WHEN TRUST MATTERS

Through the Funnel: Evaluating Innovation

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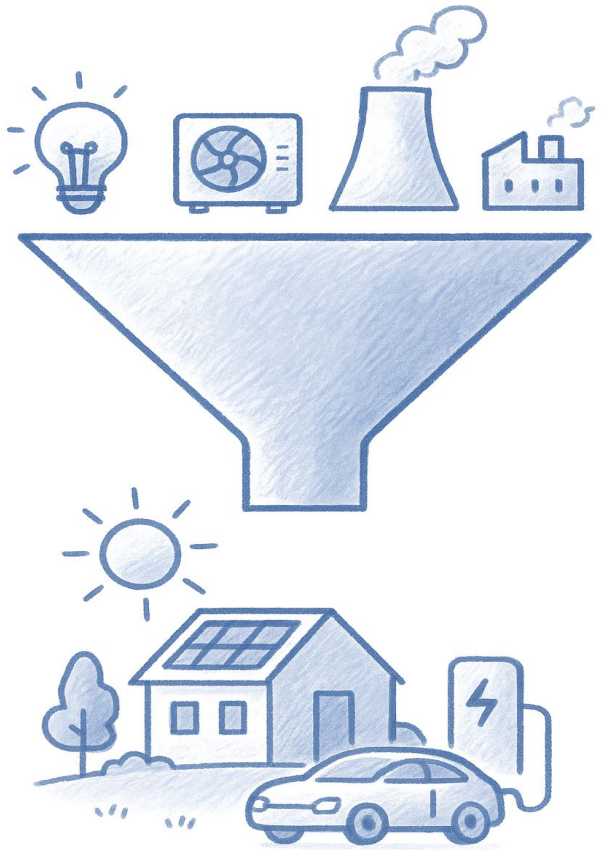
Denver, CO

07 October 2025

Agenda



- Evaluating through the innovation funnel
- Background
- Research objectives
- Our approach
- Findings
- Recommendations

Evaluating through the innovation funnel

Advancing technology innovation is critical to the energy transition.

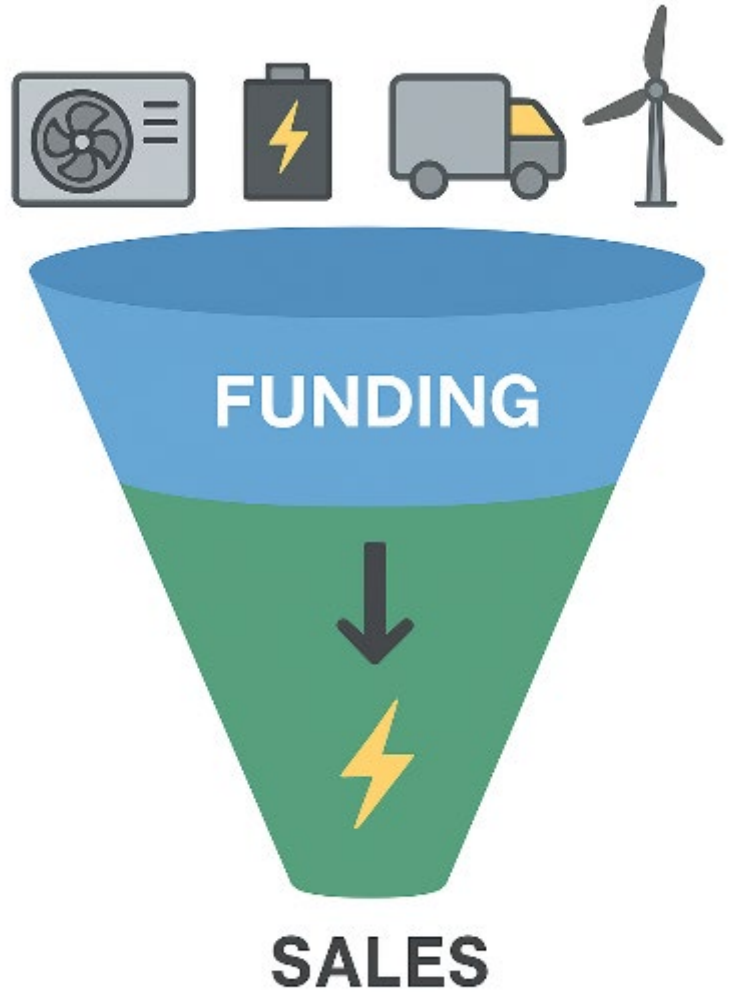
What is the role of evaluation?

