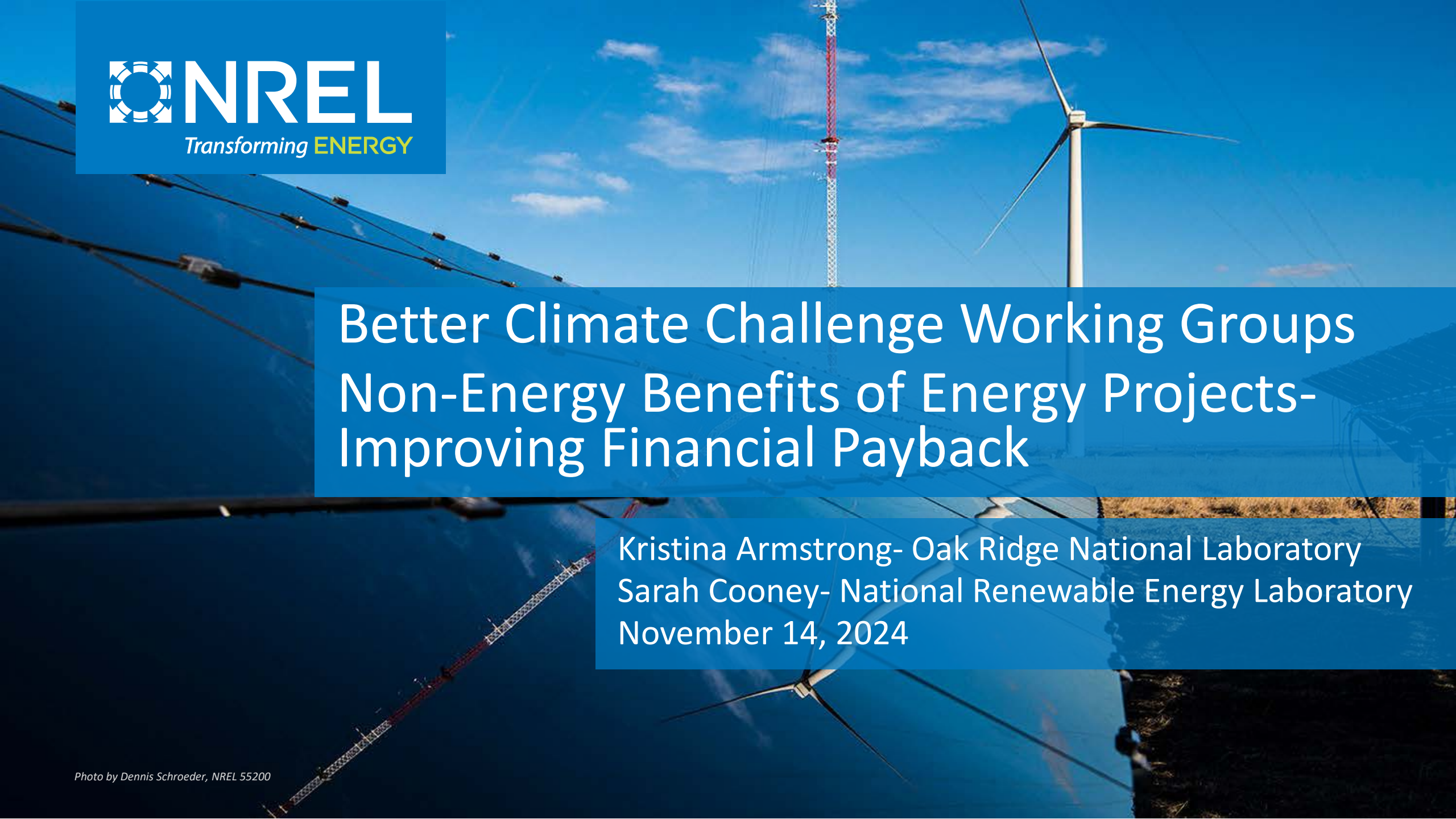


Better Climate Challenge Working Groups Non-Energy Benefits of Energy Projects- Improving Financial Payback

Kristina Armstrong- Oak Ridge National Laboratory
Sarah Cooney- National Renewable Energy Laboratory
November 14, 2024

Photo by Dennis Schroeder, NREL 55200

What will we cover today?

1. What are Non-Energy Benefits (NEBs)?
2. Why NEBs are important?
3. What is their connection to business performance?
4. How to find and maximize value?
5. Improving payback period with NEBs- Examples

Your participation in the meeting is critical to the success of the NEB tool. We kindly request that you be prepared to provide individual feedback, questions, comments, and suggestions.

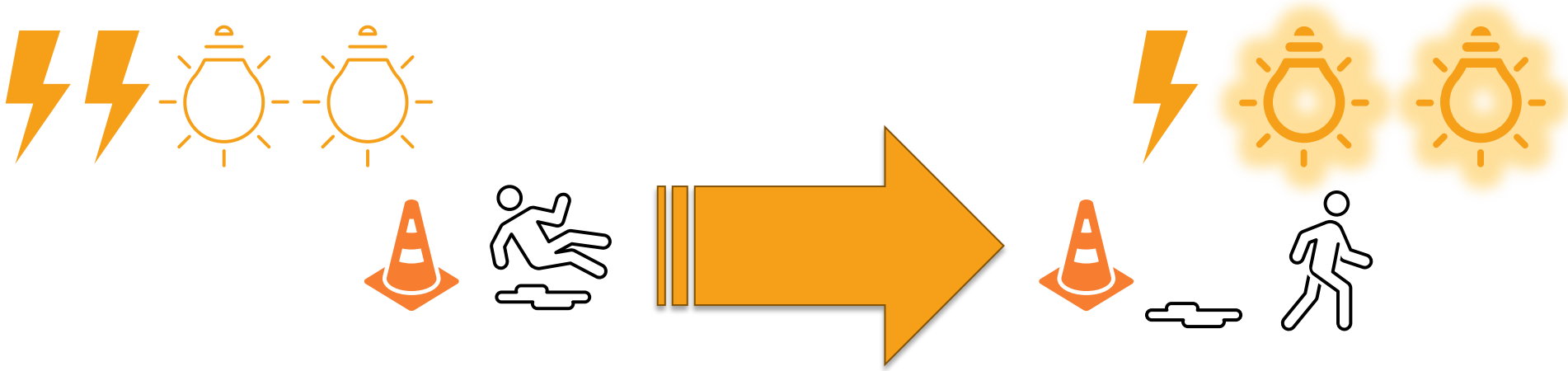
FACA Notice: In addition, to use our limited time most effectively, we will ask participants to refrain from passing judgment on another participant's recommendations or advice and instead concentrate on their own, individual experiences. It is not the object of this forum to obtain any group position or consensus.

What are NEBs?

Non-energy benefits (NEBs) are the positive outcomes that result from energy efficiency efforts, beyond the direct savings in energy and demand.

NEBs can be beneficial participants in energy efficiency program, the utility system, and society.

Also known commonly known as co-benefits, soft benefits, auxiliary benefits, ot non-energy impacts.



What are NEBs?

