



**Multiple Benefits
of Energy Efficiency**

International
Energy Agency

Multiple Benefits of Energy Efficiency for Business

Webinar

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10 September 2026



Energy efficiency is often described as the **first fuel**

The **cheapest** and **most secure** energy is the energy that is **not used**

For **businesses**, investing in energy efficiency can often

cost less than sourcing more energy
and **pay back quickly**.

But there's more! **Multiple benefits of energy efficiency** extend across several dimensions.

Operational benefits

Efficient and electrified equipment operates **more reliably** and with **less stress**, improving **process stability** and **reducing downtime**.

As processes become **more precise** and **optimised**, they also require **fewer material** and **resource inputs**, **generating less waste**. This results in **higher productivity**.

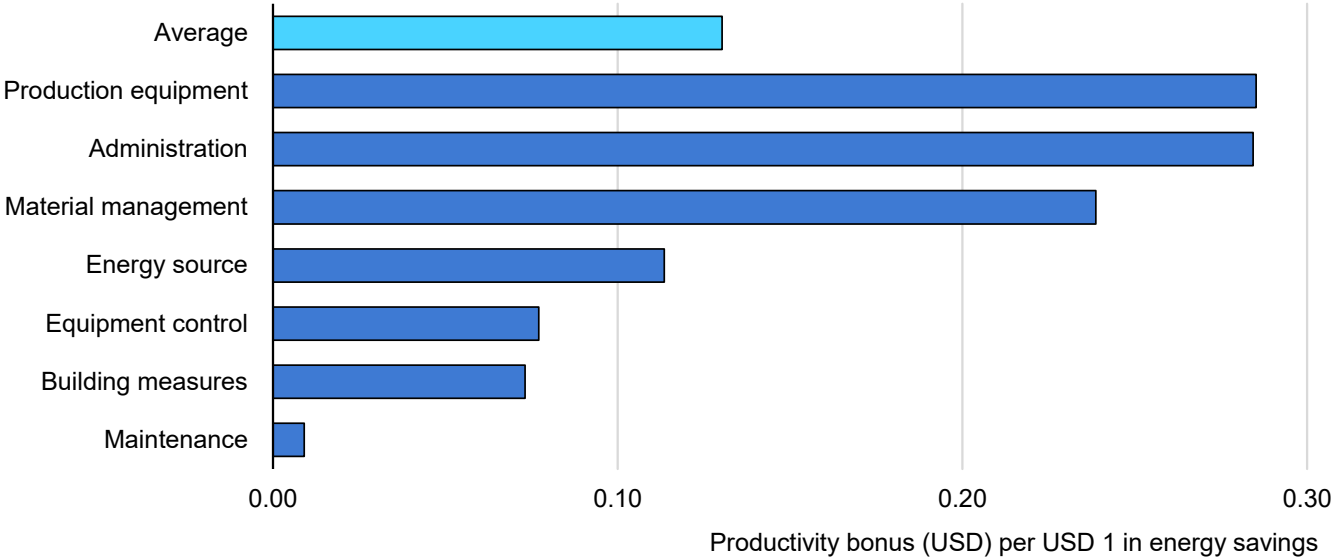
Quality and reputation

Energy efficiency often provides **improved process control**, enhancing output **consistency**, **reducing production defects** and improving product quality.

Health and well-being

By **reducing pollution** and **improving indoor conditions**, energy efficiency can significantly **enhance worker health and well-being**. Lower exposure to harmful pollutants leads to **healthier staff** and **better working conditions**, with **tangible productivity gains**.

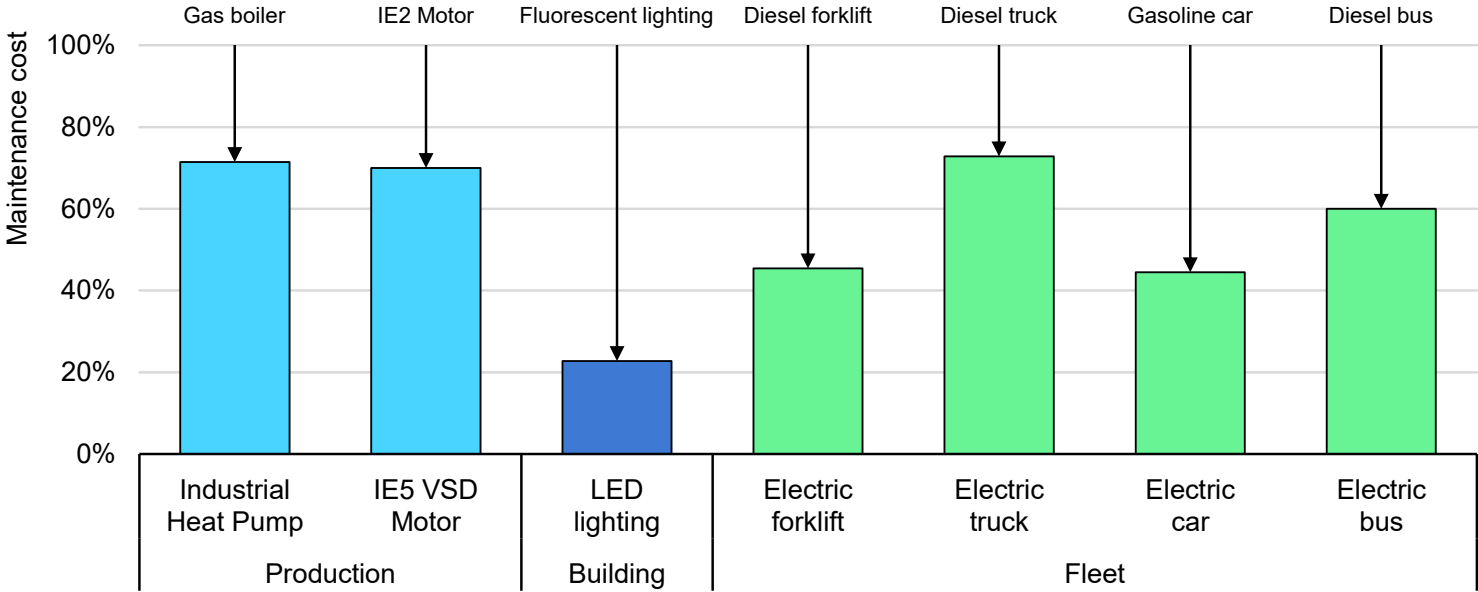
Productivity bonus, additional to energy cost savings, in SMEs by energy efficiency measure in the United States, 2002-2024



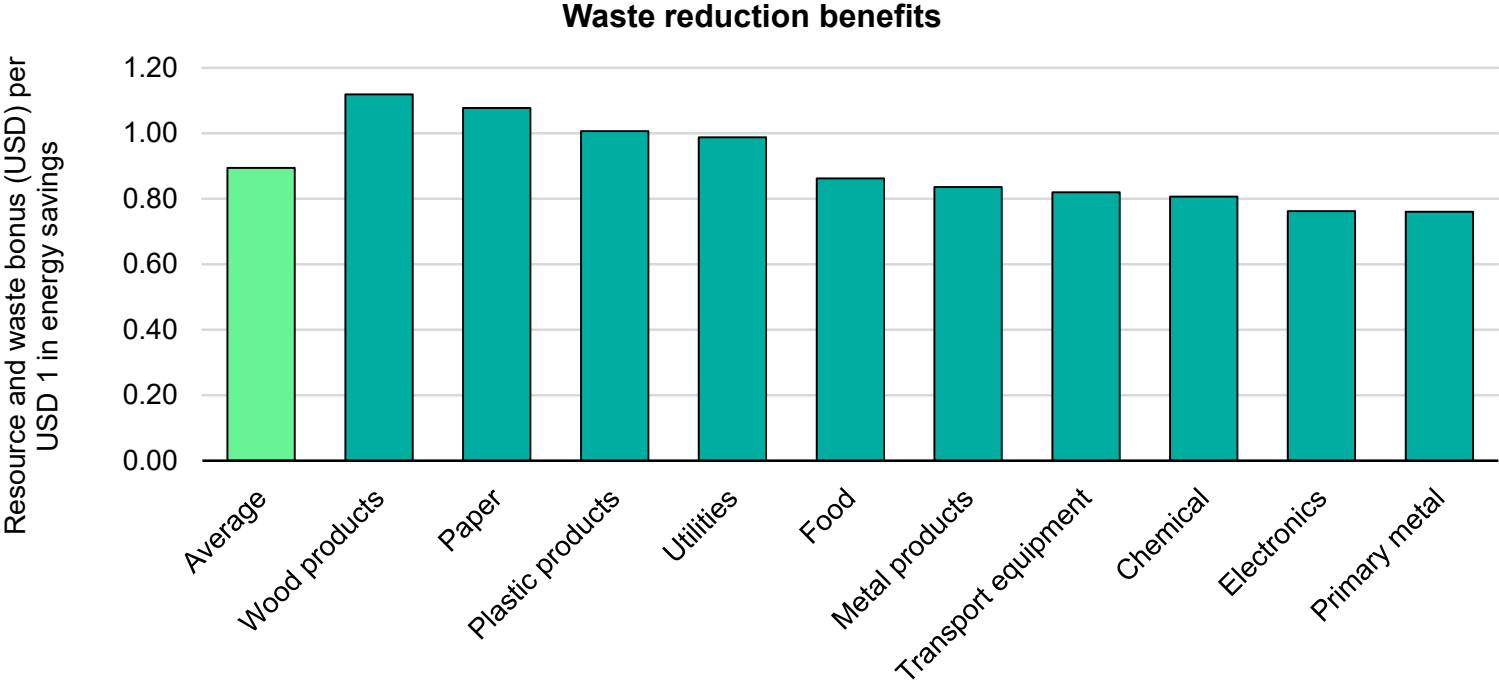
Source: IEA analysis based on Industrial Training and Assessment Centers (ITAC) (2002-2024), [ITAC Database](#)

For every dollar in energy cost savings, productivity gains can deliver up to an extra 30 cents of value.

Maintenance cost of efficient technologies compared to conventional counterparts



Efficient and electrified technologies can reduce maintenance costs by at least 25%.

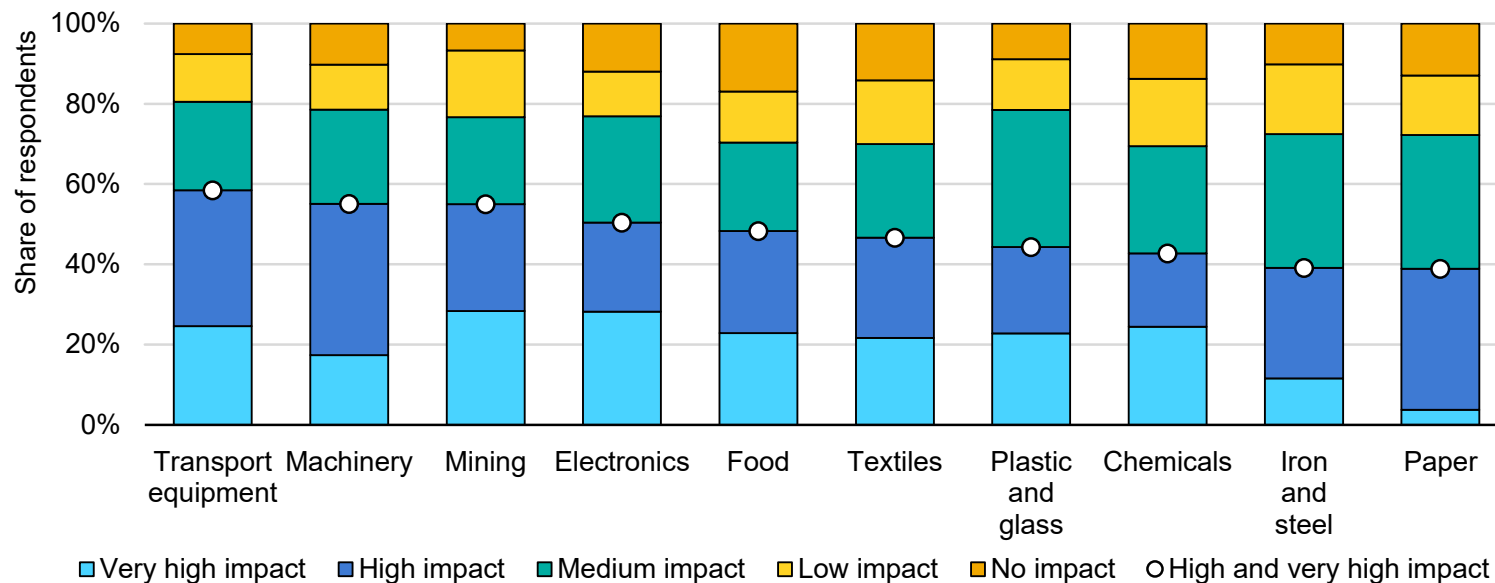


Source: IEA analysis based on Industrial Training and Assessment Centers (ITAC) (2002-2024), [ITAC Database](#).