Challenges in Early-Stage Product Funding	How Evaluation Adds Value
• Requires substantial investments (~$100–$400M per year) • Low success rate • Pivot of product development to adapt to new market needs • Diversity and complexity of products	• Demonstrates tangible impact of early-stage product investments • Tracks long-term outcomes of investments • Supports smarter, faster investment decisions

This first-of-its-kind evaluation provides a framework for Innovation and Research (I&R) program evaluation, showing the long-term value of program investments.

Background

- NYSERDA's Innovation & Research team aims to:
  - advance development of innovative, reliable, efficient, and disruptive clean energy technologies
  - increase market acceptance and adoption
- From 2016–2020, NYSERDA invested $109M in 161 products across four technical areas:
  - Building Innovation
  - Clean Transportation
  - Grid Modernization
  - Renewables Optimization
- DNV Evaluated NYSERDA's I&R investments and track product progress through the innovation funnel.



Research Objectives

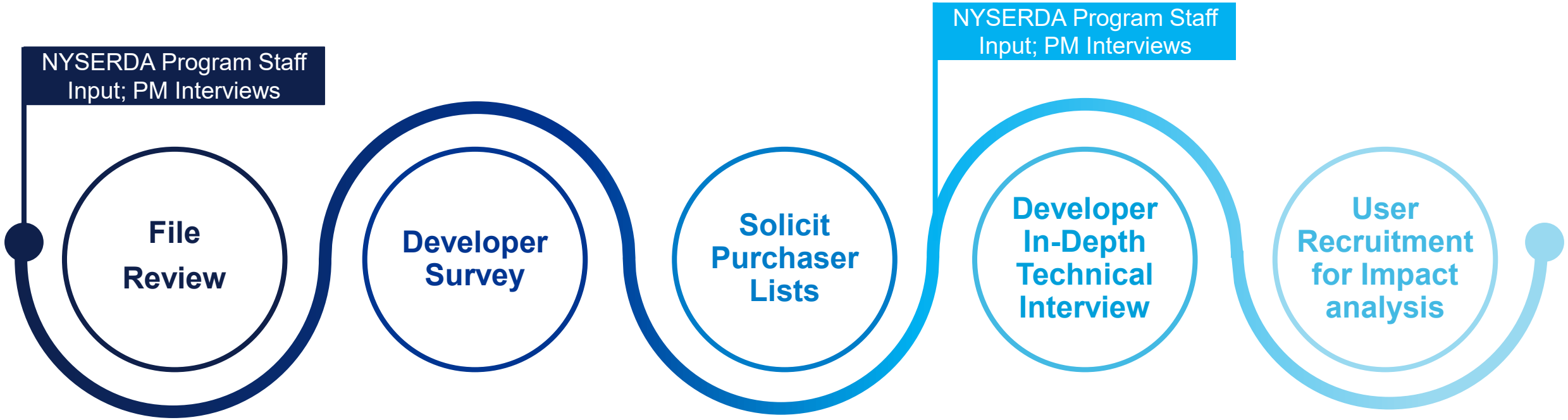
Objectives	Categories
Characterize projects and products	Types of developer companies funded, technology types and end-use customer sectors
Identify disruptive products	Create, scale, or disrupt a market
Estimate direct and indirect benefits*, energy or non-energy to contractor companies, customers of products, supply chain actors, and communities	Energy: Annualized first-year electric (kWh), natural gas (MMBtu), and other energy savings Economic: Total energy bill cost savings ($), ROI, sales, and revenue generated ($), jobs Other: GHG, increased safety, air quality, time saved, improved usability, etc.
Identify barriers and catalysts to product development, scalability of developed products	Attribution, successful PONs, barriers and catalysts to replication, factors leading to or hindering commercialization and/or sales
Identify opportunities for program improvement	Program process improvements and recommendations

*all impacts of R&D are defined as “indirect” because development was incentivized by NYSERDA, rather than directly purchased/installed by a program.

