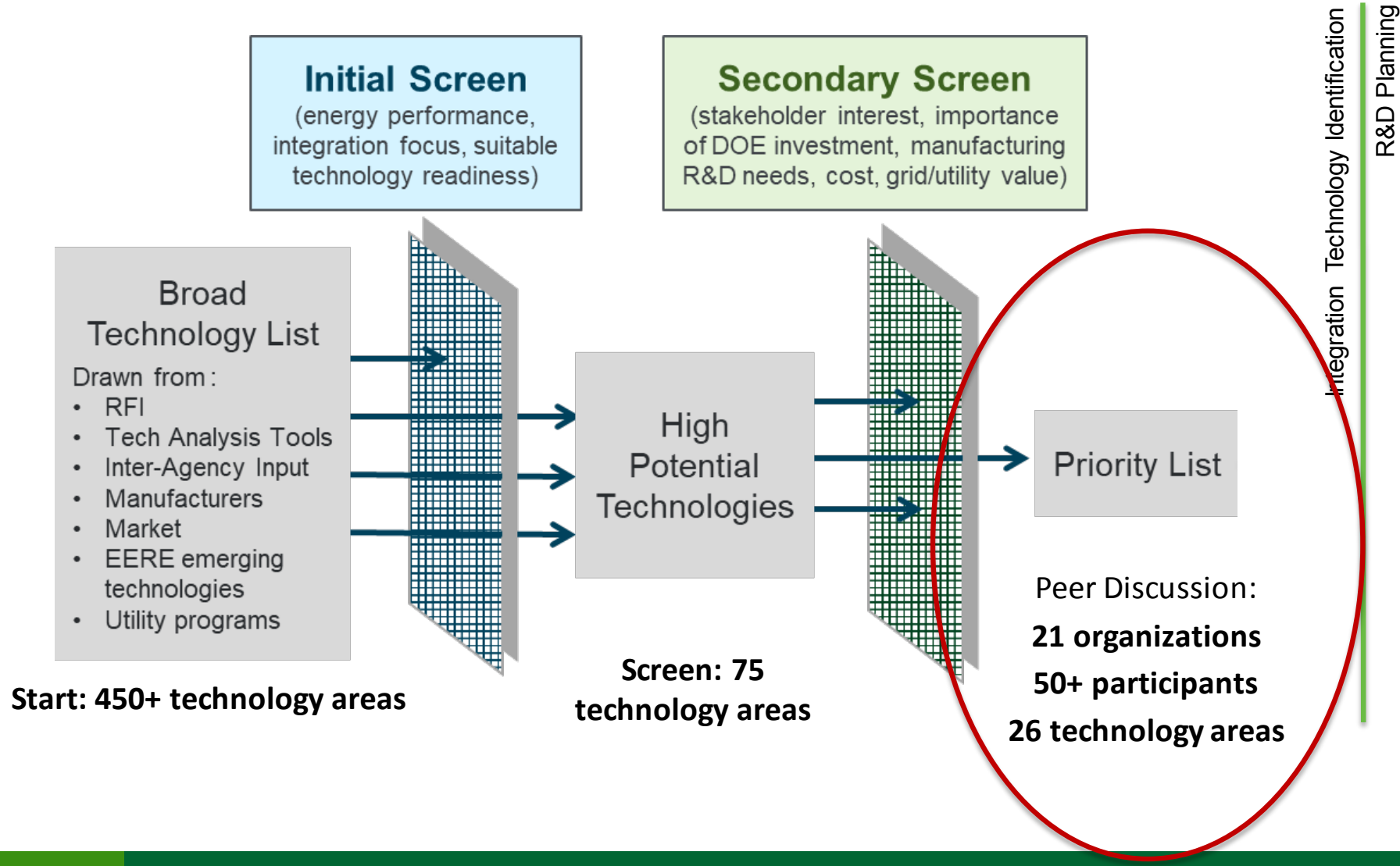
Process:

- 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



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:

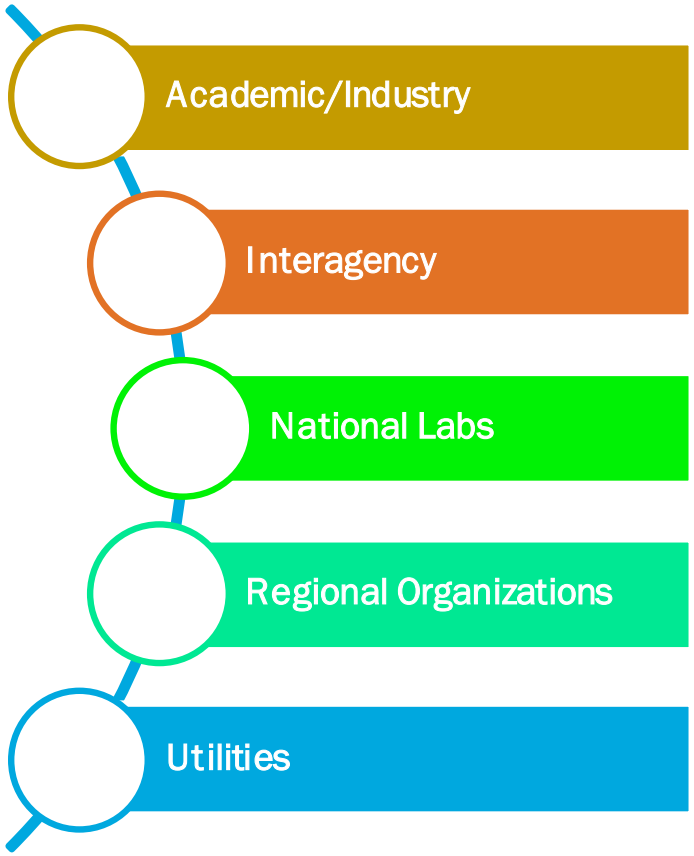
- information on technologies developed through literature review and GPG RFI;
- national energy savings potential values, TRL and integration opportunity;
- In total, over **450 measures** were evaluated.
- The Matrix includes two screens for: 1) quantitative factors; and 2) qualitative feedback and 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.

Major Takeaways from Peer Discussion

- 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

Measure Name	Description	Primary Energy Savings Potential (Tbtu/Yr)	Integration Criteria
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

Score	1. Current Development Activity	2. Manufacturing R&D Needs
3 = 🟢	Clear opportunity for DOE support to drive substantial impact	Significant opportunity for manufacturing-related R&D or technical support or to provide access to rapid manufacturing
2 = 🟡	Other programs are investing, but DOE support would provide increased capacity or reach	Some opportunity exists for DOE to support manufacturing R&D
1 = 🔴	Existing investment is substantial & the path for the tech is clear	Little opportunity for improvement via DOE support

Score	3. Understanding of Cost and Reduction Potential	4. Grid/Utility Value
3 = 🟢	Costs are not well understood; potential exists for DOE-to identify and create significant cost reductions	Extensive benefits to the grid in the form of increased reliability, resiliency, or flexibility (timing of loads, power [or reactive power], or energy source)
2 = 🟡	More techno-economic analysis is required to understand costs and the potential for cost reduction	Moderate benefits to the grid (excluding efficiency)
1 = 🔴	Costs are well understood and there is no opportunity for DOE	Little or no benefits to the grid (excluding efficiency)

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