Resource efficiency can amplify energy savings, almost doubling savings in some sectors

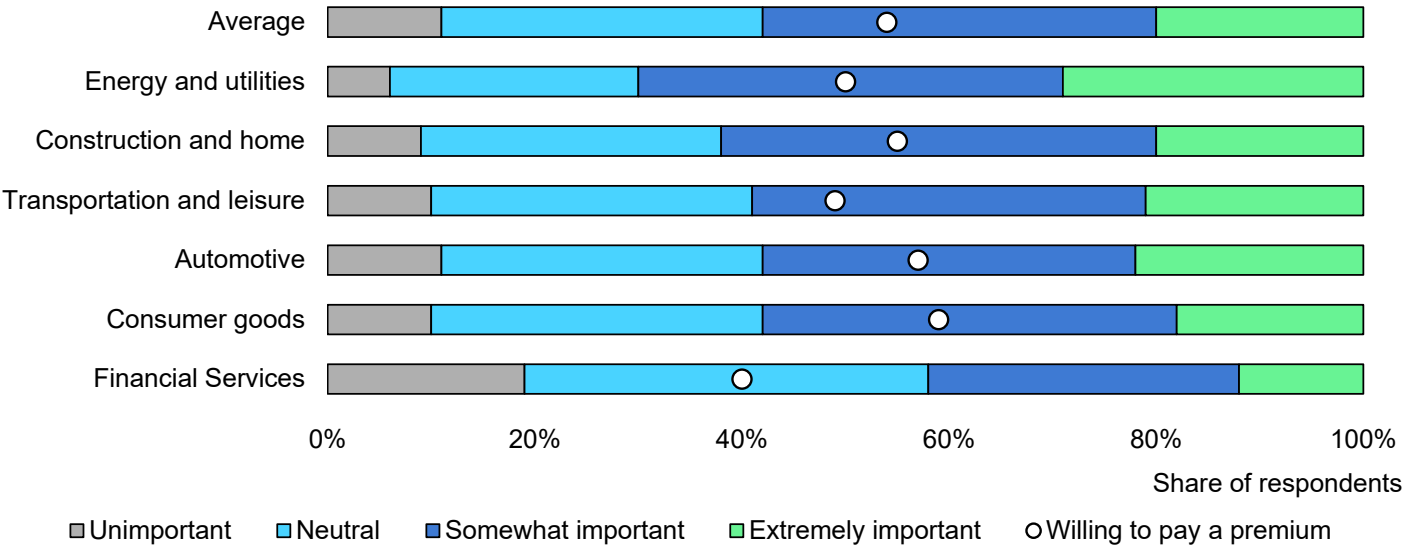


Global observed decrease in defective production due to energy efficiency measures by sector



Greater efficiency can reduce defects and improve production quality

Importance of corporate efficiency and sustainability performance for consumers, and willingness to pay a price premium, by sector, 2024

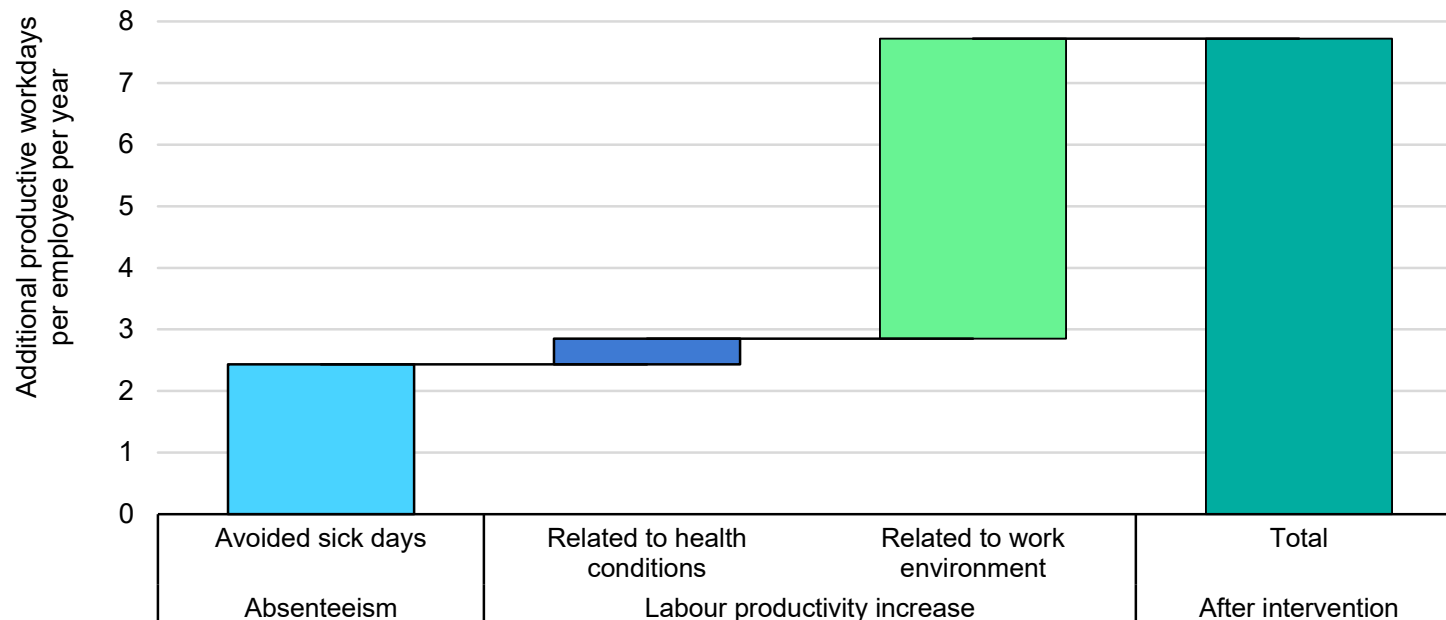


Source: Simon Kucher & Partners (2026), [Sustainability 2024: Navigating consumer behavior](#), as modified by the IEA

Improved energy performance is associated with better brand image and market positioning.



Increase in productive workdays due to improved indoor environmental quality in office buildings



Source: IEA based on [Singh A. et al. \(2010\)](#) and [Chatterjee S. and D. Ürge-Vorsatz \(2018\)](#)

**Energy efficiency can improve working conditions, increase employee productivity and reduce sick leave.
Productivity gains add up to 8 additional productive days per employee each year.**



Local air pollutants, efficiency levels and health risks of industrial heat technologies

	NO _x	SO ₂	CO	PM _{2.5}	Efficiency level
Coal boiler	173 g/GJ	900 g/GJ	931 g/GJ	108 g/GJ	80% Low
Oil boiler	513 g/GJ	47 g/GJ	66 g/GJ	20 g/GJ	85% Low
Biomass boiler	91 g/GJ	11 g/GJ	570 g/GJ	140 g/GJ	80% Low
Natural gas boiler	74 g/GJ	0.7 g/GJ	29 g/GJ	0.8 g/GJ	90% Medium
Electric boiler	0 g/GJ	0 g/GJ	0 g/GJ	0 g/GJ	99% High
Heat pump	0 g/GJ	0 g/GJ	0 g/GJ	0 g/GJ	350% Very high
Health risk	Respiratory disease, asthma	Respiratory disease, airway irritation	Cardiovascular stress, impaired cognition	Lung cancer, stroke, heart disease	

Emission intensity ● Very high ● High ● Medium ● Low ● Very low ● None

Source: IEA based on European Environment Agency (2023), [EMEP/EEA air pollutant emission inventory guidebook 2023](#); WHO (2026), [Air Quality, Energy and Health](#)

Employing efficient and electrified technologies significantly decreases the health risks associated with local air pollution in the workplace.



Now we have the facts. What's next?

The 3 big M's (and the little b)

Making

Multiple benefits

Mainstream



And we have some wonderful speakers to present their approach to that goal

Making

Multiple benefits

Mainstream

Dr. Catherine Cooremans, Ipso Facto | MBENEFITS – Making carbon neutrality your profitable reality

Philippe Langlois, ECONOLER | Insights from practice: MBENEFITS in the tertiary sector in Canada

Sarah Cooney, Jibo Sanyal, NLR | JUSTIFI – Unlocking value in energy productivity projects

Luke Aurilia, Michigan State University ITAC | Insights from practice: JUSTIFI energy assessment

Nikos Vourgidis, NTUA | Assessing non-energy benefits in EU industrial energy audits through the Audit2Measure project

Prof. Dr. Clemens Rohde, Wuppertal Institute | European Standardisation of Non-energy benefits for CEN CENELEC

Rounding it up with a panel discussion: What's missing?



Contact us!

jerome.bilodeau@iea.org



Making Carbon Neutrality your Profitable Reality

Catherine Cooremans, PhD, MBA, Ipso Facto

Philippe Langlois, P.Eng, MBA, Econoler

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Outline

- 2005 -2023: from research to the markets
- MBENEFITS analysis software
- Results and lessons learned of three assessments:
 - ❑ Manufacturing
 - ❑ Multi-occupancy housing
 - ❑ Services
- Current situation and next steps
- Conclusion

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MBENEFITS History & Background



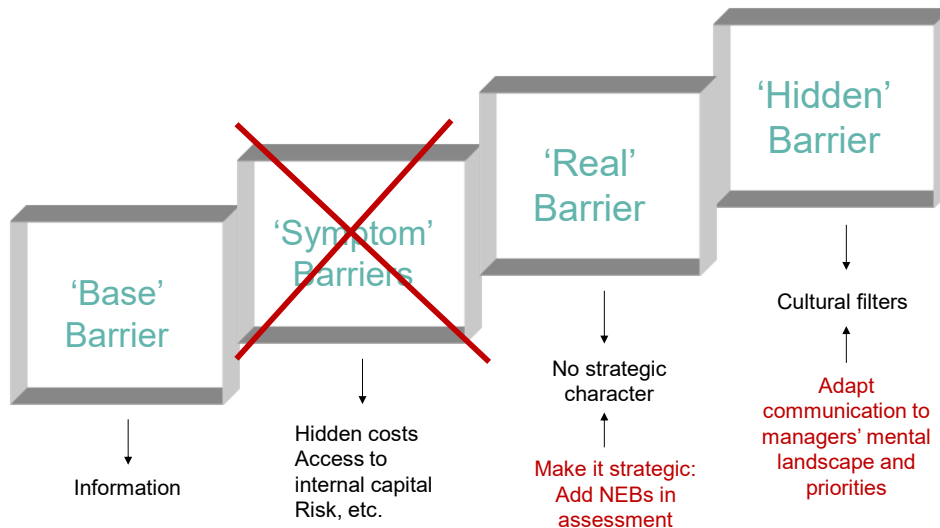
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- 2005-2010 - **Research**: doctoral research in business management on investment decision-making and the relevance of non-energy benefits (NEBs).
- 2013–2017 - **Development**:
 - ❑ Canton of Vaud (Switzerland) public programme (qualitatively) includes NEBs in subsidized energy audits.
 - ❑ Canton of Vaud financially supports the methodology development.
- 2018-2021 - **Demonstration**: M-Benefits, a research project of the EU Horizon 2020 programme. The methodology is embedded in a software and tested in 23 pilot assessments (EU – CH – USA).
- 2022 - **Deployment**: the University of Lausanne (UNIL, Switzerland), owner of the MBENEFITS software, gives Ipso Facto S.A., Geneva, exclusive rights to commercialization.
- 2024: marketing of the MBENEFITS software + training.

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Redesigning the Energy-Efficiency Barriers Concept:

A new model to explain the “barriers” to energy-efficiency improvement



Source: Cooremans (2012) Investment in energy efficiency: do the characteristics of investments matter? Energy Efficiency, 5:497–518.
<https://link.springer.com/article/10.1007/s12053-012-9154-x>

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Get the Boss to Buy In

74 Harvard Business Review January–February 2015

THE SOLUTIONS

“Successful issue sellers employ seven tactics significantly more often than people who don’t succeed in gaining buy-in. A powerful framework for leading change from the middle ranks.”

TACTIC 1 – Tailor your Pitch to Decision-Makers

“It’s essential for issue sellers to familiarize themselves with their audience’s unique blend of goals, values, and knowledge and to allow that insight to shape their messages.”

THE PROBLEM

“... most [middle] managers struggle to sell their ideas to people at the top.... If [senior executives] don’t already perceive an idea’s relevance to organizational performance, they don’t deem it important enough to merit their attention.”

TACTIC 2 – Frame the Issue

“An issue’s place on your organization’s list of priorities depends heavily on how you package the idea... Once people see how your initiative fits into the big picture, they’ll be more willing to devote resources to it.”

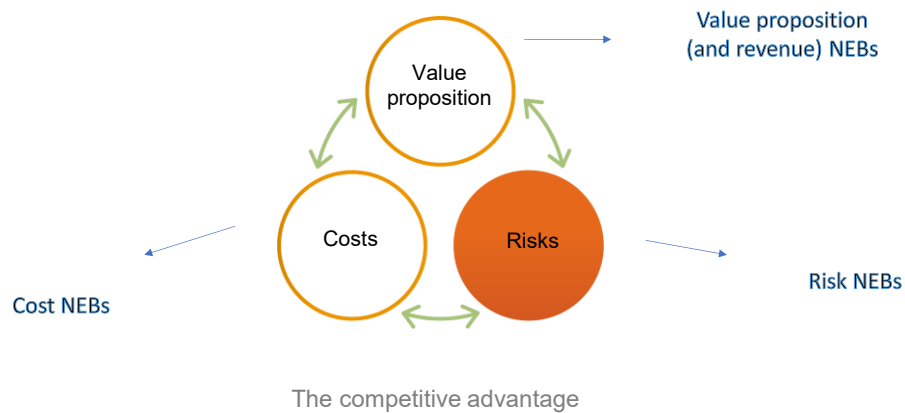
Ashford S. & Detert J.R. (2015). Get the Boss to Buy In Learn to sell your ideas up the chain of command. Harvard Business Review. Jan-Feb. 2015:74-75). <https://hbr.org/2015/01/get-the-boss-to-buy-in>

MBENEFITS

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Make it Strategic!