Our Approach

Activity	Product set	Count	Scope of Study	Data sources
Products population summary	All	161	Characterize projects and products, funding, timing	Project data Metrics survey PM interviews
Process Improvement	Developer survey respondents	109	Assess rates of commercialization, barriers, catalysts, opportunities	Developer survey
Market characterization	Subset with disruptive or high impact potential	57	Characterize markets and disruptive potential of products	Developer survey I&R staff interviews
Benefits evaluation	Subset with sales	18	Estimate impacts: energy, economic, and non-energy benefits	Developer In-Depth Interviews
Case Studies	Subset with customer interviews or verification data	3	Detailed success stories	Customer interviews/ Verification data

Data Collection Activities



All products (161)

- Project data
- Metrics survey
- Project SOW/ reports
- Website

Attempt all products (109 responses)

- Impact estimates
- Barriers/ catalysts
- Purchase chain

Attempt all survey respondents with sales and high/medium disruptive potential (20)

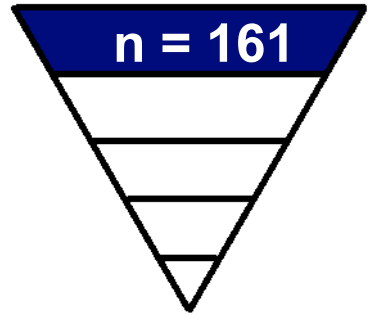
Subset of survey respondents (18)

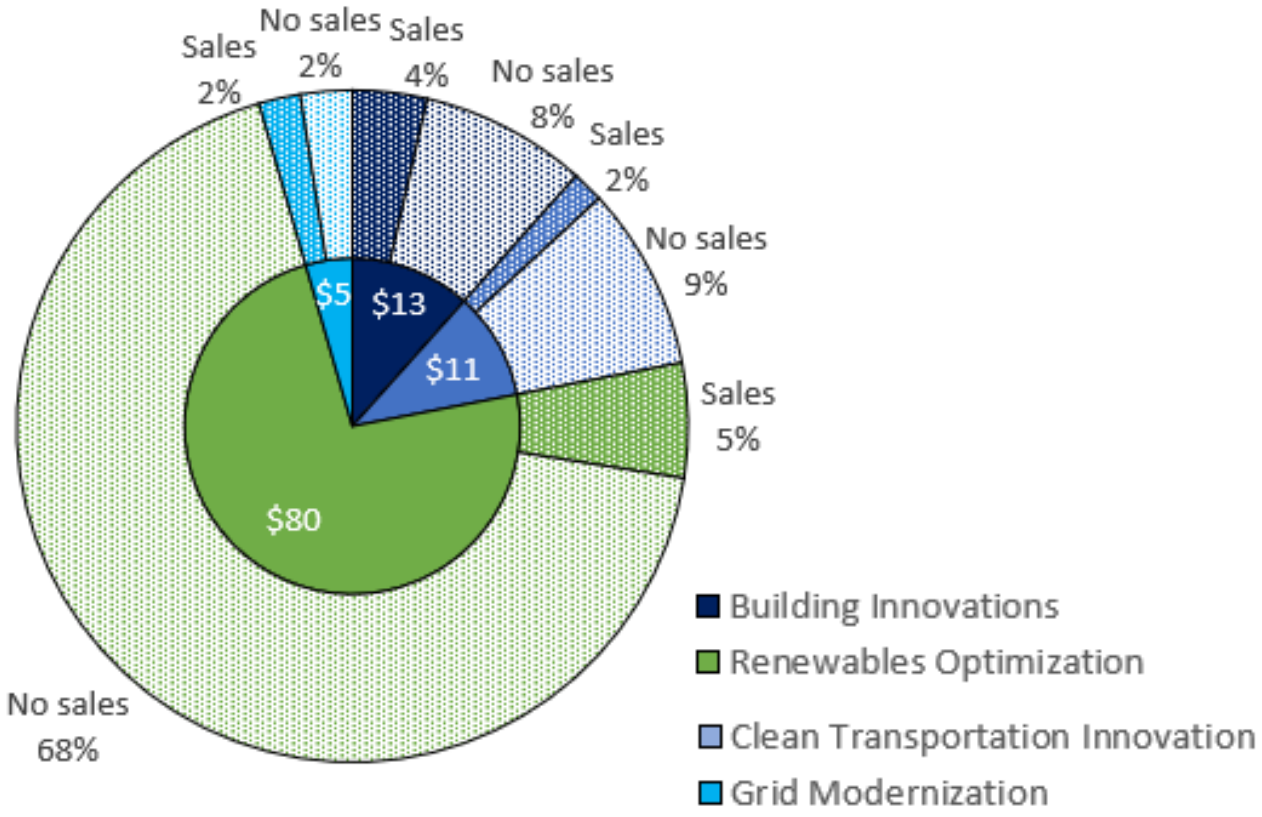
- Technical clarifications
- Verification data
- Attribution
- Barrier/catalyst