- Additional benefits of energy projects which also impact business performance and objectives
- Help drive down payback for energy projects by quantifying and showcasing additional cost and other benefits

Example of Corporate Responsibility Report

Principle	FY2018	FY2019	FY2020	FY2021	FY2022	2022 Goal Progress
Vibrant Communities						
Annual Vibrant Communities Charitable Giving (U.S. Dollars in Millions)	0	2.8	6.8	5.9	3.0	
Cumulative Charitable Giving Toward 2030 Goal (U.S. Dollars in Millions)	**0**	**2.8**	**9.1**	**15**	**18**	
Safety Excellence						
Employee Total Reportable Incident Rate (Number of Incidents x 200,000 /Total Hours Worked)	**0.28**	**0.27**	**0.36**	**0.29**	**0.27**	
Employee Lost Time Incident Rate (Number of Incidents x 200,000 /Total Hours Worked)	0.05	0.04	0.04	0.06	0.07	
Employee Fatalities	0	0	0	0	0	
Contractor Total Reportable Incident Rate (Number of Incidents x 200,000 /Total Hours Worked)	**0.23**	**0.32**	**0.30**	**0.15**	**0.23**	
Contractor Lost Time Incident Rate (Number of Incidents x 200,000 /Total Hours Worked)	0.00	0.02	0.03	0.03	0.03	
Contractor Fatalities	0	1	0	0	0	
Tier 1 Process Safety Event Rate (Number of Events per 100 Workers per Year)	**0.04**	**0.02**	**0.01**	**0.03**	**0.03**	
Tier 2 Process Safety Event Rate (Number of Events per 100 Workers per Year)	0.11	0.14	0.13	0.12	0.11	
Distribution Incidents	**3**	**6**	**3**	**2**	**3**	
Total Number Significant Spills	0	0	0	0	0	

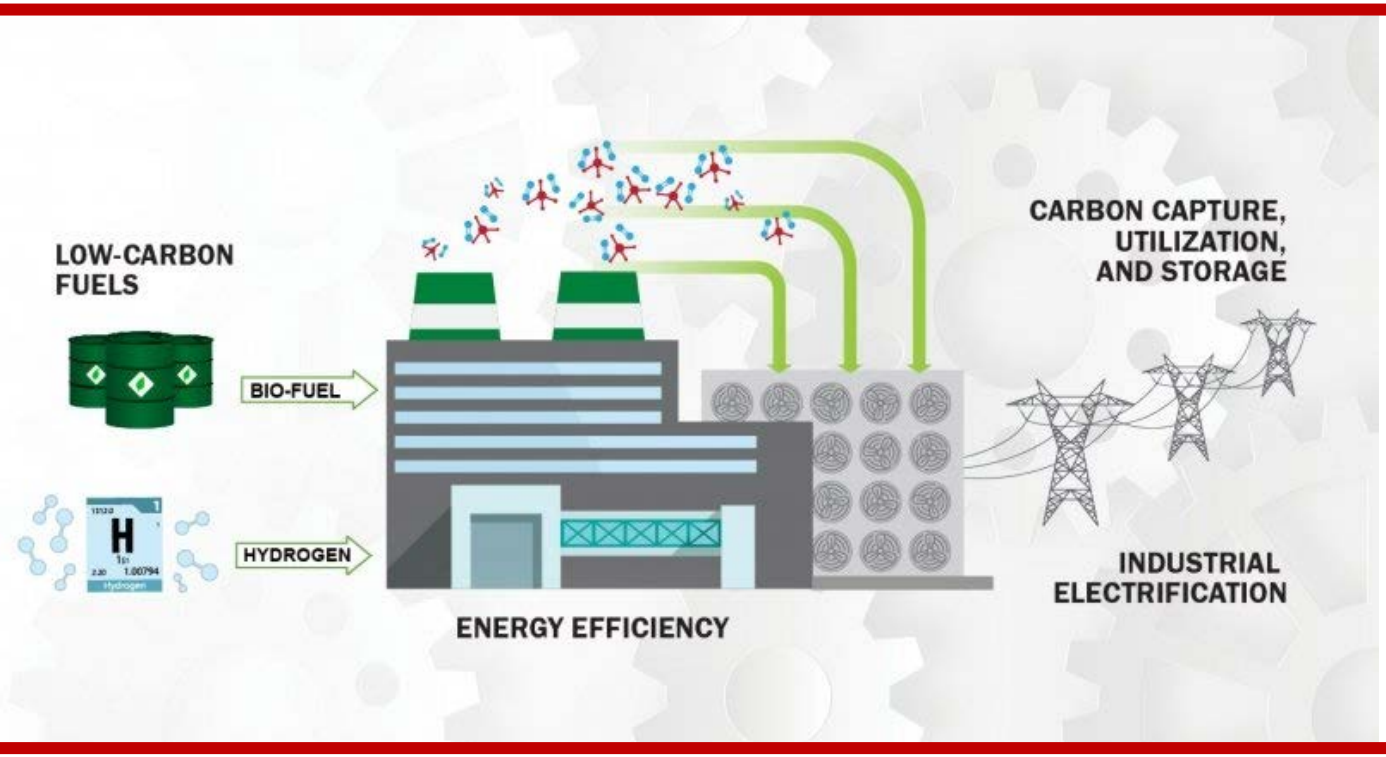
NEB

NEB

NEB

Why Important?
Pillars of Industrial Decarbonization

Industry is responsible 30% of primary energy-related U.S. CO_2 emissions



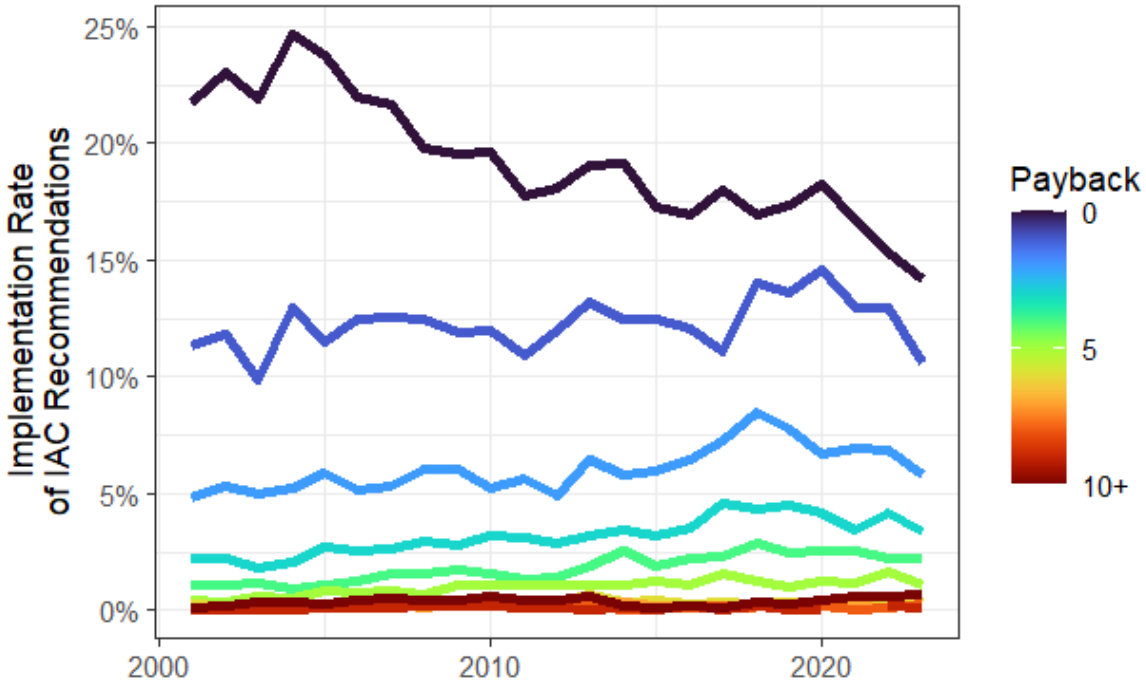
Energy Efficiency & Electrification are at the heart of decarbonization pillars
- ***but project implementation needs improvement***