Assessing the contribution of an investment to business competitiveness: the Value-Cost-Risk Analysis



Sources : Cooremans (2011) Make it strategic! Financial Investment Logic is not enough, Energy Efficiency, 4:473–492.
<https://link.springer.com/article/10.1007/s12053-011-9125-7>
 Cooremans (2012) Investment in energy efficiency: do the characteristics of investments matter? Energy Efficiency, 5:497–518.
<https://link.springer.com/article/10.1007/s12053-012-9154-x>

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Operational Analysis :

Identifying NEBs along the 5 pillars of corporate operational excellence



OPERATIONAL EXCELLENCE	
What are the impacts of the proposed energy efficiency measure on the company's operational excellence? Summarize in the boxes below the impact on employee safety, product quality, cost, and time:	
SAFETY	
QUALITY	
COSTS	
TIME	

MBENEFITS software - Version 32 – September 2023

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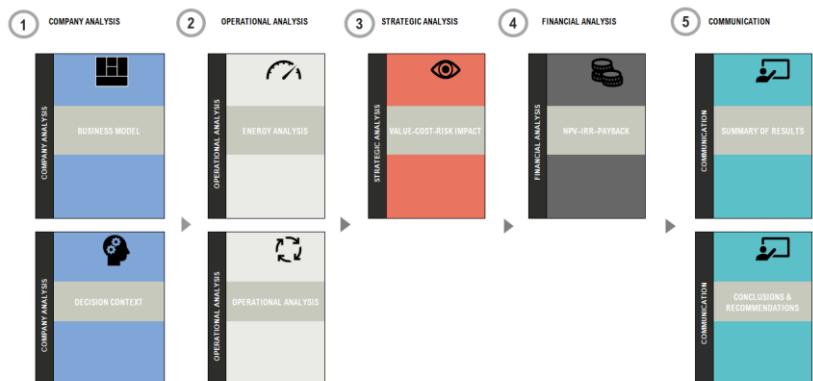
MBENEFITS The Software



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MBENEFITS – The Software

- A systematic, universal, flexible and easy-to-follow tool in 4 steps of analysis.
- A coordinated set of proven business management concepts.
- A checklist of 60 NEBs and 5 EBs.
- Not free: a reasonable user licence fee depending on the size of the buyer.
- Not open source: for harmonization and consistency purposes.



MBENEFITS software main menu - Version 35 – June 2025



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Analysis Summary

Figures of monetized NEBs are not disclosed for confidentiality reasons

BENEFICES NON ENERGETIQUES DES PROJETS EN EFFICACITE ENERGETIQUE / RENOUVABLES	DESCRIPTION DE L'IMPACT	IMPACTS OPERATIONNELS					ANALYSE STRATEGIQUE	TYPE DE BNE	RESSOURCES POSITIVEMENT IMPACTEES PAR L'INVESTISSEMENT Humain (HR), Organisationnel (ORG), Physique (PHY), Technologique (TECH), Réputationnel (REP), Financier (FIN)
		Human SÉCURITÉ	Human QUALITÉ	Human COÛTS	Human TEMPS	Human ÉNERGIE			
PRODUCTION & PRODUITS									
Réduction des défaillances ou des pannes de machines et d'équipements	Compresseur avec système de refroidissement neuf, et avec un seul réservoir								ORG, PHY, FIN
Fiabilité accrue de la production (après 3 an meilleur contrôle)	Le réservoir sera plus stable - identiques partout dans l'usine pas de perte de productivité							Qualitatif	ORG, FIN
Gains de productivité plus longs	Possibilité de produire plus de paniers car plus de surfaces automatisées au Air propreté de l'usine							Qualitatif	FIN
Fiabilité accrue de la production	Gain de temps sur des changements de layout. Réserve de T/M en moins							Quantitatif non quantifié	ORG, FIN
Réduction des consommables	Réduction du changement de filtres fin, 1 par an au lieu de 2 fois auparavant								FIN
Réduction des temps d'arrêt non planifiés	Réserve stable et sécurisée / pas d'arrêt prolongés des machines, pas d'impact CA								
DÉCHETS & EAU									
Réduction de la chaleur fatale	Réduction de la consommation électrique des compresseurs								PHY, FIN
Réduction de la consommation d'eau	Circuit d'eau fermé							Quantitatif non quantifié	PHY, FIN
Réduction des pertes de produits	Pas d'investissements qualité ni de rework concernant les problèmes de qualité d'air, mais les pièces sont retouchées							Quantitatif non quantifié	PHY, FIN
Réduction des autres déchets (par ex. consommables non dangereux)	Plus de points d'entretien du réparateur d'eau, 2 services par an au lieu de 4 par compresseur							Quantitatif non quantifié	PHY, FIN
MAINTENANCE & CONTRÔLE									
Coûts de maintenance corrective/prédictive en baisse	Maintenances correctives quand on se préoccupe d'eau								FIN
Réduction du coût des plaintes des utilisateurs et de la résolution des problèmes	oui, car réservoir stable, uniformément, à diffuser en fin avec les unités de production qui demandent des heures d'indirect							Qualitatif	HR, ORG, FIN
Coût de contrôle d'installations conformes	Contrôle préopéré sur							Quantitatif non quantifié	HR
ENVIRONNEMENT DE TRAVAIL									
Réduction du bruit	Passeage de 15% à 10% de fuite par réservoir, et optimisation de fonctionnement des compresseurs (différence comprise dans les gains énergétiques)							Qualitatif	HR
Confort thermique amélioré	Récupération de chaleur et air purifié							Qualitatif	HR, ORG, FIN
Amélioration de la motivation et de la loyauté du personnel	Confort thermique / diminution du bruit / plus d'unité de production							Qualitatif	HR, ORG, FIN
RÉDUCTION DES RISQUES									
Réduction du risque de défaillance de l'équipement	Garantie de 2 ans des compresseurs neufs et optimisation de fonctionnement entre compresseurs							Qualitatif	ORG, PHY, FIN
Réduction des risques climatiques (exposition à des événements extrêmes)	Oui, moins de paniers car extraction de la chaleur des compresseurs vers l'extérieur, risque d'arrêt lors de canicule							Qualitatif	ORG, FIN
AUTRES IMPACTS OPERATIONNELS, STRATEGIQUES ET FINANCIERS									
Dépenses d'investissement différées ou réduites	Révisions importantes à faire sur 3 compresseurs dans les 2 prochains années								FIN
Contribution à la vision ou à la stratégie de l'entreprise	Réduction des consommations énergétiques							Qualitatif	ORG
Contribution à la conformité réglementaire et à la production de rapports	Reconnaissance de la local - contrôle cercle							Qualitatif	
II. IMPACTS ENERGIE ET DECARBONATION DES APE									
Réduction des émissions de CO2	Le projet permettra de réduire la consommation électrique d'environ 65 MWh par an, correspondant à une réduction des émissions de gaz à effet de serre de 65 000 kg CO2e							Quantitatif non quantifié	REP, FIN
Réduction des risques liés au CO2 et au prix de l'électricité	Dans l'investissement, le site reste exposé aux fluctuations du marché de l'électricité. Pour une consommation totale de 65 000 kWh/an, voir								FIN
SCORE		17	23	31	24	13	11	21	15
NOMBRE DE BNE IDENTIFIES		23					22		
MAXIMUM		23 x 5 x 3 = 345 points					22 x 3 x 3 = 198 points		
TOTAL		108 / 345					47 / 198		

Color codes: white = no impact / green = minor impact / yellow = moderate impact / red = high impact



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MBENEFITS Case Studies

www.mbenefits.ch



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Case Study 1 - Industry



PLC Fas (CH)

Manufacturing Valves
for Industrial & Healthcare Use

**Greater Reliability, Capacity, and
Productivity for our Health Care
Products**

Complete modernization of the factory's compressed
air production and distribution systems



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Strategic Analysis

Step 3 – Strategic analysis

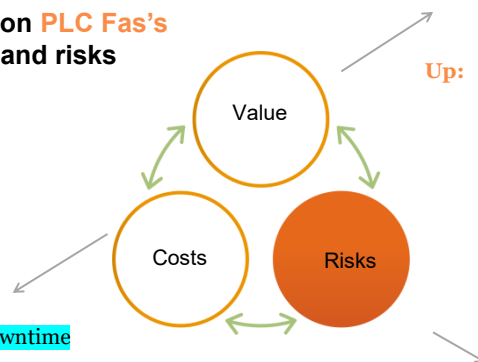
Value-Cost-Risk Analysis:

Impact of the investment on **PLC Fas's**
value proposition, costs, and risks

Benefits monetized and included in the
financial analysis

Down:

- Costs of unplanned production downtime
- Future investment costs
- Consumable costs
- CO₂ and energy price volatility costs
- Machine and equipment failures/breakdowns costs
- Predictive and corrective maintenance costs
- Energy costs



Up:

- Production reliability
- Production flexibility
- Product ranges possibilities (larger area is supplied with "Medic" clean air)
- Customer satisfaction
- Sales
- Staff satisfaction
- Governance and Control
- Success of sustainability strategy

Down:

- Operational risk: malfunctions / unplanned downtime
- Risk of business disruption
- Climate risk: resilience to heat waves
- Obsolescence risk



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Financial Analysis

EBs + NEBs:

- CAPEX*: -- CHF
- Investment income (t2 – T10) :
EBs = 25% / NEBs = 75%
- NPV: -- CHF
- IRR: 13,76%
- Payback**: 5 years and 4 months

EBs only:

- CAPEX* : -- CHF
- Investment income (t2 – T10):
EBs = 100%
- NPV: -- CHF
- IRR: -9,21%
- Payback: N/A

*CAPEX, investment income, NPV and IRR are not disclosed for confidentiality reasons. No subsidies included.

** = Simple payback.

Discount rate: 7 %

Investment duration: 10 years (i.e. number of years taken into account to calculate NPV and IRR)



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Why this Investment is Worth it:

Operational Impacts: increased Safety – Increased Productivity

- Fewer malfunctions and unscheduled downtime
- Lower future operating costs and capital expenditures (CAPEX)
- Increased capacity of the medical network
- Improved flexibility, stability, and control across the entire new network

Strategic Impacts: a Stronger Competitive Position

- Broader product range
- Increased customer satisfaction
- Increased sales and market share
- Reduced operational, obsolescence and climate risks
- Contribution to the sustainability strategy

Financial Assessment: Very Good

- Internal rate of return (TRI) : 13,25%
> 7% required by the Finance Dpt

*The MBENEFITS analysis
strongly recommends
this investment*



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Case Study 2 - Multi-occupancy Housing

next
IMMOBILIER

DES LIEUX
À VIVRE



Next Immobilier (CH)

Rental and Sale of Residential and Commercial Properties

OASIS - Greater Attractiveness and Yield

Full energy renovation of the OASIS building
(27 apartments – 2,000 m²)



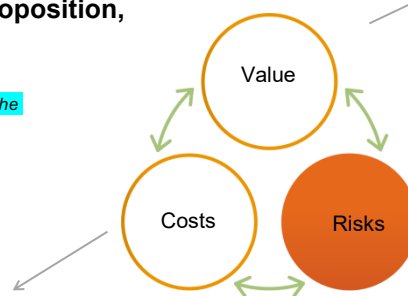
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Strategic Analysis

Step 3 – Strategic analysis

Value-Cost-Risk Analysis: impact of the investment on NEXT IMMOBILIER's value proposition, costs, and risks

Benefits monetized and included in the financial analysis



Down:

- Avoided future investment costs
- Corrective maintenance costs
- Costs of handling tenant complaints
- Energy costs

Up:

- Building quality (safety and comfort, aesthetics, services)
- Tenants' comfort and health
- Tenants' satisfaction
- Sales (rents)
- Governance (data quality)
- Success of the corporate strategy (sustainability, CSR)

Down:

- Commercial risk
- Operational risk (malfunctions, breakdowns)
- Financial risk (asset value higher, future investments avoided)
- Climatic risk (resilience to heat waves)



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Financial Analysis

EB + NEBs:

- CAPEX* : 5'260'000 CHF
- Investment income (t11-T45): CHF 213'640
EBs = 86% / NEBs = 14%
- NPV: 659'884 CHF
- IRR: 3,93%

EB only:

- CAPEX* : 5'260'000 CHF
- Investment income (t11-T45): CHF 29'500
EBs = 100%
- NPV: - 3'395'958 CHF
- IRR: -1,29%

*CAPEX : after deducting the CHF 280,000 grant.