Sample from user lists (3)

- User project details
- Verification data

Findings: Products population summary

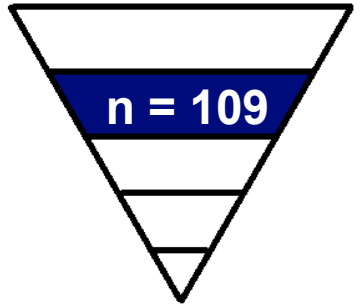




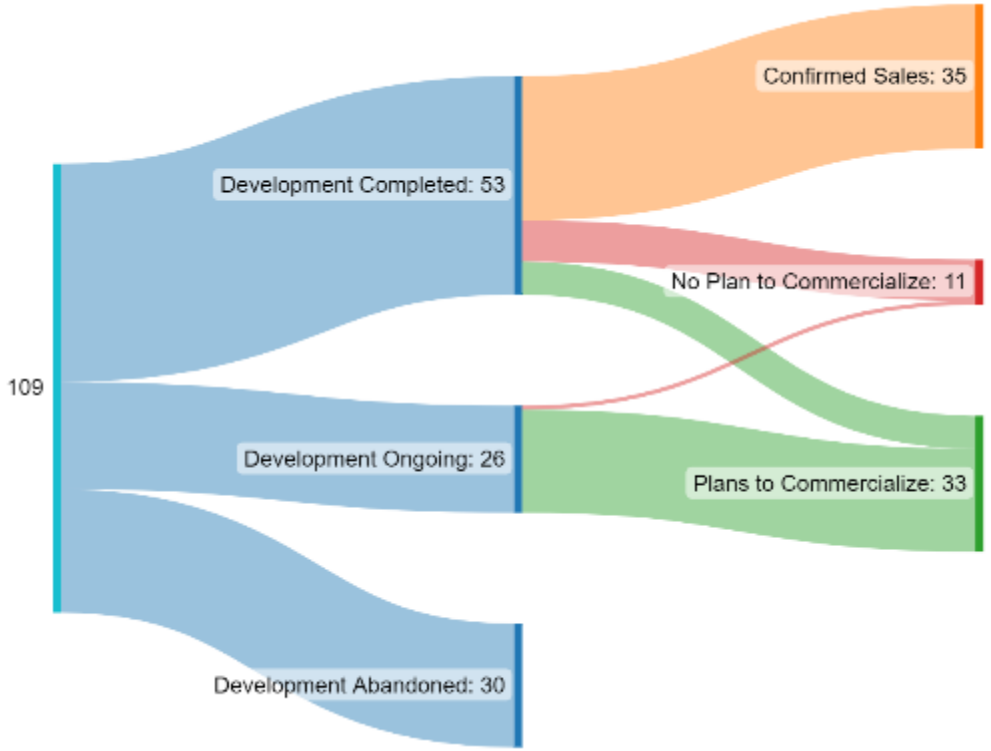
Total NYSERDA funding by program area (million $)

- Product sales indicates commercialization: 23% of projects and 13% of investments resulted in sales
- Other benefits not evaluated: increased product/market awareness, fostered replication, future engagements

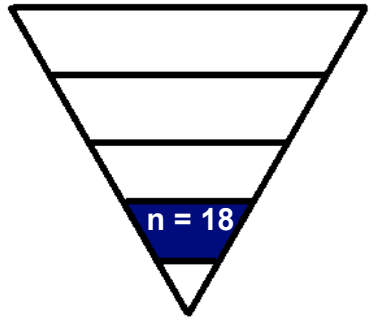
Findings: Developer self-reports of product status