U.S. Department of Energy, 2022. https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap#:~:text=The%20crosscutting%20decarbonization%20pillars%20are,capture%2C%20utilization%2C%20and%20storage.

More Implementation Needed!

What will it take to get more manufacturers to implement decarbonization projects?

- **$ -** Improve payback period
- **Training** - Connect benefits to their business objectives
- Make it easy for available **resources** to maximize benefits of projects



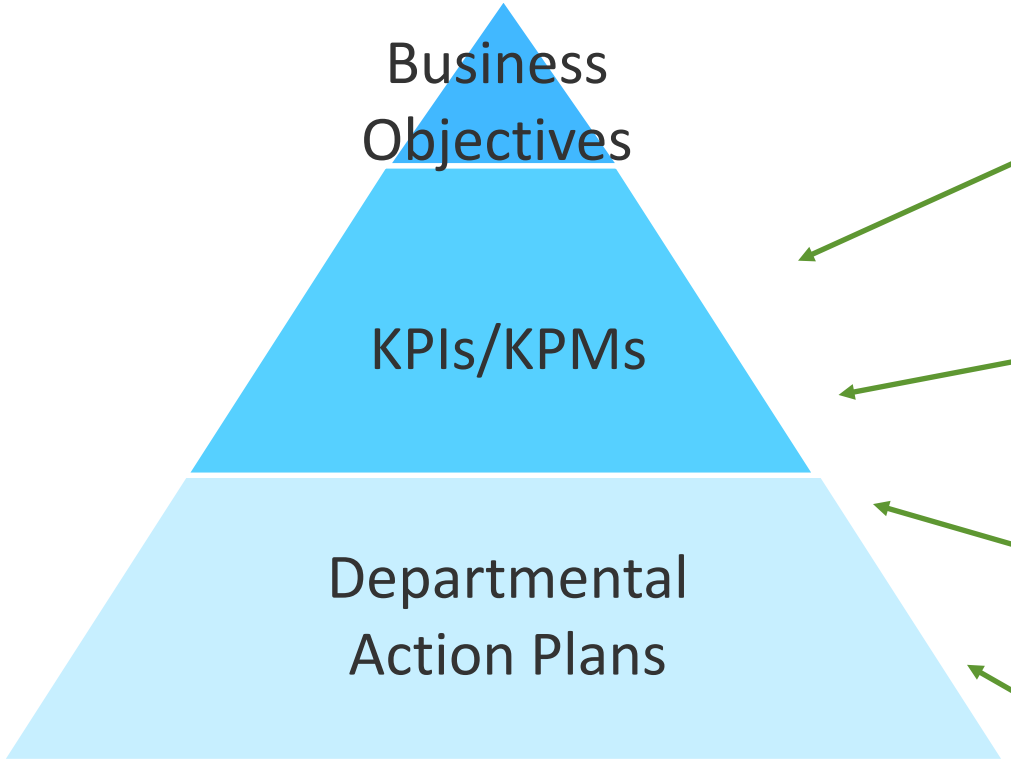
Industrial Assessment Centers, "Industrial Assessment Center Database," 2024. https://iac.university/download (accessed Oct. 23, 2024).

NEBs Contribute to Strategic Business Goals

Business Perspective

Non-Energy Benefits (NEBs)

Sustainability Perspective

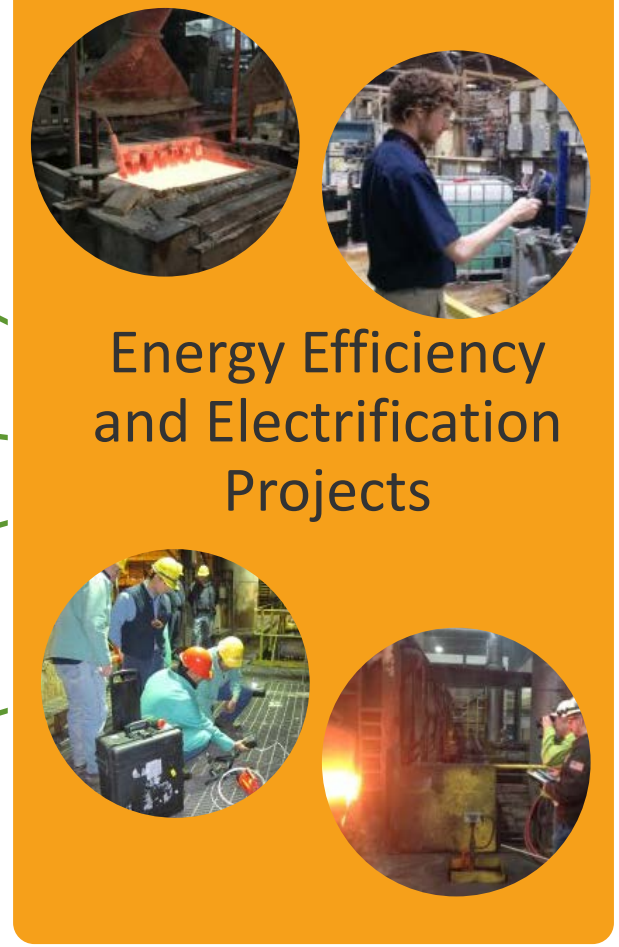


Safety

Sustainability

Cost Savings

Productivity



NEBs Strategic Contribution Table

- NEBs contribute to Key Performance Metrics (sometimes they are the KPMs)
- Impact Risk, Value, & Cost
- Quantifiable- KPM and associated financial value
- Not all are easily quantifiable but are still important
- Based on research our team created NEBs Strategic Contribution Table with ~50 examples

Example from Table

KPI	KPM	NEB	Risk Reduction	Value Proposition Increase	Decrease Costs
Operations-Quality					
	Defect Rate-PPM or DPM	Improved quality-machine performance	X	X	X

Jam Board - Exercise

Let’s Brainstorm common NEBs and sort them into KPI/KPM categories

Key Performance Indicators/Metrics

- Strategic Relationship Impacts
- Operations (Productivity/Quality)
- Sustainability/Environmental Impact
- Employee/Workplace Impact (Safety/Engagement)
- Other

How do we find NEBs for an Energy Project?