Discount rate: 3,16 %

Investment duration: 45 years (i.e. Number of years taken into account to calculate NPV and IRR)

Why this Investment is Worth it:

Operational Impacts: Improved Safety and Quality – Lower Costs

- Tenants' safety preserved and improved
- Improved building quality (aesthetics, comfort, energy efficiency)
- Future tenant complaints, breakdowns, and malfunctions prevented, along with associated costs

Strategic Impacts: Next Immobilier's Competitive Position in the Market Strengthened

- Increased tenant satisfaction
- Higher rents
- Commercial, operational, climate (exposure to heat waves) and financial risks down
- Contribution to the climate and sustainability strategy

Financial Assessment: Very Good

- Internal Rate of Return (IRR): 3.93% > 3.16% required
- Future investments avoided
- Increase in asset value

The MBENEFITS analysis strongly recommends energy-efficient renovation of the OASIS asset

Case Study 3 - Services

ECONOLER 



Campus Notre-Dame-de-Foy

Multi-building post-secondary campus with academic facilities, residences, sports complexes, and community spaces

From Aging Infrastructure to a Future-Ready Campus

SOFIAC ESCO Project

Lighting & HVAC modernization, RCx, and smart hoods



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Strategic Analysis Value-Cost-Risks

Monetized NEBs included in the financial assessment

Reduced machine and equipment failures or breakdowns

Longer service life of mechanical equipment (more efficient devices)

Reduced maintenance costs related to lighting and boilers

Reduced cost of user complaints and resolution

Reduced staff turnover and associated costs

Capital expenditure deferred or reduced thanks to SOFIAC

Improved planning (better data quality and reliability)

Improved internal communication and collaboration

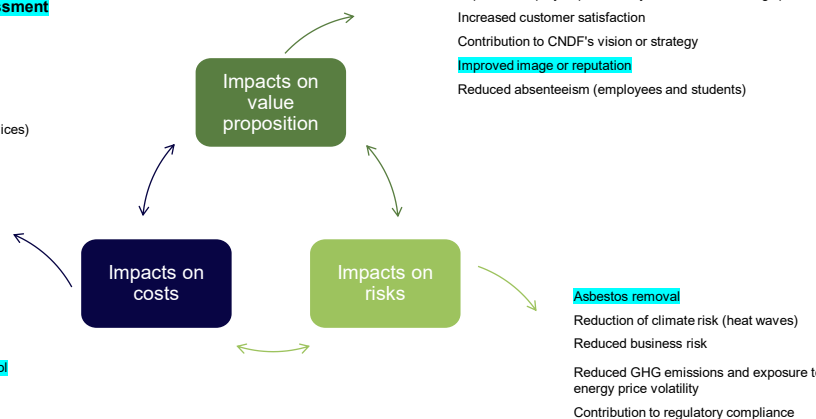
Organizational time savings

Increase in asset and market value

Reduced energy consumption and GHG emissions

Better process knowledge through training and automatic control

Reduced energy costs



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Financial Analysis

Energy Benefits & Non-Energy Benefits

CAPEX: 5,756,097 CAD

Subsidies: 3,053,872 CAD

Annual investment income: 347,776 CAD

NPV: 1,513,036 CAD

IRR: 12.51%

Simple payback: 7 years

Energy Benefits

CAPEX: 5,756,097 CAD

Subsidies: 3,053,872 CAD

Annual investment income: 233,989 CAD

NPV: 319,763 CAD

IRR: 8.19%

Simple payback: 10 years

Discount rate: 6.99%

Investment period: 16.8 years

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Why This Project Was Worth It

- **Operational Impacts: Improved Comfort, Reliability and Resilience**
 - Improved indoor air quality and thermal and visual comfort
 - Reduced equipment failures, maintenance needs and emergency interventions
 - Improved quality of teaching, accommodation, and sports facilities
 - Enhanced resilience to heat waves through newly available cooling capabilities
- **Strategic Impacts: CNDF's Competitive Position Strengthened**
 - Improved student, employee and stakeholder satisfaction
 - Enhanced institutional attractiveness and reputation through modernization and decarbonization
 - Reduced operational, obsolescence and climate-related risks
 - Strengthened CNDF's ability to fulfill its educational mission over the long term
- **Financial Assessment: Very Good**
 - IRR increased from 8.19% to 12.51% when NEBs are included
 - NPV increased from \$319,763 to \$1,513,036
 - Simple payback reduced from 10 years to 7 years

The MBENEFITS analysis confirms that implementation of the project was strongly justified.

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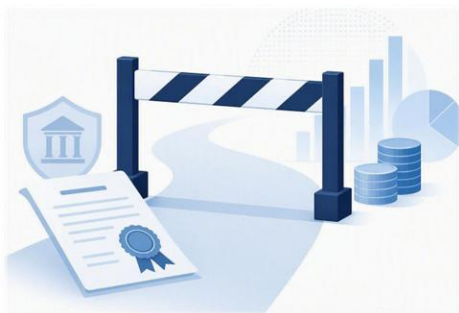
Current Situation and Next Steps



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CANADA

Strong momentum, but the full value is still invisible



- **Econoler** — 45 years tackling barriers to energy efficiency
- **Canadian context**
 - No shortage of retrofit opportunities, but few become investable, strategic projects, especially in the current economic climate
 - The NEB concept exists here; the systematic practice does not
 - Policy and market signals emerging, project-level uptake still early
 - Canadian evidence builds trust — CNDF is a first step



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MBENEFITS IN CANADA

From a first case study to mainstream practice



• Where we are

- Offered across Canada through Econoler
- ReCover: exclusive provider in Atlantic Canada
- Growing interest: accelerators, utilities, financial institutions, and federal and provincial programs
- Feedback from Canadian MBENEFITS Projects

• Next steps

- Embed NEBs in audits, business cases and program design
- Align with emerging international standards
- From promotion to practice: how projects are developed, financed and approved



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Current Situation in Europe

- The conventional EB approach remains overwhelmingly dominant: NEBs are rarely included in investment assessments, or in a very partial way.
- Professionals in the energy efficiency sector use sales pitches not tailored to business decision-makers.
- Business decision-makers are still being shown technical presentations that fail to address their priorities. As a result, strategic investment opportunities are missed.
- The level of investment in energy efficiency and decarbonisation is not sufficient to meet public targets for climate change mitigation and adaptation, and energy independence.
- The Multiple Benefits approach is slowly gaining traction.
- The market, although still small, is growing, as are MBENEFITS' reputation and sales.

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Next Steps

- **Public frameworks/policies.** The integration of the multiple benefits approach in energy and climate public policies is essential for a widespread adoption (and thus for more investments implemented).
 - USA: the USDOE has supported the development of the approach and the JUSTIFI tool, which is excellent news.
 - Switzerland: for the first time in Europe, public authorities —the Canton of Vaud— are testing the approach —and MBENEFITS— with the intention of integrating it into public energy (and environmental) assessment tools.
- **Energy-efficiency professionals.** Communication and training are needed to raise awareness and develop skills.
- **MBENEFITS:**
 - Development of a specialised version for the multi-occupancy housing sector.
 - A network of certified experts and partners.

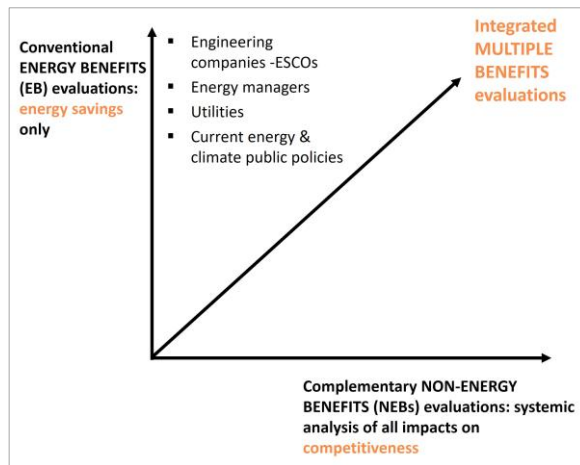


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Conclusion

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A Paradigm Shift Needed



- The Multiple Benefits approach delivers :
 - Methodology and data not a problem anymore.
 - It makes investments more strategic and more profitable. More appealing.
 - More investments approved and implemented.
 - Greater productivity and competitiveness for businesses.
 - Fewer public subsidies needed.
 - Energy and climate goals within reach.
- For this approach to become widely adopted, a paradigm shift is needed.

Thank you for your attention

catherine.cooremans@ipso-facto.ch



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References



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National Laboratory
of the Rockies

Mainstreaming Multiple Benefits with JUSTIFI

Sarah Cooney and Jibonananda (Jibo) Sanyal

10 September 2026

Unlocking Full Value of Energy Projects

Elevator Pitch: JUSTIFI is a free, open-source project valuation tool that helps industrial users identify and quantify the multiple benefits associated with energy productivity projects to support stronger business cases and more informed investment decisions.

Shift from selling energy cost savings to positioning strategic operational investments.



<https://justifi.ornl.gov/#/welcome>



Mainstreaming Multiple Benefits with JUSTIFI

Key Topics:

1. Summary of the JUSTIFI project and why it integrates continuous improvement methodology.
2. Our strategy for mainstreaming multiple benefits to foster sustained user engagement and advocacy.
3. Lessons learned from outreach, training, and results, including an ITAC student testimonial.

JUSTIFI



JUSTIFI is a free, open-source project valuation tool developed through a collaboration between Oak Ridge National Laboratory (ORNL) and the National Laboratory of the Rockies (NLR), with funding from the U.S. Department of Energy (DOE).

The platform is designed to help industrial users identify, quantify, and communicate the **multiple benefits** associated with energy productivity projects, supporting stronger business cases and more informed investment decisions.

Accomplishments

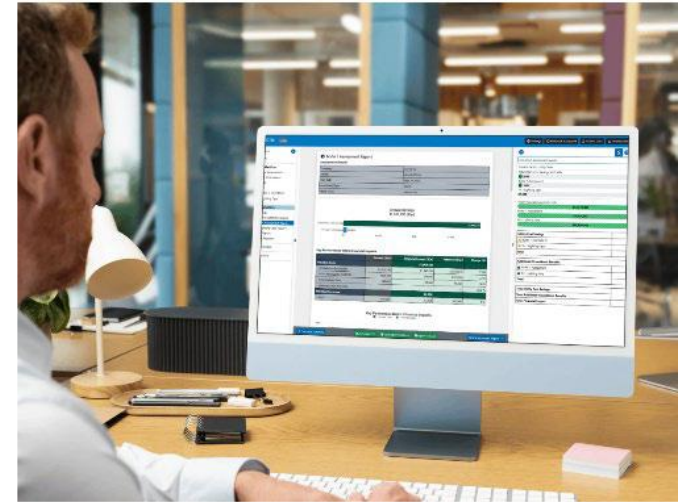
- Released JUSTIFI 1.0 in March 2026.
- Adapted continuous improvement tools for energy productivity projects.
- Launched the Multiple Benefits resources website to centralize guidance.
- Produced a communications toolkit and user guide to streamline onboarding.
- Engaged 10 manufacturing sites to validate methodology across sectors.
- Executed promotion campaigns and created adoption assets to drive engagement.

<https://aut.nlr.gov/manufacturing/multiple-benefits-of-manufacturing-energy-productivity>



JUSTIFI

The Project Valuation Tool



Acknowledgements- JUSTIFI TEAM

Core Team

- Kristina Armstrong, ORNL
- Mark Root, ORNL
- Gina Accawi, ORNL
- Leslie Jones, ORNL
- Jibo Sanyal, NLR
- Liz Wachs, NLR
- Roy Li, NLR
- Dan Rowlands, NLR
- Kelly Dwyer, NLR
- Julia Laser, NLR
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- Andreana Louis Roxas, formerly MSU
- Sydney Abbett- University of California Irvine
- Bruce Lung, formerly DOE
- Nate Roberts, formerly DOE
- John Slater, formerly DOE
- Crystal Bell-current DOE project lead, ORISE Fellow



Advisory Board

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- Kristen Cetin, Michigan State University, Industrial Training and Assessment Center
- Kody Powell, University of Utah, Intermountain Industrial Training and Assessment Center
- Tamara Cook, Leggett & Platt
- Yong Kwon, Sierra Club.

This work is being conducted in collaboration with Oak Ridge National Laboratory

Building the Business Case

What is the purpose of integrating widely recognized continuous improvement methodologies into JUSTIFI?