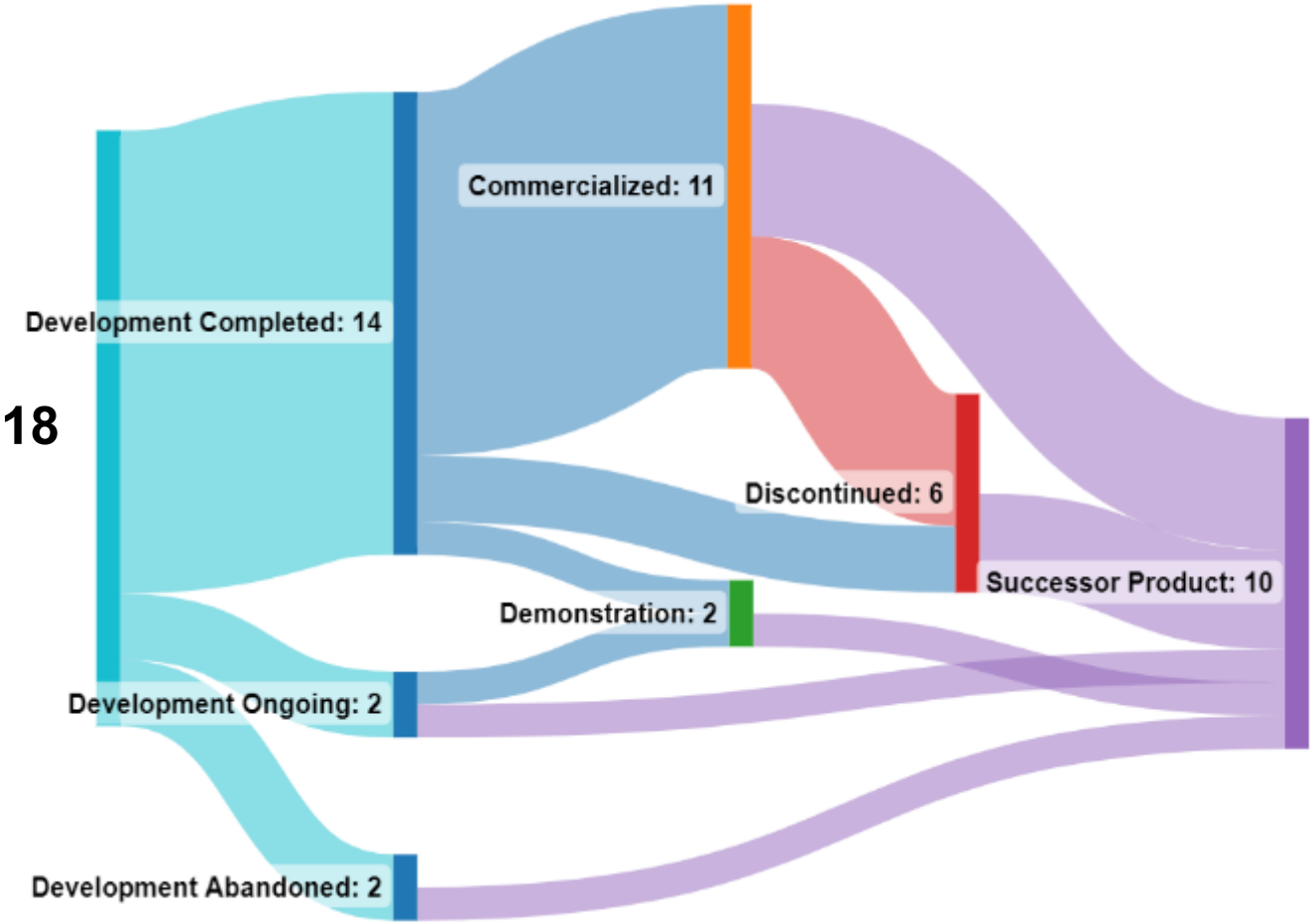
Program Area	Complete	Ongoing	Abandoned	Total
Advanced Buildings	20	8	10	38
Clean Transportation	15	6	6	27
Smart Grid Systems and Distributed Energy Integration	4	0	2	6
Renewable Optimization and Energy Storage	14	12	12	38
Totals	**53**	**26**	**30**	**109**