- Goals & objectives
- Training & guidance on learning about what kind of NEBs are common to different kinds of energy projects
- Understand the full process & problems
  - Impact the facility
  - Impact other operations
- Talk to people!
  - End Users, Maintenance, Safety, Human Resources, Quality

Photo from Microsoft stock image

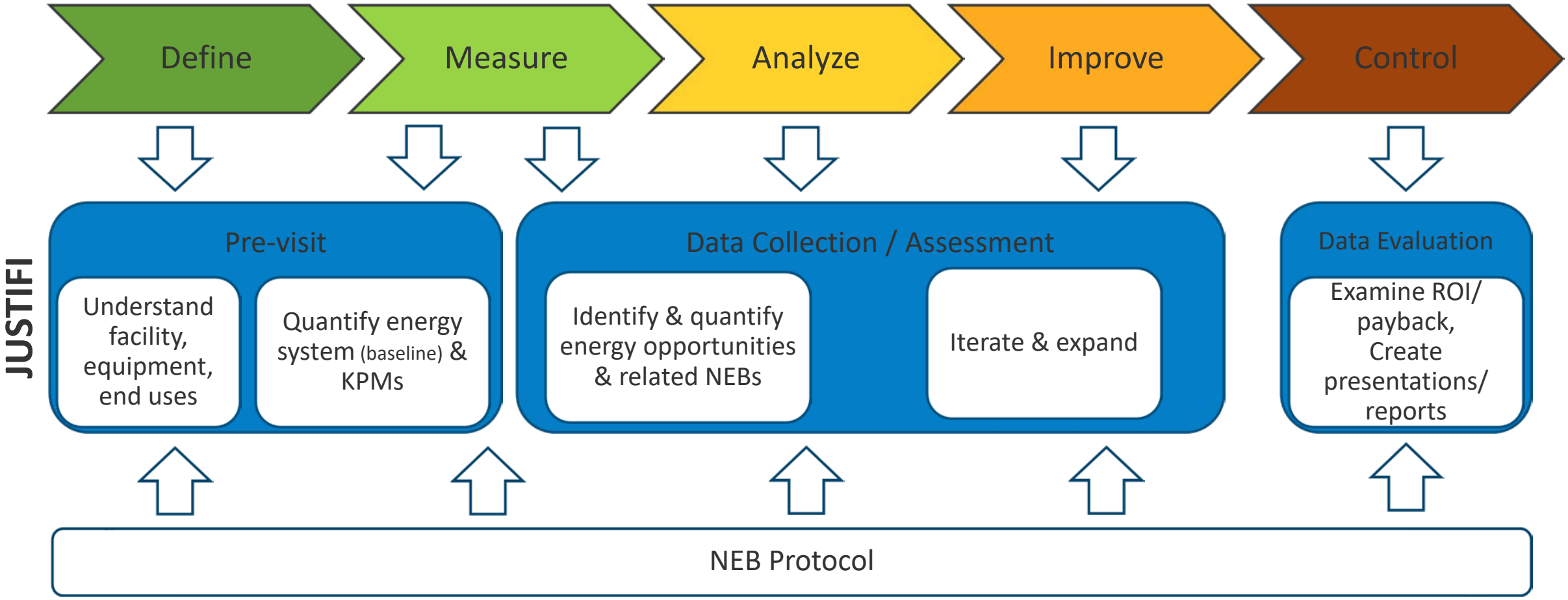
What does this sound like?

Process Improvement- Continuous Improvement

NEB Finding Guidance Process & JUSTIFI Software

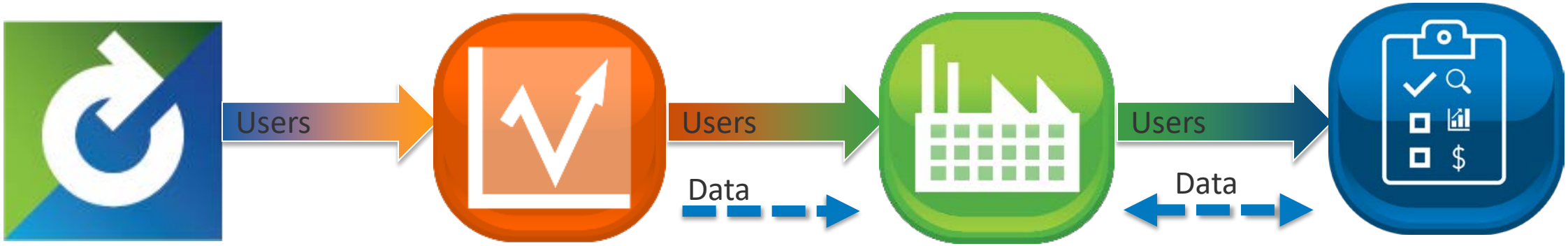
- Utilizes Six Sigma's DMAIC Improvement Process
- Standards
  - Quality Systems (ISO 9001)
  - Environmental Management Systems (ISO 14001)
  - Energy Management Systems (ISO50001)

JUSTIFI Key Features



JUSTIFI translates the DMAIC process from the NEB Finding Guidance and Protocol documents into an actionable, user-friendly workflow