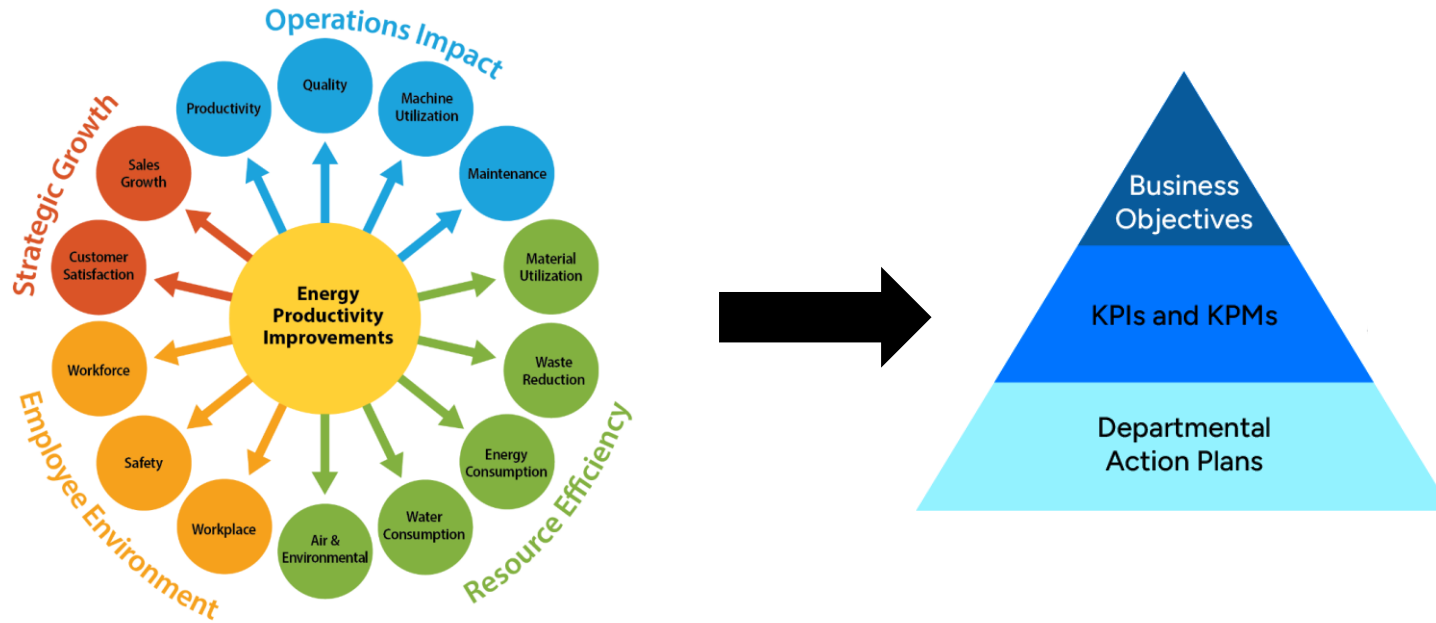
Building the Business Case

As you know energy initiatives undergo the same rigorous evaluation and approval process as other capital investments, competing for funding and strategic fit.



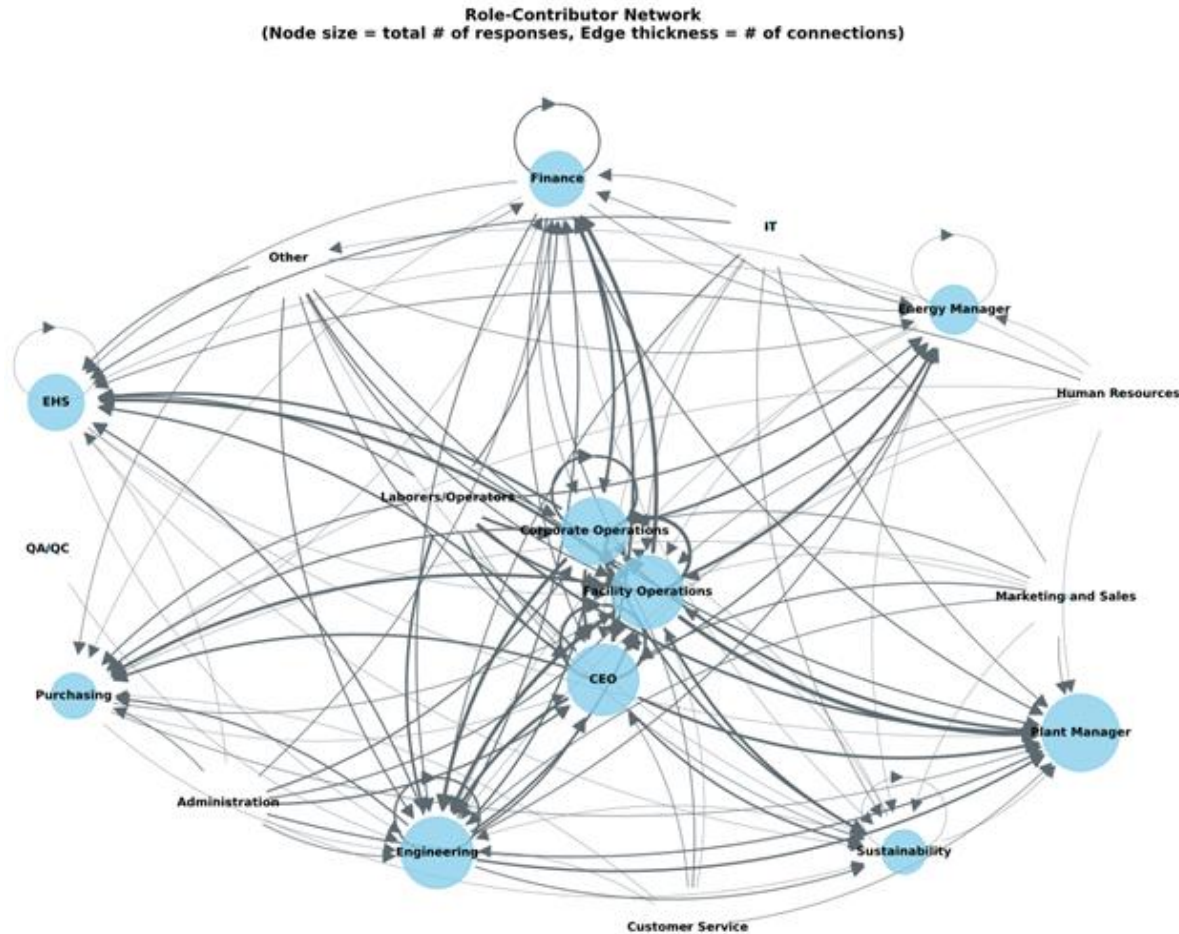
Building the Business Case

Multiple Benefits are Aligned with Performance Metrics



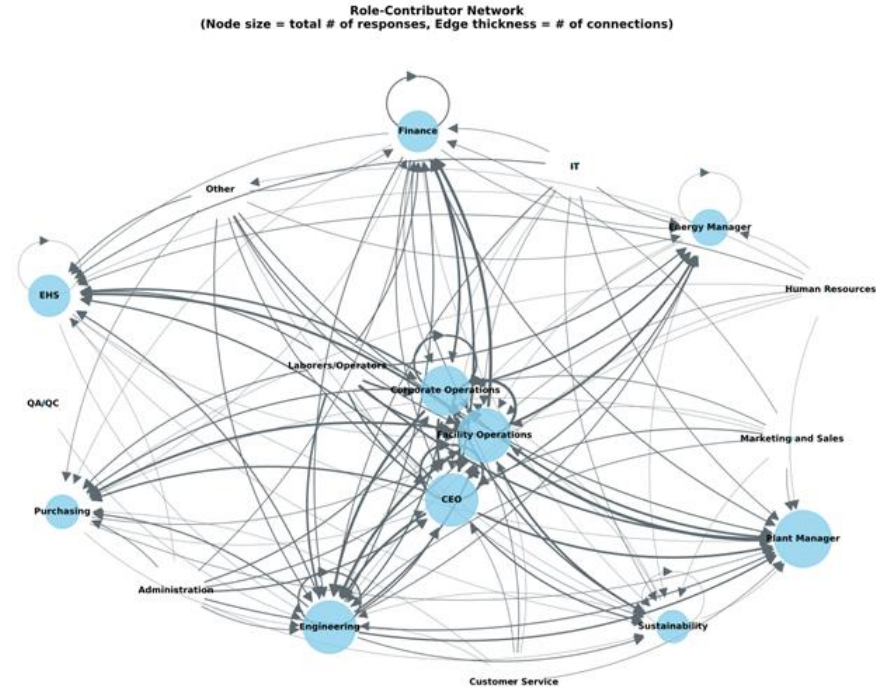
Graphic by Katie Carney, NLR

Decision Making for Capital is Complicated



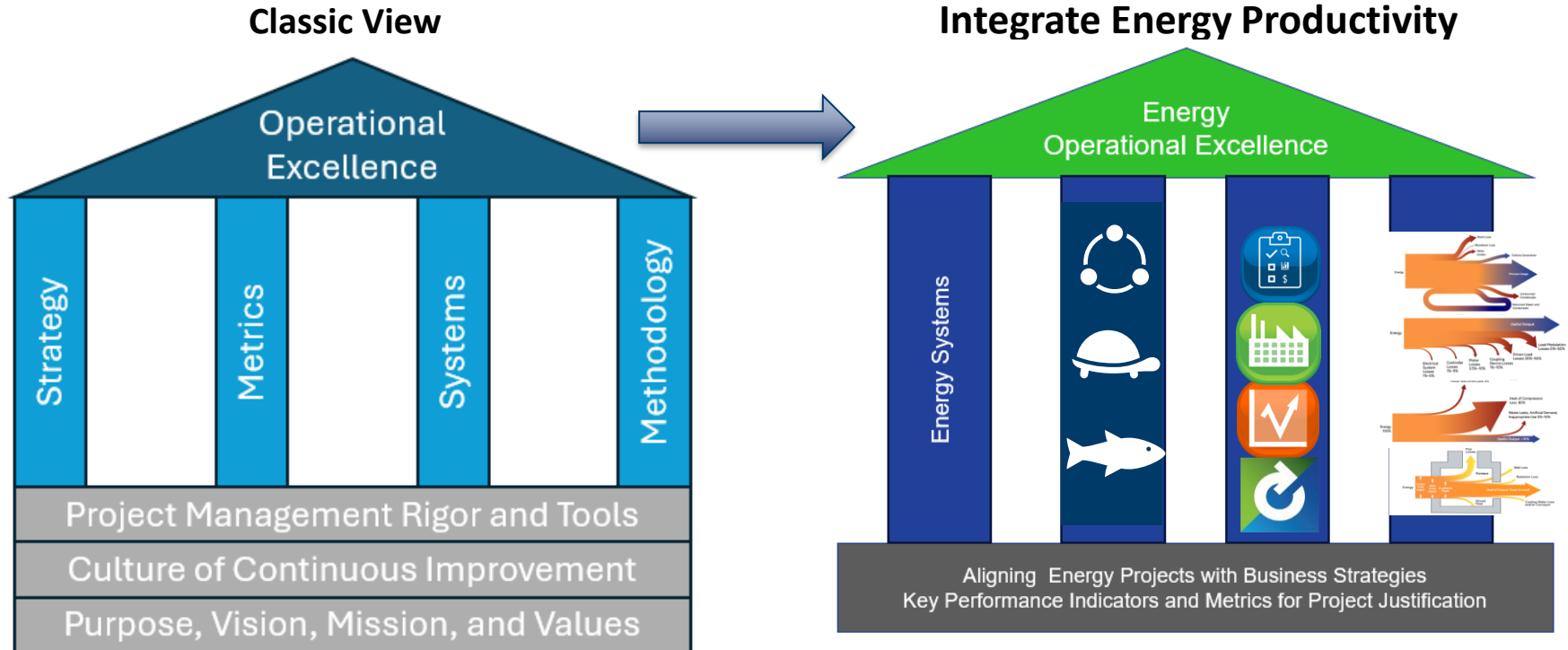
How do you manage this complexity?

A structured approach is essential—continuous improvement tools make it possible.



Using Continuous Improvement

Energy Projects Contribute Operational Excellence

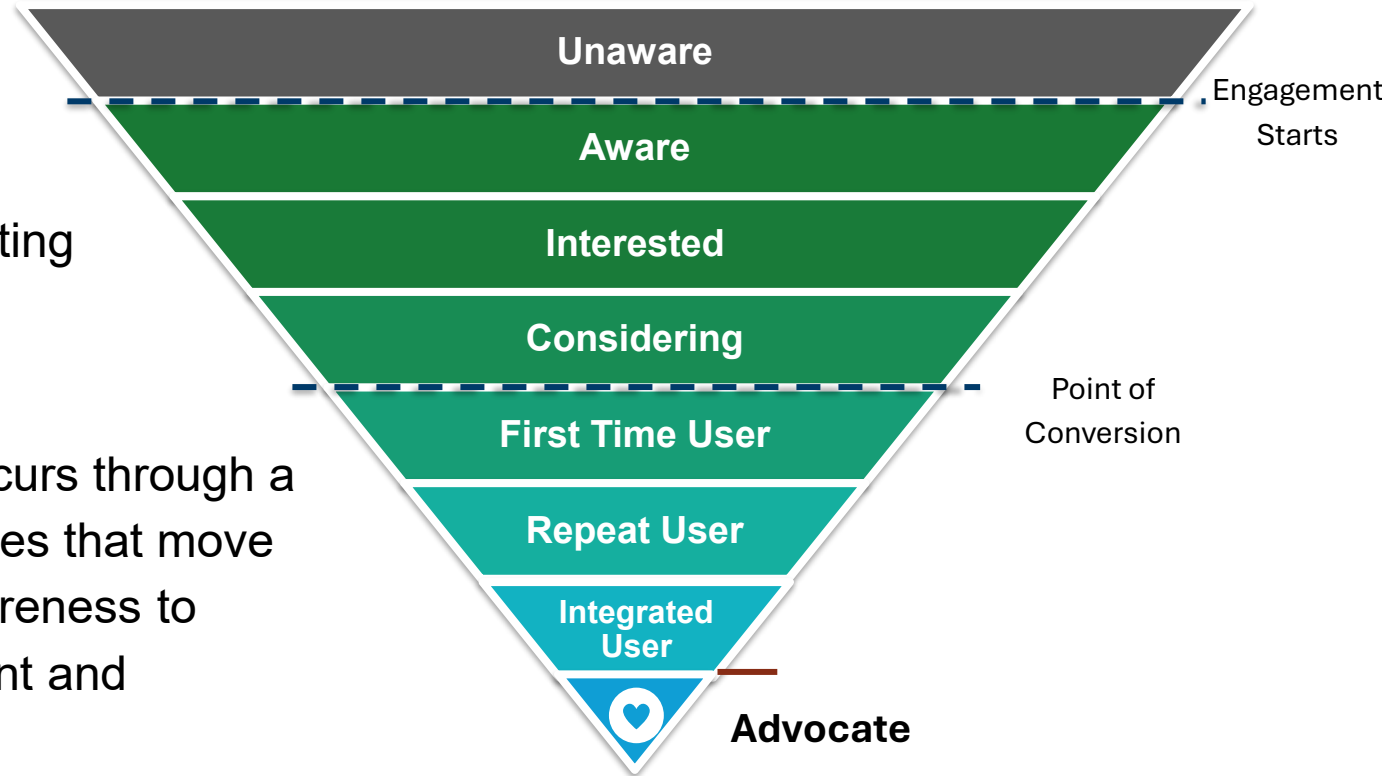


Strategy for Mainstreaming Multiple Benefits

- Implemented a product adoption funnel with targeted promotion and training to recruit and guide users.
- Developed assets to support the adoption strategy.
- Tracked and analyzed results.