Findings: Development Status for high impact and disruptive potential products



Products: 18

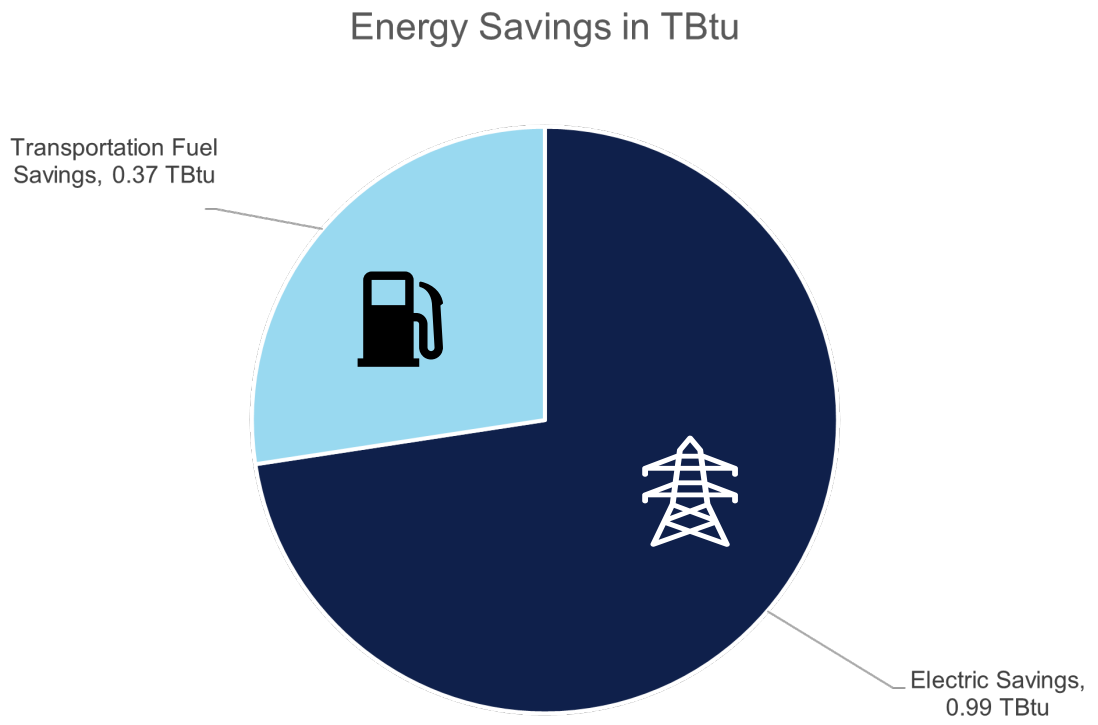


Energy Impacts (to date) for 11 Commercialized Products

TOTAL energy savings (electric + fuel): 1.36 TBtu

Electric savings of
289,700 MWh across 7 products

Transportation fuel savings for 2 products



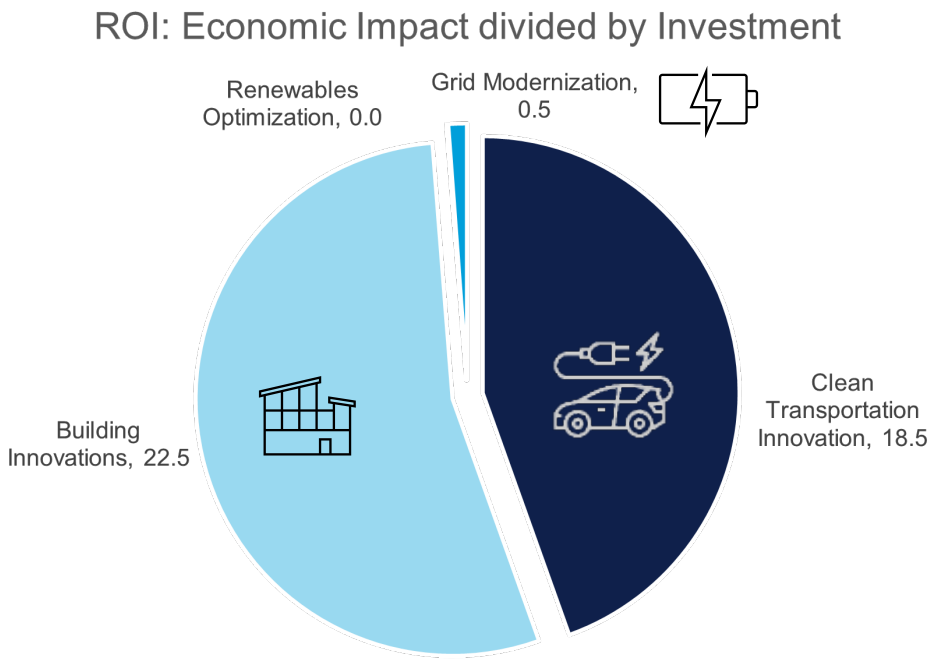
Economic Impacts for Commercialized Products

11 products returned a total of $66.5 million in economic impacts from a $7.23 million NYSERDA Investment