DOE IEDO Energy Efficiency & Decarb Software Tools Workflow



50001 Ready Navigator

Energy management

- Resources
- Track progress

VERIFI

Facility energy use

- Utility bill tracking and analysis
- Utility/ GHG savings analysis

MEASUR

System energy use

- Industrial System Analysis
- Treasure Hunts
- Inventory

JUSTIFI

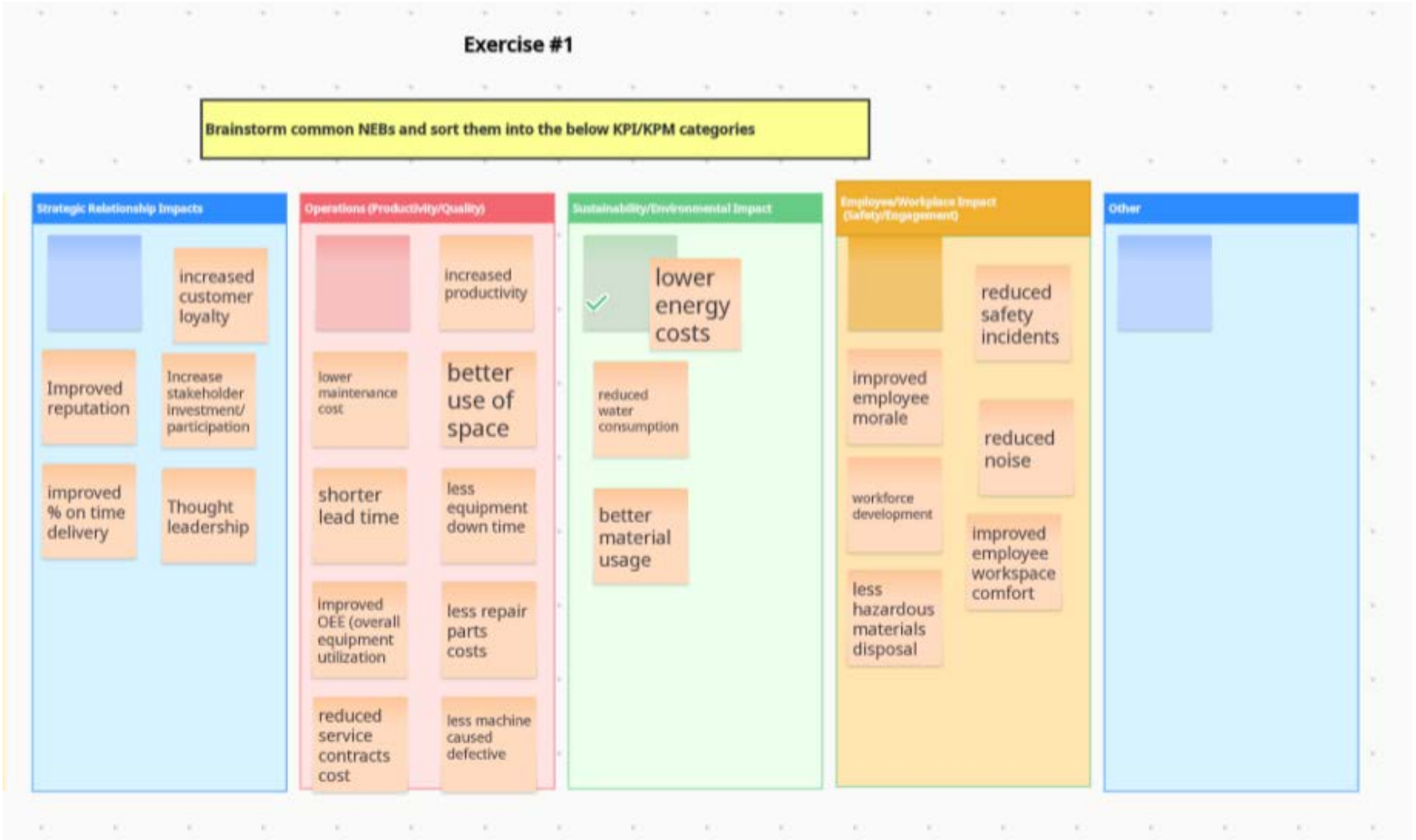
Additional impacts

- Financial & Performance metrics impacts of energy projects

Let’s Illustrate with examples

How finding and quantifying NEBs for an energy projects impact KPIs/KPMs and improve payback periods for projects.

Whiteboard Group Exercise- Results



JUSTIFI Example: Cocoa Co.

Value Proposition: “Quality you never forget!”

Performance Metrics: Safety, Quality, On Time Delivery, Cost, & Sustainability

Goals: Increase Revenue 20%, Reduce Defects 10%, & Reduce Energy Cost 20%

Details

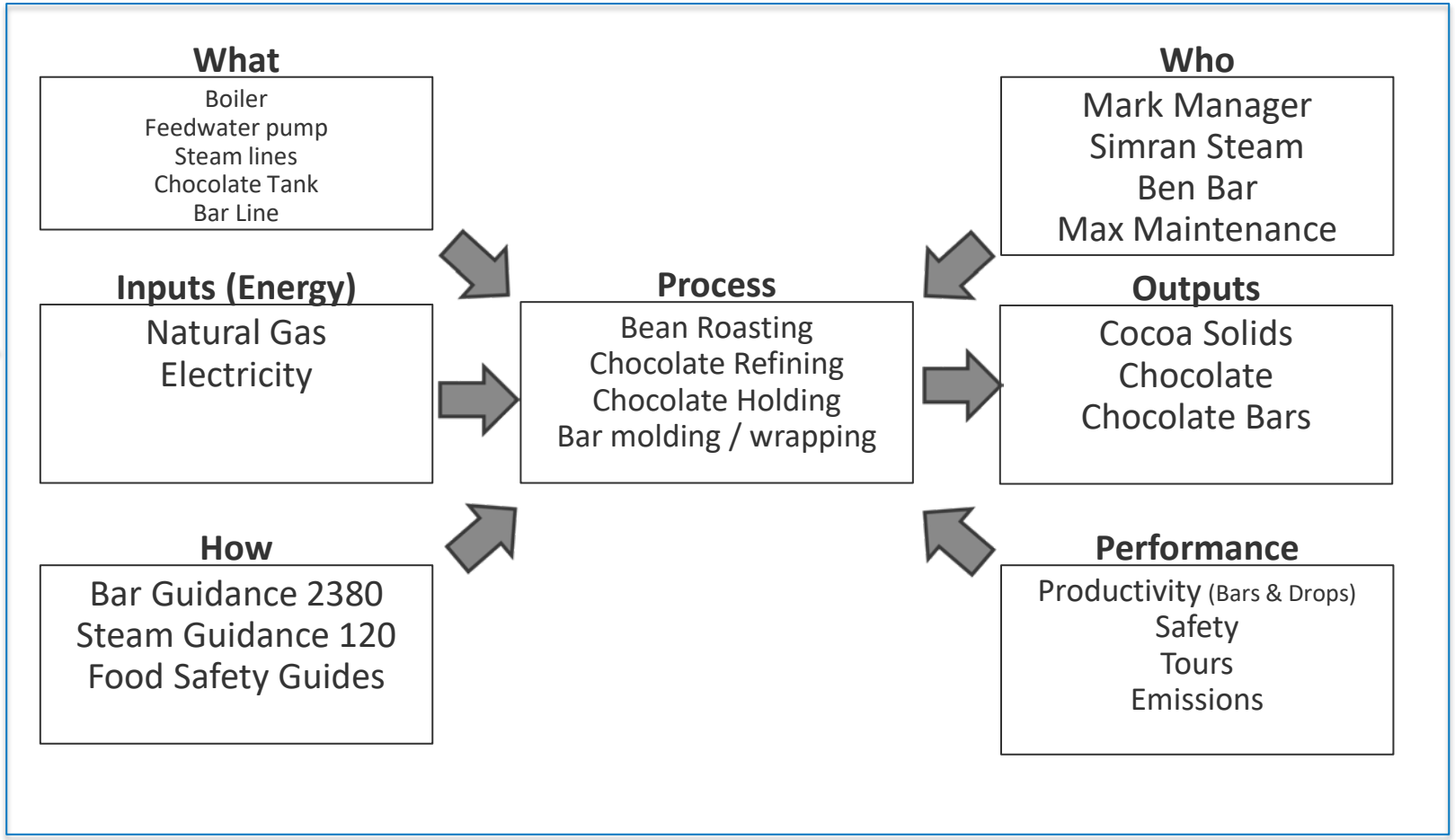
- Small manufacturer (SMM), making high quality chocolate bars and candies. Quality drives customer loyalty. Folks from all over central Ohio enjoy touring the chocolate factory.
- Chocolate bar machine rate: 1200 units/hr. Chocolate bar line has 1% defect rate.
- Plant manager **problems**: safety- incidents cost between $50K-$100K each, new sustainability goals, defect rate, need to reduce costs.