Turning Awareness into Advocacy: Our Adoption Path

- Successful software adoption extends beyond simply attracting visitors or increasing downloads.
- Long-term growth occurs through a progression of activities that move users from initial awareness to sustained engagement and continued use.



Adoption Through Promotion and Training

- JUSTIFI's adoption strategy has focused on coordinated outreach and stakeholder engagement.
- We leveraged advisory board involvement, conference presentations, pilot demonstrations, and targeted training events like webinars and bootcamps.
- The team developed user guide, toolkits, and case studies to support onboarding.
- Media coverage and promotional assets helped build credibility and drive engagement.
- We continuously seek and integrate user feedback and lessons learned, aiming to move users from initial awareness to sustained advocacy and mainstream use.

Promotion and Training Assets

- JUSTIFI User Guide
- Centralized toolkit for consistent JUSTIFI messaging and outreach.
 - Ready-to-use materials for events, presentations, and digital channels.
 - Designed for flexible use by staff, partners, and trainers.
 - Supports customization while maintaining core messaging.
 - Includes templates, branding, and resource links.

When creating custom graphics that incorporate JUSTIFI logos or visual assets, users are encouraged to maintain consistency with the approved branding and messaging provided throughout this toolkit. Whenever possible, use the approved graphics and templates included in the [JUSTIFI Promotional Assets Folder](#).



JUSTIFI
The Project Valuation Tool



PMS: Pantone 285 C
HEX: #0079C2
RGB: 0, 121, 194
CMYK: 100, 38, 0, 24



PMS: Pantone 2955 C
HEX: #004874
RGB: 0, 72, 116
CMYK: 100, 38, 0, 55



PMS: Cool Gray 1
HEX: #D8D8D8
RGB: 219, 220, 215
CMYK: 14, 11, 12, 0

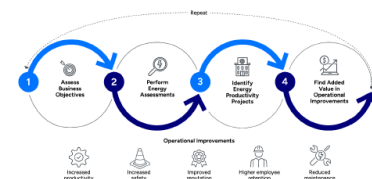


PMS: Pantone 447
HEX: #373A36
RGB: 55, 58, 54
CMYK: 85, 60, 64, 54

Infographic 1: DMAIC structure applied to energy project assessments; DMAIC is an acronym for "Define, Measure, Analyze, Improve, and Control".



Infographic 2: Multiple Benefits in the energy assessment process.



NATIONAL
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Energy Productivity Cause-and-Effect Fishbone Diagram

Instructions:

1. Select an energy project close to the head of the fishbone diagram.
2. Reflect on opportunities to talk to all or some of the contacts in these areas below.
3. Add notes that are missing.
4. Talk to contacts in these areas and ask them how this project could improve operations.
5. Gather data on quantifying the operational impacts.



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JUSTIFI

The Project Valuation Tool

Comprehensive User Guide

2026 - 2027



Assess the Full Value of Your Energy Productivity Projects

Traditional energy accounting methods often undervalue energy productivity investments by looking only at energy cost savings. Our free JUSTIFI software reveals multiple benefits' full value by capturing operational and financial cost savings, which can result in:

- Higher productivity and quality
- Lower maintenance and operating costs
- Improved workplace safety



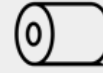
Case Studies and User's Feedback

To move users from initial awareness to sustained advocacy and mainstream use:

- We conducted training events with Better Plants program, ITACs, consultants, and others.
- We engage with manufacturers (10) from various sectors to integrate multiple benefits into energy assessment projects.

Let's hear from an ITAC student.

Case Studies Sectors



PAPER



AUTOMOTIVE



FURNITURE



AGRICULTURE



ADVANCED
MANUFACTURING



DEFENSE



BIOTECH



MINES



ENVIRONMENTAL
SERVICES

Luke Aurilia

Energy Assessment

Applying JUSTIFI to Real Industrial Projects

- As an ITAC analyst, I evaluate energy related improvements for commercial and manufacturing facilities.
- JUSTIFI allowed me to quantify multiple benefits in an easy way that is easy to communicate to facilities.
- My work this summer focused on applying JUSTIFI to real industrial measures (HVAC, compressors, casting equipment).
- **The goal:** make multiple benefit analysis an integral part of our process.

My Experience Using JUSTIFI

Inside of JUSTIFI:

- Entered baseline equipment performance, maintenance costs, and downtime.
- Modeled upgrade scenarios and quantified multiple benefits.
- Calculated ROI and payback periods in an easy way to understand.

Outside of JUSTIFI:

- Gathered facility data (Downtime logs, maintenance records, equipment quotes).
- Performed supplemental calculations when a measure required additional analysis.
- Built assumptions using facility data, previous assessments, and engineering judgment .

What I Learned & Results

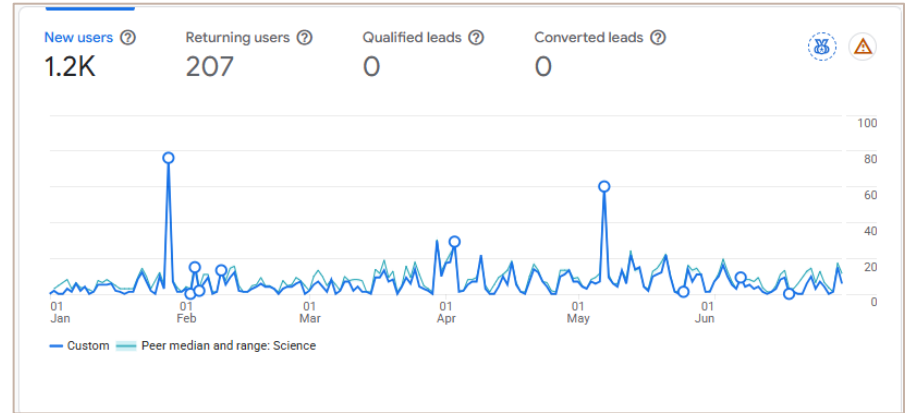
- Strong multiple benefit analysis requires good data and cooperation from facilities.
- JUSTIFI is flexible, reports and calculations can be updated at any time.
- JUSTIFI gives a consistent and easily defensible way to communicate multiple benefits.

Impact on Project Payback

	Energy Cost Savings			With Operational Cost Savings		
	Implementation Cost (\$)	Financial Impact (\$/yr)	Simple Payback (yrs)	Implementation Cost (\$)	Financial Impact (\$/yr)	Simple Payback (yrs)
Atlas Copco Air Compressor	\$112,661	\$1,287	87.54	\$112,661	\$94,087	1.2
Steam Generator	\$4,000	\$49	81.63	\$4,000	\$1,888	2.12
Casting Oven	\$1,000,000	\$6,059	165	\$962,160	\$449,299	2.14
Space Heater	\$27,700	\$1,750	15.83	\$27,700	\$2,020	13.71
Total	\$1,144,361	\$9,145	121	\$1,106,521	\$547,294	2.02

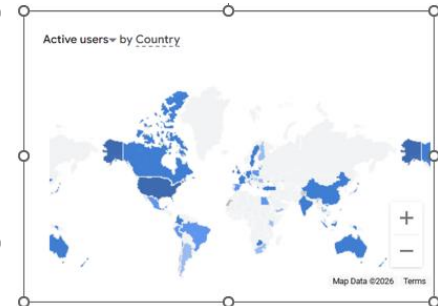
Results

- From 3 of 10 Projects (so far):
 - \$120,000 energy cost savings.
 - \$1,100,000 multiple benefits cost savings.
 - More than cut payback in half.**
- User Growth & Engagement 1.0 Release
 - 1,200 new users** Jan-Jun 2026. Over 2,200 total new users.
 - Nearly **9,700 page views**,
 - Returning users -more than a brief informational visit.
 - Average engagement time – 2mins.**



Core User Activities

User Activity	Event Count
Add Process Equipment	756
Add Energy Equipment	534
Add Energy Opportunity	488
Add Facility	464
Add Assessment	435
Add KPI	369
Add Multiple Benefits (MB)	319
Add Company	236
Add Contact	89
Add On-Site Visit	76
Add KPM Impact	57
Generate Report	20



Lessons Learned

- We have curious users who are not yet using JUSTIFI to its full potential.
- Curiosity extends beyond energy efficiency projects.
 - We are often asked, “Can you use with/for buildings, data centers, general projects, on site power generation projects, utilities’ interests, financing organizations, vendors, new technology, etc.?”
- Training and resources are not one size fits all- need to tailor to stakeholder whether experienced or new learner.
- Folks are excited to hear if plans exist for AI integration.
- Big challenge is how to move from “tacked on at end” to integrated into workflows.



<https://justifi.ornl.gov/#/welcome>

sarah.cooney@nrl.gov

Q&A

www.nlr.gov

NLR/PR-5700-102150

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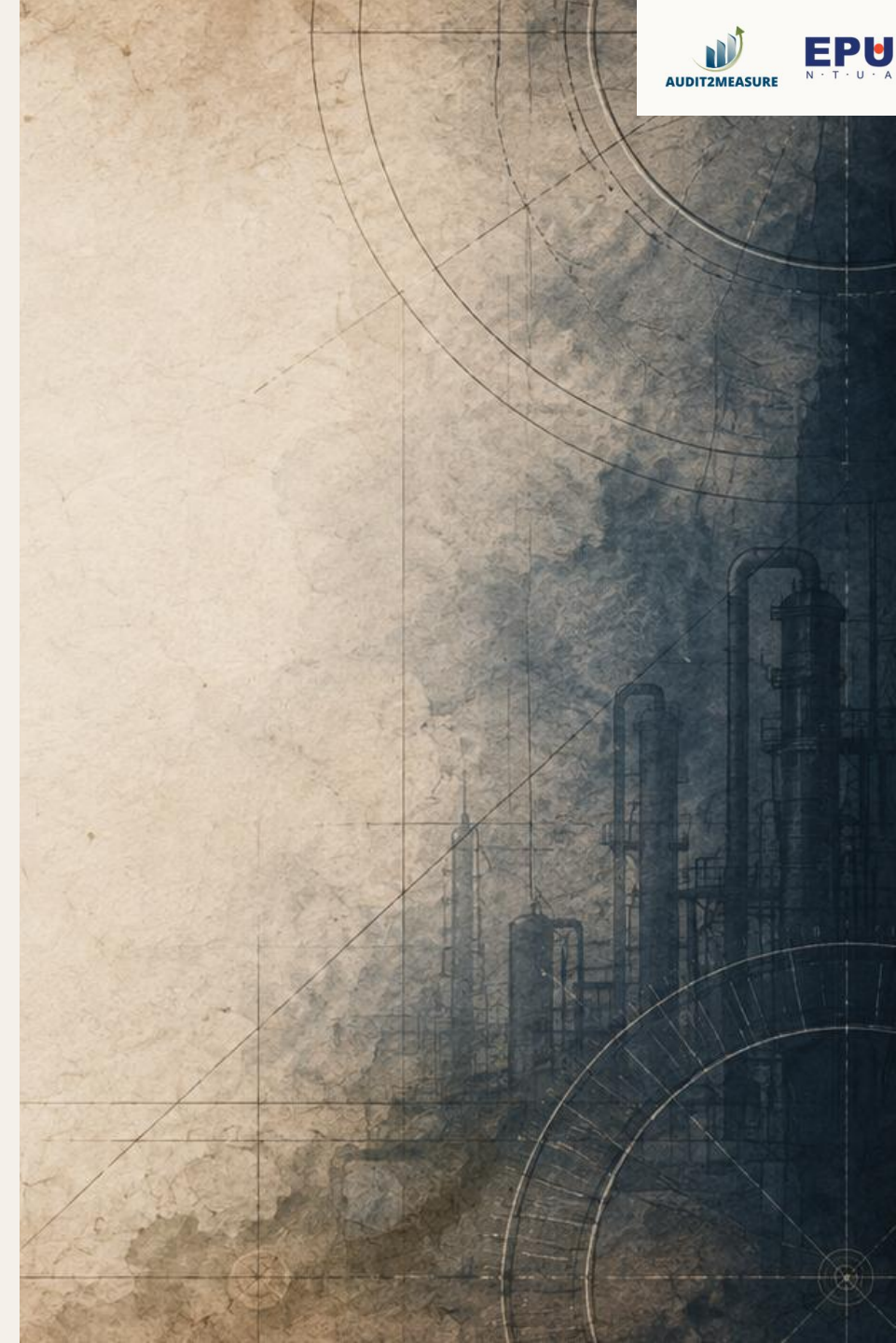
This work is being conducted in
collaboration with Oak Ridge
National Laboratory

Assessing non-energy benefits at the energy-saving measure level

Evidence from European industrial energy audits
through Audit2Measure

Nikos Vourgidis
PhD candidate
School of Electrical and Computer Engineering
National Technical University of Athens

IEA webinar, 10 September 2026



Audit2Measure: moving from energy audits towards implementation

Audit2Measure developed the Audit2Action Strategy to help companies convert energy-saving opportunities identified in audits into implemented measures. The project addressed adoption barriers and provided evidence, tools and direct support for assessment and knowledge exchange.