The population of products received $109.2 million NYSERDA Investment

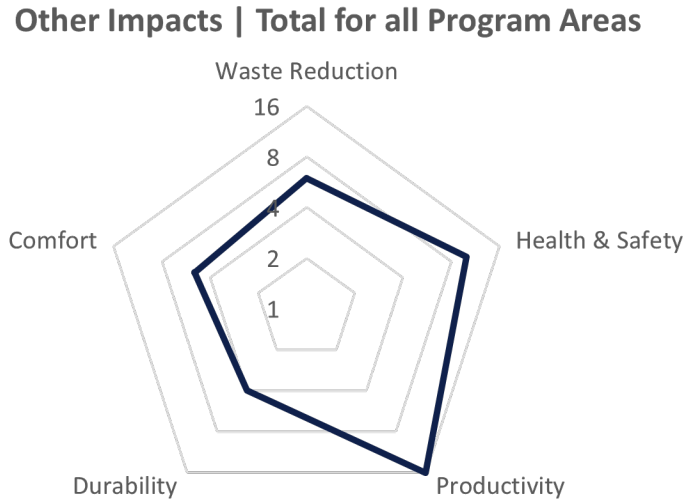
Gross Consumer Benefit (n=18)* is 9.19 times the NYSERDA Investment

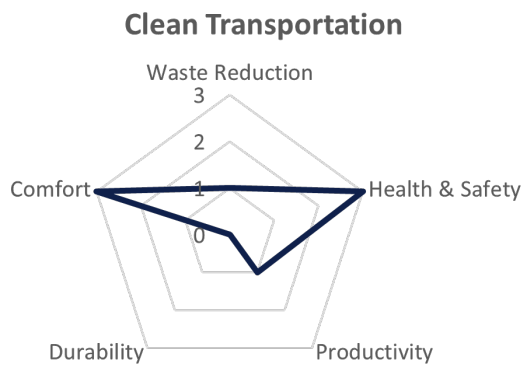
Lower Bound Overall Gross Consumer Benefit (n=161) = 61%

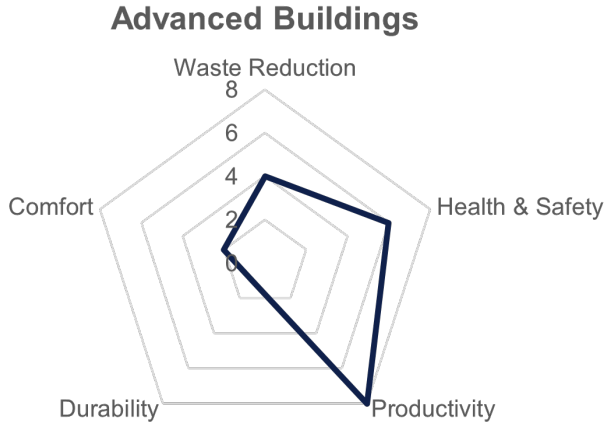


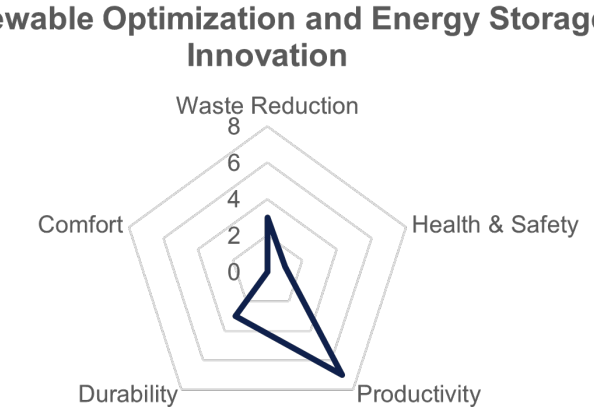
*Gross Consumer Benefit = Economic impact/NYSERDA investment for selected products
Economic cost-benefit analysis was limited to fuel/electric bill savings, O&M costs, avoided replacements, manufacturing cost, construction and accident avoidance.

Impacts by Program Area









Challenges

Low success rate of early-stage products

Challenges of tracking market diffusion and long-term impacts of early-stage products

Pivot of product development to adapt to new market needs

Diversity and complexity of products

Recommendations

Predict probability of development to market and disruptive potential

Early impacts and market potential estimates from developers,
Longitudinal sales data collection

Include impacts from successor products

Create a library of calculation templates and processes

Adaptable and automated key metrics data collection

Thank you

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