General Information	Annual Energy Information
Location: 100 Woodruff Ave, Columbus, Ohio 43228	Electricity Use: 100,000,000 kWh
Building Age: 75 years	Electricity Cost: $0.1/kWh
Building Area: 70,000 ft2	Demand Use: 960 kW
# of Employee (This facility/Total): 150	Demand Cost: $16.12/kW
Annual Operating Hours: 4160 hrs.	Natural Gas Use: 4,500,000 MMBTU
Annual Sales: $10.3M	Natural Gas Cost: $4.00/MMBTU
Annual Production: 3,744,000 units	

JUSTIFI Demo: Cocoa Co. Steam Assessment

Completed Facility Tour:

- Coalesced all pre-visit data and entered it into JUSTIFI
- Engaged operators responsible for steam equipment
- Gathered steam system-related data
- Gained insights into key performance concerns
- Quantified 3 energy efficiency opportunities

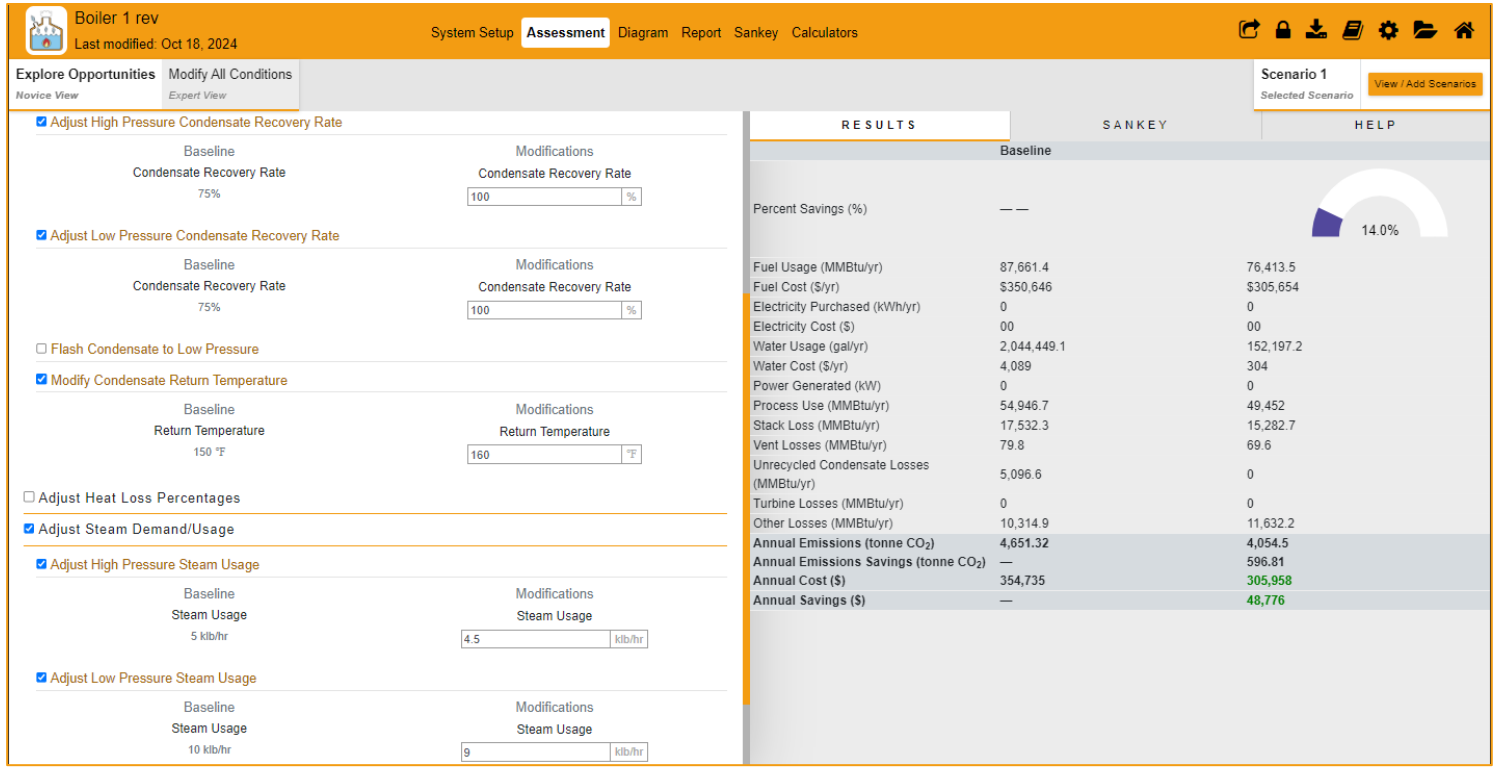


Next Steps:

- ❑ Explore steam processes / end uses to identify NEBs
- ❑ Gather missing data
- ❑ Quantify NEB impact
- ❑ Review impacts on costs, energy, and KPI/KPMs

Cocoa Co Projects and NEBs

- 3 Energy Efficiency Projects with 12.8% energy savings
  - Insulate Hot Product Tank: $50k
    - Are there safety issues?
  - Fix Steam Leaks: $2.5k
    - Are there safety issues?
  - 100% Condensate Recovery: $50k
    - Water Savings
  - If do everything…
    - CO2 Emissions
    - Quality Improvements

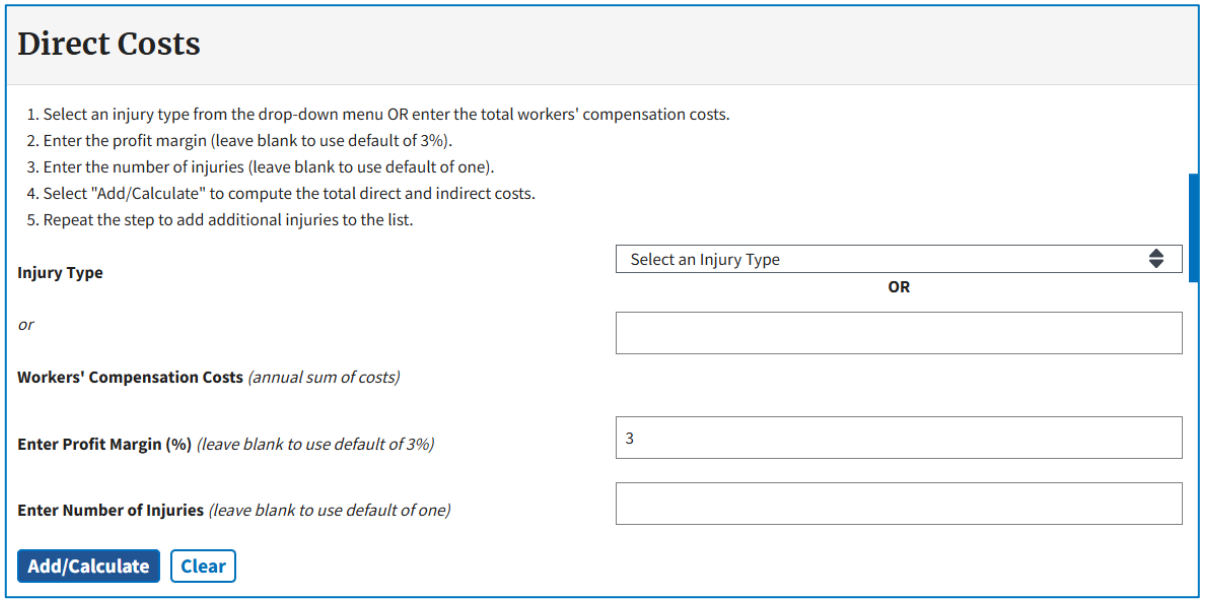


How to estimate? Talk to people!