DESK RESEARCH

National audit systems

Adoption barriers

Decision pathways

Financing mechanisms

ANALYTICAL TOOLS

A2M ESM Performance
Assessment
Framework

A2M Database

A2M Energy
Management
Maturity Model

Evaluation of NEBs

DIRECT INDUSTRY SUPPORT

Capacity building program

Executive engagement, staff training and workshops

Energy-saving opportunities

One-to-one identification, analysis and quantification new energy saving opportunities

AUDIT2ACTION STRATEGY

Evidence and tools translated into company action plans and implementation support

NEBs already appear in energy audits — but not systematically

SURVEY BASE

**31 industrial companies
and 35 energy auditors**

Five countries

Czech Republic, Greece, Italy, the
Netherlands and Spain

Interpretation

Qualitative case studies. The sample was small
and not statistically representative.

COMPANY PERSPECTIVE

67%

14 of 21 audited companies said their
audit report mentioned non-energy
benefits.

ENERGY EXPERT PERSPECTIVE

60%

21 of 35 auditors said they mentioned
non-energy benefits in audit reports.

40%

of surveyed
auditors did
not report
mentioning
NEBs

Companies and experts see different parts of the business case

COMPANIES MOST OFTEN RECOGNISED

- Carbon footprint and climate
- Health, safety and working conditions
- ESG indicators and resource protection

ENERGY EXPERT VIEW

Broadly similar priorities

Auditors selected reduced maintenance much more often than companies did.

Product quality, productivity and maintenance benefits were less visible in the company responses.

RESPONSES

TECHNICAL AND ENERGY STAFF

Analyse opportunities and prepare proposals, usually using energy-cost savings and conventional cost-benefit calculations.

BOARD OR SENIOR MANAGEMENT

Makes the final investment decision in most surveyed medium and large companies.

Communication implication

The benefits most frequently associated with ESM at measure level may remain absent from the company investment narrative.

From 3,191 ESMs to a focused NEB evidence base

FULL A2M DATABASE

3,191

energy-saving measures

9

industrial sectors

Technology group	Number of ESM
Process heating / cooling	31
Processes	20
Drives / engines / pumps	15
Power generation	13
Compressed air	11
Lighting	11
Other	10
HVAC systems	8
Building envelope	3
ICT	3

NON-ENERGY-BENEFIT WORKBOOK

125

complete ESM records

8

countries

9

industrial sectors

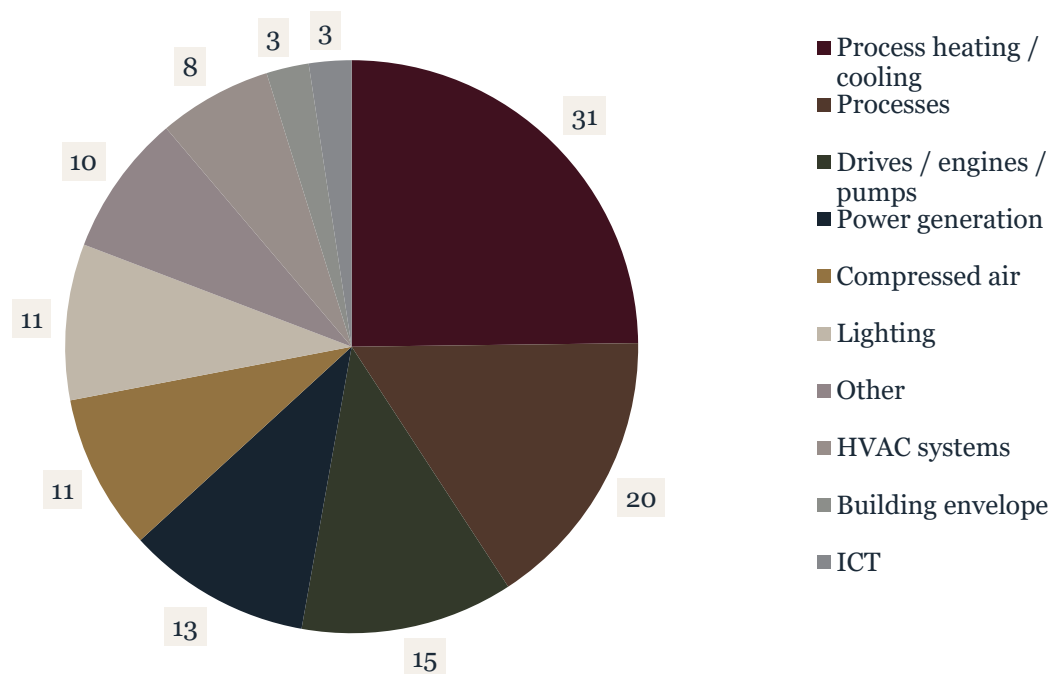
Industrial sector	Number of ESM
Metal	21
Plastics	20
Machinery	18
Chemicals	16
Food	14
Ceramic	12
Pharmaceuticals	9
Pulp & Paper	9
Automotive	6

Data note

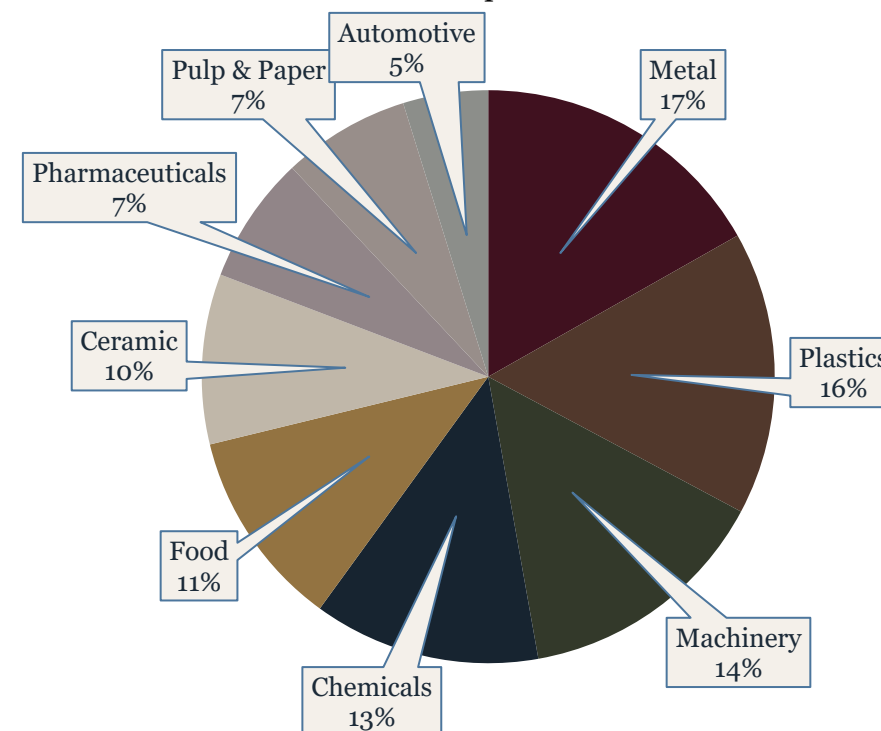
The ESMs were collected using a standardized data collection template addressing over 60 data points including ESM description, anonymized industry operational data, energy savings, carbon savings, technology group, ESM CAPEX, technoeconomic indicators

The NEB evidence spans technologies and industrial sectors

Technology-group distribution



Number of ESM per industrial sector



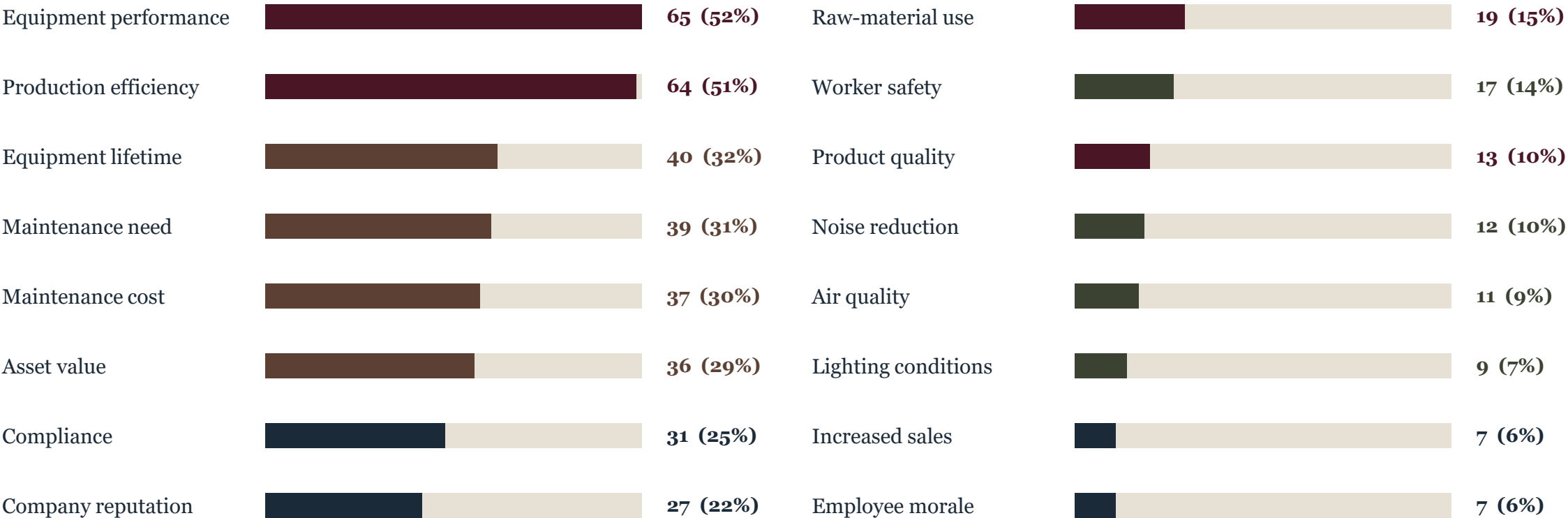
A structured framework to identify and map 16 non-energy benefits

PRODUCTIVITY	OPERATION & MAINTENANCE	WORK ENVIRONMENT	OTHER BUSINESS BENEFITS
Product quality	Maintenance need	Lighting conditions	Corporate reputation
Production cost	Maintenance cost	Air quality	Compliance
Production efficiency	Equipment lifetime	Noise	Sales
Equipment performance	Asset value	Worker safety	Employee morale

Energy experts marked each perceived applicable benefit for each Energy Saving Measure.

Operational benefits dominate the measure-level evidence

Number of measures with each indicator, n = 125



Operational concentration

Equipment performance and production efficiency appear in just over half of the records.

Maintenance cluster

Maintenance need, cost and equipment lifetime form the second most frequent group.

Rarely attributed

Sales and employee morale appear in only seven records each.

A broader evidence base can improve the audit recommendation

CONVENTIONAL AUDIT VIEW

Energy savings

Investment cost

Simple payback

EXPANDED BUSINESS CASE

Energy and carbon

Financial case

Productivity and O&M

Working conditions

Wider business effects

Measure-level NEB information can make the recommendation relevant to the managers who carry the operational effects and approve the investment.

From Audit2Measure to BUSINESS2ACT

AUDIT2MEASURE

- Which NEBs are associated with which measures?
- Which benefits appear most frequently?
- Where are company and expert perceptions misaligned?

BUSINESS2ACT: NEXT METHODOLOGICAL STEP

- How does the benefit relate to wider sustainability and ESG objectives?
- How can the NEB be incorporated into the post-audit Action Plan presented to management?
- How can follow-up and standardisation make the evidence more comparable and credible?

BUSINESS2ACT in nutshell

The project's goal is to accelerate the green transition of European industry while strengthening competitiveness.

BUSINESS2ACT continues the move from audit recommendations to measures that companies can assess, prioritise and implement.

CONSORTIUM

Ten partners, one mission

To accelerate the green transition of industries while boosting its competitiveness.



BUSINESS
2ACT



EED ARTICLE 11

Businesses identified by energy-consumption threshold

COMPANY UPTAKE

Support for implementing audit recommendations

EU COORDINATION

Partners, companies and policy stakeholders

BUSINESS2ACT objectives and methodology



The project develops a practical route from energy audits to company Action Plans, field implementation and wider uptake.