- Safety
  - https://www.osha.gov/safetypays/estimator
  - Talk with Human Resources
    - Cost of intervention programs
    - Cost of days off
- Quality
  - Talk with Quality Team
  - Cost of production to point of waste
- Carbon
  - EPA Emissions Hub / MEASUR
  - Internal Cost of Carbon
- Expenses
  - Maintenance Costs
    - Replacement Costs
    - Labor Costs
  - Other Materials / Utilities

How to estimate? Talk to people!

- Tank Insulation
  - Talked with Safety team
    - Someone gets burned at least every other year
    - Had to reroute Tour groups
  - https://www.osha.gov/safetypays/estimator



Injury Type	Instances	Direct Cost	Indirect Cost	Total Cost	Additional Sale (Indirect)	Additional Sale (Total)	
Burn	1	$ 47,192	$ 51,911	$ 99,103	$ 1,730,373	$ 3,303,433	Remove

Cocoa Co Projects and NEBs

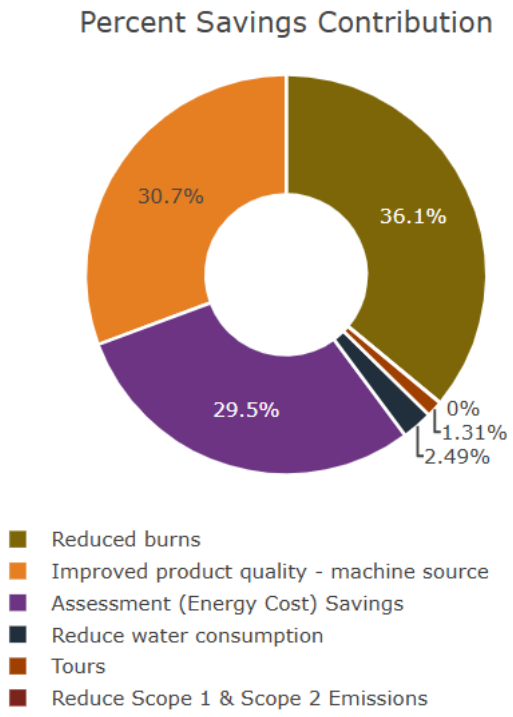
- 3 Energy Efficiency Projects with 12.8% energy savings
  - Insulate Hot Product Tank: $50k
    - Safety NEB: $55k/yr
    - Customer Relations NEB (Tours): $2k/yr
  - Fix Steam Leaks: $2.5k
    - No direct NEBs found
  - 100% Condensate Recovery: $50k
    - Reduced water intake: $3.8k/yr
  - 2 NEBs for entire project
    - Reduced Scope 1 Emissions (no direct cost benefit)
    - Reduced defects: $46.8k/yr

KPI	KPM	Baseline Cost ($/yr)	Annual Savings ($/yr)	Modified Cost ($/yr)	Change (%)
Safety	OSHA Recordable Incidents	$1,760,000	$55,000	$1,705,000	3.13 %
Quality	($) Defective Production	$93,600	$46,800	$46,800	50 %
Water Consumption	Consumption Cost	$10,000	$3,800	$6,200	38 %
Tours	Tours	$40,000	$2,000	$38,000	5 %
Strategic Relationship Impact	Contribution to company's vision or strategy	Qualitative Metric			
CO, CO_2, NO_x, SO_x emissions	Scope 1 & Scope 2 Emissions	—	—	—	6.2 %
Totals		**$1,903,600**	**$107,600**	**$1,796,000**	**5.65 %**

Cocoa Co. Results Report

- NEBs reduced payback from over 2 yr to less than 1!
- About 2/3 of cost reductions from NON Energy Efficiency
- Improves KPMs – even if there are no cost benefits!

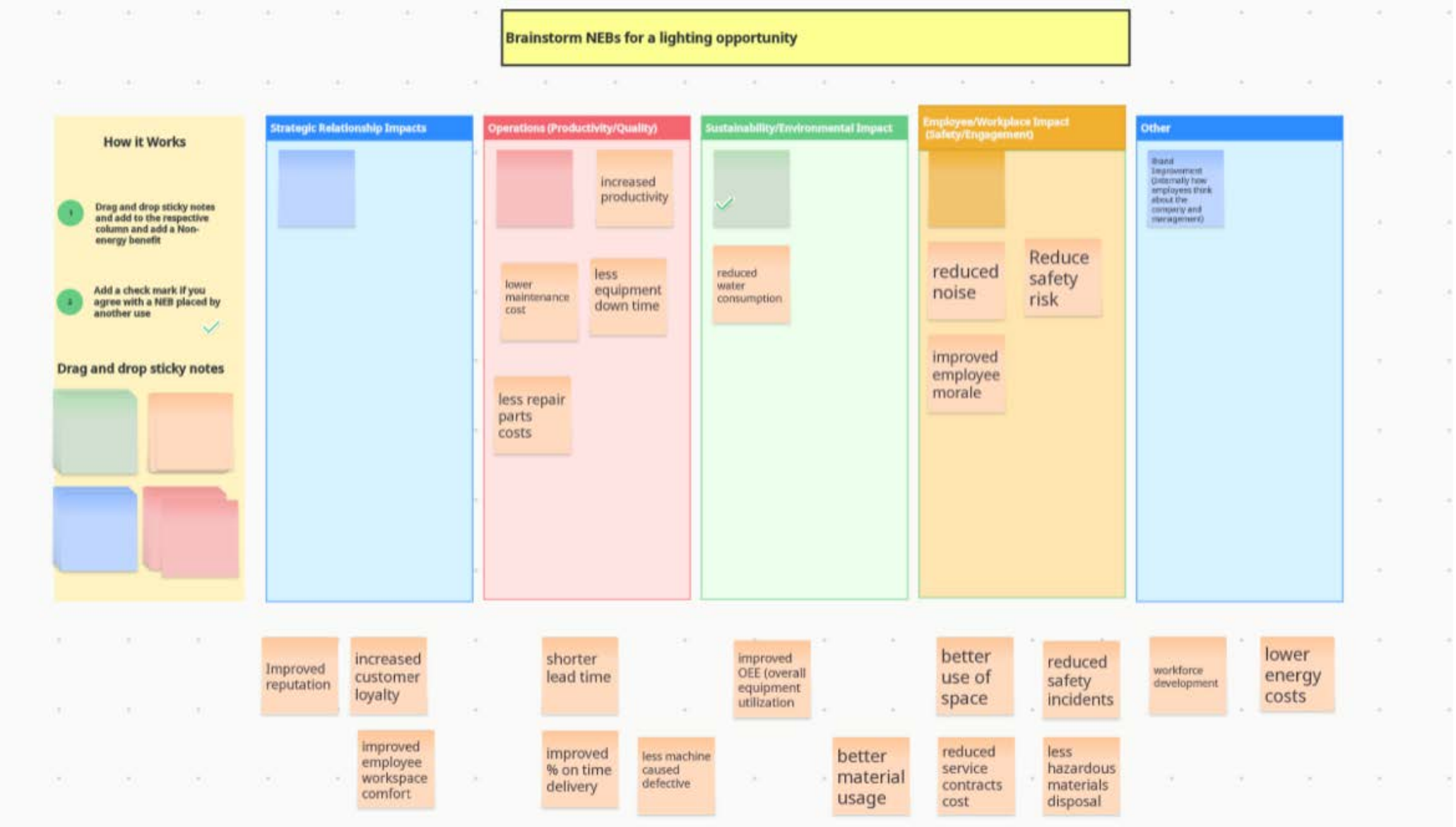
	Implementation Cost ($)	Annual Energy Savings ($/yr)	Annual Savings W/ NEBs ($/yr)	Simple Payback (yrs)	Simple Payback With NEBs (yrs)
Steam Assessment	—	$44,920	$91,720	—	—
Insulate Melted Chocolate Tank	$50,000	—	$57,000	—	0.88
Steam Leaks at HP & LP	$2,500	—	—	—	—
Condensate Recovery	$50,000	—	$3,800	—	13.16
Assessment Total	**$102,500**	**$44,920**	**$152,520**	**2.28**	**0.67**



Jam Board Break - Lighting

- 10% of all projects recommended by ITAC's are related to using more efficient lighting
- They have about a 70% implementation rate
- You've probably done a lighting project, but did you think of all the additional benefits?

Whiteboard Group Exercise- Results

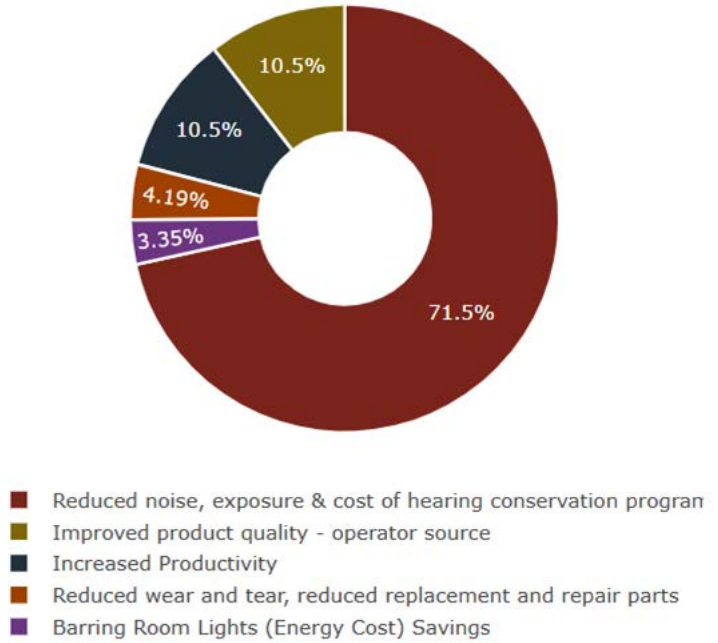


Pay Back-Summary Report for all findings (Lighting)

With the safety NEB...

KPI	KPM	Baseline Cost ($/yr)	Annual Savings ($/yr)	Modified Cost ($/yr)	Change (%)
Safety	OSHA Recordable Incidents	$250,000	$32,000	$218,000	12.8 %
Quality	($) Defective Production	$93,600	$4,680	$88,920	5 %
Productivity	Cycle Time - Time to make goods	—	$4,680	—	—
Maintenance Expense	Labor Costs	$240,000	$1,000	$239,000	0.42 %
Expense Cost	Service Parts	$100,000	$875	$99,125	
Maintenance Expense	Engineering support ($ or hours)	$120,000	—	$120,000	
Cost Totals		**$803,600**	**$43,235**	**$760,365**	

	Implementation Cost ($)	Annual Energy Savings ($/yr)	Annual Savings W/ NEBs ($/yr)	Simple Payback (yrs)	Simple Payback With NEBs (yrs)
TH - Lighting Opp	—	—	—	—	—
Barring Room Lights	$15,000	$1,500	$44,735	10	0.34
Assessment Total	**$15,000**	**$1,500**	**$44,735**	**10**	**0.34**

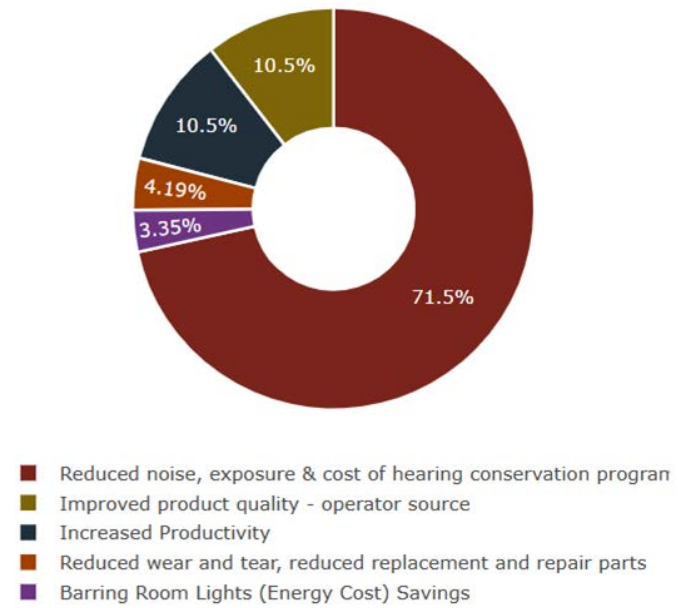


Pay Back-Summary Report for findings w/o Safety NEB (Lighting)

Without the safety NEB

KPI	KPM	Baseline Cost ($/yr)	Annual Savings ($/yr)	Modified Cost ($/yr)	Change (%)
Quality	($) Defective Production	$93,600	$4,680	$88,920	5 %
Productivity	Cycle Time - Time to make goods	—	$4,680	—	—
Maintenance Expense	Labor Costs	$240,000	$1,000	$239,000	0.42 %
Expense Cost	Service Parts	$100,000	$875	$99,125	0.88 %
Cost Totals		**$433,600**	**$11,235**	**$422,365**	**2.59 %**

	Implementation Cost ($)	Annual Energy Savings ($/yr)	Annual Savings W/ NEBs ($/yr)	Simple Payback (yrs)	Simple Payback With NEBs (yrs)
TH - Lighting Opp	—	—	—	—	—
Barring Room Lights	$15,000	$1,500	$12,735	10	1.18
Assessment Total	**$15,000**	**$1,500**	**$12,735**	**10**	**1.18**



Conclusions

- NEBs- Often important to key decision makers
- NEBs- Find them by understanding the company, their processes and talking to people
- NEBs- Improved performance metrics
- NEBs- Will reduce payback period for energy projects
- NEBs -Support implementation

Questions?

NREL/PR-5700-92410

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