IMPLEMENTATION PATHWAY

01

Identify and motivate

Locate businesses around the EED Article 11 thresholds. Use self-assessment and tailored motivation packages.

02

Build the Action Plan

Translate audit measures into technical, financial and implementation information. Integrate NEBs, ESG/CSRD links and EnMS.

03

Test and refine

Test with companies in at least 12 countries. Use feedback from decision-makers, auditors and EU stakeholders.

STANDARDISATION AND HARMONISATION

Engage national standardisation bodies, CEN/CENELEC and ISO throughout the project.

Link energy audits and EnMS with NEBs, ESG indicators and CSRD procedures.

Use their feedback to harmonise the Action Plan with legislation and support integration into new or revised standards.

ACTION PLAN OUTPUT

Audit measures with ownership, timing, finance, NEBs, ESG/CSRD relevance and implementation priorities

Key Takeaways

1

NEBs are already recognised, but their treatment in energy audits is not systematic.

2

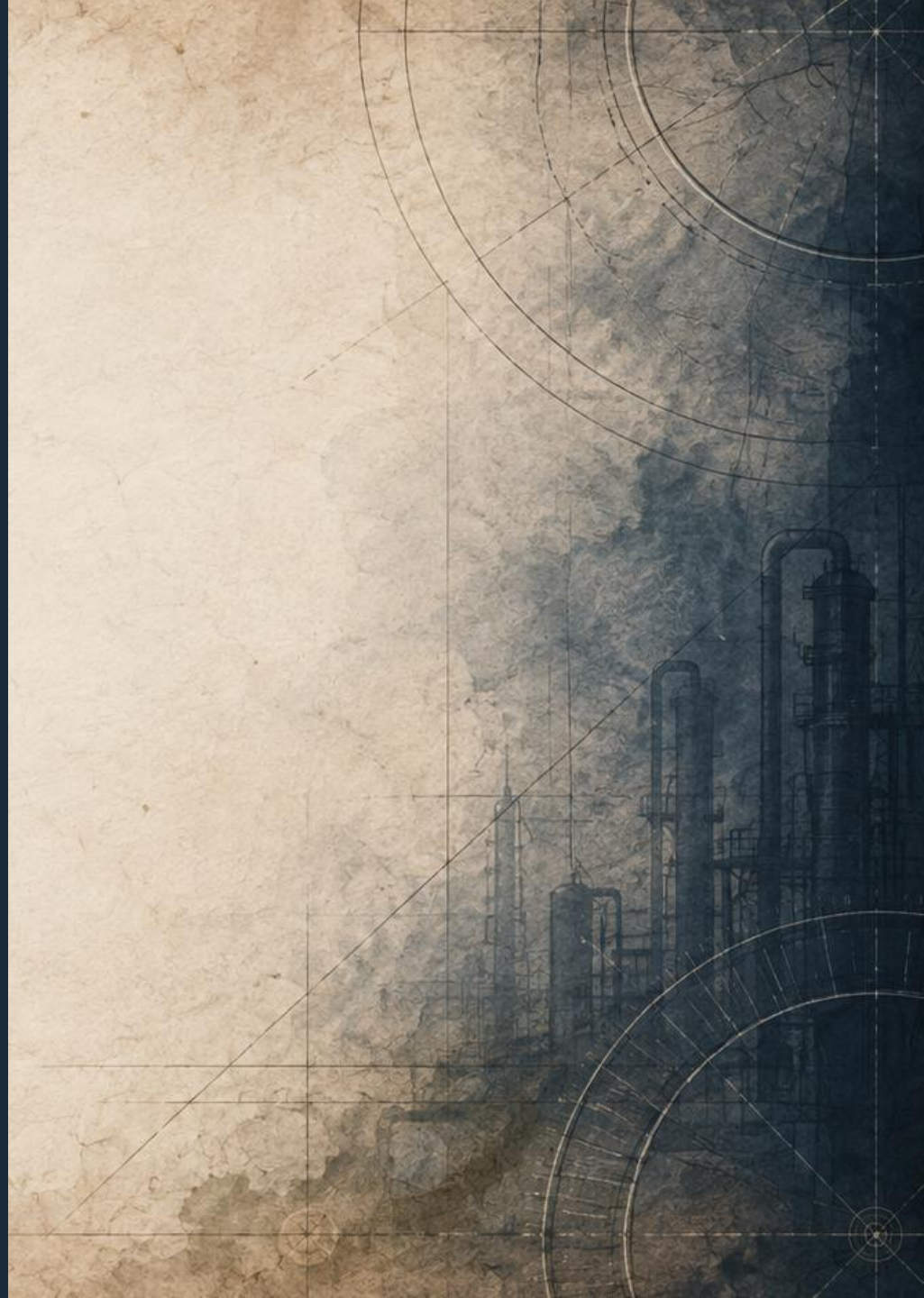
The strongest measure-level signals are operational: production efficiency, equipment performance, maintenance and equipment lifetime.

3

The next step is to connect ex-ante assessment with ex-post evidence

**Thank you for your
attention!**

Questions?



IEA Webinar – Multiple Benefits of Energy Efficiency for Business · 10 September 2026

European Standardisation of Non-energy Benefits

CEN-CLC/JTC 14/WG 4 · Work Item JT014023

Prof. Dr. Clemens Rohde

Wuppertal Institute · Nominated expert, CEN-CLC/JTC 14/WG 4

The projects are sound. The business case doesn't fly.

What the energy team brings

Annual energy savings in kWh and €
Payback period, measured against a baseline
Evidence from an EN 16247 audit or an ISO 50001 system

What the investment committee asks

What does this do to margin, output and product quality?
Which risks does it remove – and which does it create?
How does it land in our reporting and our rating?

Both sides are right. Neither has a shared method, shared metrics or shared evidence.

Good projects are not rejected because they are bad. They are deferred because they are illegible – the value is real, but it is not in a form the money side can act on.

Why a standard, and not another method?

The three approaches you have just seen work. A standard is what makes a method usable by people who did not develop it.

One language

Same terms, categories and boundaries – for the plant, the auditor, the ESCo and the bank

Repeatable

A defined sequence with 'shall' requirements, not a bespoke consultancy exercise

Verifiable

Ex-ante assessment and ex-post verification against declared KPIs; open to third-party audit

Referenceable

Can be cited in contracts, tenders, due diligence and disclosure – and by policy

A method convinces one company. A standard changes what a market expects to see.

The regulatory pull already exists

EED (EU) 2023/1791, Art. 11(7)

Member States shall support SMEs in quantifying the multiple benefits of energy efficiency measures

Recommendation (EU) 2024/2002

Sets out the multiple-benefits approach to promoting investment – beyond energy savings alone

Recommendation on cost-benefit methodologies (2026)

Guidelines for applying the energy efficiency first principle – explicitly beyond classical CBA

CSRD · ESRS · EU Taxonomy · CSDDD

Non-energy impacts are already reportable – they are simply not yet assessable in a comparable way

Policy now asks organisations to quantify multiple benefits. It does not say how.

That gap is what the work item was written to close.

Who is writing it – and where we are

CEN-CLC/JTC 14 / WG 4

Joint Technical Committee 14 – ‘Energy management and energy efficiency in the framework of energy transition’

Working Group 4 – energy and financial aspects

Chair: Ettore Piantoni (UNI/CTI)

Secretariat: Standards Norway

Around 15 nominated experts: national standards bodies, research institutes, manufacturers, ESCo associations, energy agencies, consumer representation and the European Commission (CINEA)

2022

Preliminary Work Item adopted by JTC 14

Feb 2025

Activated as a New Work Item – unanimous, 13 positive votes, experts nominated from 13 countries

2025–2026

More than ten working meetings; successive drafts

Now

Draft being finalised in WG 4

Next

CEN Enquiry → Formal Vote → European Standard

Where the standard fits

Upstream – what the measure is

EN 16247 – energy audits
ISO 50001 / 50005 / 50009 – energy management
ISO 14001 – environmental management
ISO 50100 – decarbonisation

The gap this work item fills

prEN – Values and benefits of decarbonisation and energy performance actions
A general framework for assessment
Work Item JT014023

Downstream – what it is worth, how it is reported

EN 17463 (VALERI) – valuation of energy-related investments
EN 17669 – energy performance contracting
ISO 50006 / 50015 – indicators, measurement and verification
CSRD / ESRS, EU Taxonomy, IWA 48, IWA 42

The left tells you what to install. The right tells you how to report it.
Neither tells you what the measure is worth to the business beyond the kilowatt-hour.

What the standard actually does

It specifies

- Principles and requirements to assess, validate, verify and monitor energy and non-energy impacts
- A framework of quantitative and qualitative KPIs – economic, environmental and social
- Ex-ante assessment and ex-post verification of the same indicators
- Rules for monetisation – and rules for what must not be monetised
- Applicable to any organisation: public or private, any sector, any size

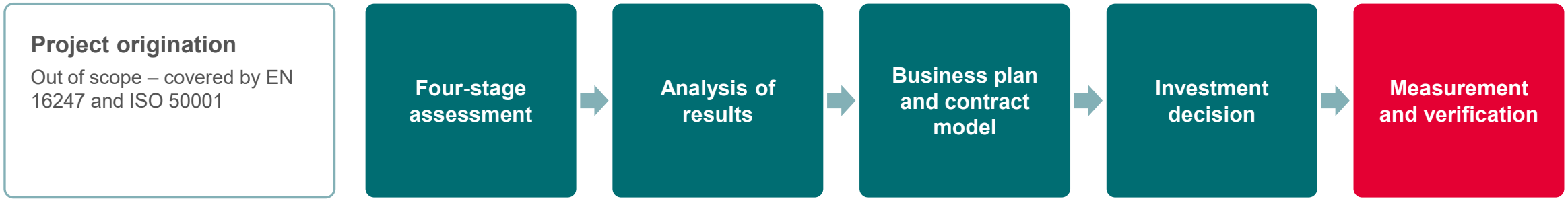
It deliberately does not

- Decide which measures to implement – that is the energy audit or the management system
- Replace EN 17463 – the financial valuation method is referenced, not rewritten
- Impose a fixed catalogue of benefits – the list of non-energy impacts is informative
- Assume an industrial site – buildings, services and public bodies are in scope too

Target user: the decision maker – and everyone outside the organisation who has to believe them.

Investment committees, financial institutions, ESCos, auditors, rating agencies, public funders.

One process, from origination to verification



The standard covers everything after the measure has been identified – including what happens after the money is spent.

Non-energy benefits claimed ex-ante have to be measured ex-post, against the same indicators, for the lifetime of the measure.

Who runs it

The organisation itself, an ESCo, a consultant or a rating agency – signed off by management

What it produces

A business plan with energy and non-energy cash flows, a risk allocation and an M&V plan

Where it lands

A documented investment decision: approve, defer or reject – with reasons on the record

The four-stage assessment

1

Context and scope

Which internal and external stakeholders does this measure touch? Which energy and non-energy impacts are on the table, and are they material?

2

Energy and operations

Correlation mapping: energy carriers → energy uses → processes → operational KPIs. Where does the measure actually show up in the plant?

3

Competitive advantage

Value proposition, costs and risks – the three dimensions after Cooremans. Does this measure make the organisation harder to beat?

4

Financial assessment

Monetised energy and non-energy impacts feed NPV, IRR and payback, following EN 17463.

Sequential and iterative – stage 4 regularly sends you back to stage 2.

One chiller, six conversations

Replace the chillers

Higher efficiency, low-GWP refrigerant

Operations

Chilled-water availability, cooling-tower load, process stability

Sales and marketing

Production rate, downtime, scrap rate – product quality and delivery

Human resources

Refrigerant safety, working conditions, training needs

Finance

Capex and opex, project return, disclosure obligations

Sustainability

F-gas compliance, EU Taxonomy alignment, ESRS reporting

IT

Data-centre cooling: PUE and reliability

The energy engineer sees kilowatt-hours. Five other functions see something they care about more.

The standard forces those conversations to happen before the investment decision – and to be written down with an indicator attached.

The hard part: what counts as a euro

● Measurable and monetisable

Into the cash flow. Direct market value, avoided cost, willingness to pay or accept.

Scrap rate: 400 → 100 rejected parts per year at €400 per part = €120,000 per year

● Measurable by proxy

Into the cash flow, with the assumption documented and justified.

Absenteeism: 1,000 → 670 hours per year at €40 per hour = €13,200 per year

● Not measurable

Out of the cash flow, into the narrative. Prudential value: zero.

Contribution to biodiversity, brand reputation: reported and carried forward, never hidden

Signed off by the financial manager

Credibility is the whole product. A number the CFO will not defend is worse than no number.

What is still missing

1 A number a CFO will defend

Monetisation that survives an audit rather than one that wins an argument. Standardised assumptions, documented, comparable between companies.

2 Evidence after the fact

Ex-post verification of non-energy benefits at scale. Without it these stay claims – and claims do not lower the cost of capital.

3 Demand from the financial side

Financial institutions have to start asking for this in due diligence. Companies produce what they are asked for.

The standard can supply the language. The market has to start speaking it.

Comment through your national standards body when the draft goes to Enquiry.

Thank you very much for your attention!

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