Multiple benefits of energy efficiency

M-Benefits: D2.2 Guidelines for Protocols, Interventions and Evaluations

Authors: Gavin Killip, Catherine Cooremans, Tina Fawcett

Based on work by: Catherine Cooremans, Wina Crijns-Grauss, Tina Fawcett, Gavin Killip, Subramani Krishnan, Matthias Reuter, Fabian Voswinkel, Katharina Wohlfarth

© The Multiple Benefits of Energy Efficiency project and its partners

Document number: v1.0

Publishing date: 31 August 2018

Project deliverable: D2.2

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Project partners

Fraunhofer ISI

BPIE

FIRE
FEDERAZIONE ITALIANA PER L'USO RAZIONALE DELL'ENERGIA

Environmental *Change* Institute
eci
UNIVERSITY OF OXFORD

BORGOCO

National Technical University of Athens

eceee
european council for an energy efficient economy

Unil
UNIL | Université de Lausanne

KAPE

Graz ENERGYAgency

Hes·so
Haute Ecole Spécialisée de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts Western Switzerland

Utrecht University

Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
FH Zentralschweiz

IREES
Institute for Resource Efficiency and Energy Strategies

ISR - University of Coimbra

www.mbenefits.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Table of Contents

Summary

This document summarises the key findings from a ‘rapid evidence assessment’ literature review conducted by four project partners (the Universities of Oxford, Utrecht and Lausanne; and the Fraunhofer Institute). The methodology and literature review are available as separate documents of the M-BENEFITS project.

It uses finding from the literature to offer:

- Insights on how to influence the investment decisions made by firms
- Protocols for data collection and comparison
- Guidelines for developing training materials and other resources for practitioners
- Criteria and procedures for evaluation of projects

The aim is for practitioners to be enabled to identify the multiple benefits of energy efficiency or energy management investments which also offer strategic benefits to the firm. This should help increase uptake of efficiency measures. The focus is on for-profit companies, particularly those active in goods manufacturing or services.

The task of conducting firm-level and project-level analysis of multiple benefits is not at all well established. Initial work strongly suggests that the task will require new kinds of analysis compared with conventional energy efficiency assessments and evaluations.

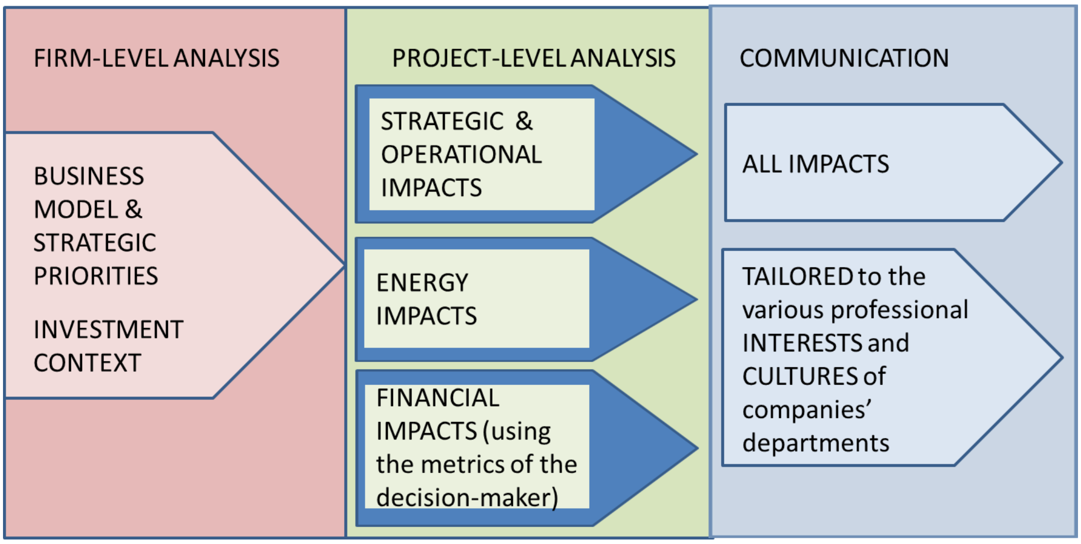
Making progress will involve several major changes to working practices, requiring:

- Different skills
- Different concepts
- Different evaluation methods
- Different ways of reporting

This document has been created within the first six months of the project, and based on the literature review stage only. We expect its findings to be used, debated and refined throughout the course of the project, as the empirical work progresses. It should be regarded as a starting point which will be built upon, rather than final conclusions from M-BENEFITS.

Conducting analysis for decision-making and investment by firms

In order to understand how to influence the energy efficiency decisions made by firms, practitioners need insights into how these decisions are likely to be made. This means making the effort to understand who makes the decisions, what the underlying values and logic of decisions really are, and which tools (including financial analysis methods) are used. Based on Cooremans’ theoretical work, a simplified model of three different steps of analysis is shown in Figure 1 and discussed in the following sections.



Source: Adapted from Cooremans' previous work, for references see report D2.1

Figure 1: A comprehensive approach to firm-level MBs, integrating strategic & cultural factors

Firm-level analysis

Firstly, it is important to understand the firm's overall business model, including, when possible, any existing future development plans in the short- or longer-term, in order to understand the firm's sources of competitive advantage. Competitive Advantage is a well-established concept in business management, for which the components of analysis are:

- Value proposition – the value which a firm is able to create for its customers
- Costs – of delivering the value proposition
- Risks – of delivering the value proposition

Secondly, the investment context must be considered. This involves investigation of how decisions are made within the firm, including taking into account the following variables:

- Tools and resources used internally to assist decision-making and to drive the decision-making process.
- External environment, including how it is monitored and reflected in decisions
- Organisational context, including the structure, culture and management systems of the organisation
- Individuals and groups, including the influence of leaders, champions, departments and others on decisions
- Priorities regarding characteristics of projects

Project-level analysis

Having identified the sources of a firm's competitive advantage, the challenge then is to identify how energy efficiency projects, and their multiple benefits, can add to this. This is the strategic impact of the project.

Operational impacts are also critically important. Changes to processes, equipment, buildings, facilities can all have knock-on effects for other parts of the operation of the business. An assessment of the likely impacts of a project (positive and negative) is needed alongside the assessment of how well it contributes to competitive advantage. Operational impacts are typically assessed as secondary to competitive advantage, i.e. a project which only has advantages at the operational level is unlikely to be supported. However business operations are responsible for an efficient use of resources and for meeting customer requirements. Operations produce products, manage quality and create service. Therefore operations may have a direct impact on competitive advantage and the frontier between operational and strategic impacts is often blurred.

In addition, the energy impacts and financial impacts of the project must be assessed - much as is carried out in standard energy audits. Although evidence shows an analysis in solely financial terms is unlikely to be persuasive on its own, all decisions need to be supported by a financial analysis. However, it is critical that the financial impacts must be communicated in the metrics of the decision maker (as identified in the firm-level analysis). Different industries (and even different firms in the same sector) can use different conventions and criteria for assessing their investment projects and for presenting financial information, so the energy analyst needs to adopt whatever system the decision-maker is used to and understands best for the evaluation of investment projects.

Communication

High quality communication of the project-level analysis will be key to success. This necessitates tailoring the information provided to meet the various interests and cultures of the company departments involved in decision-making (as identified in the firm-level analysis). Different individuals and departments within the firm may wish to receive selected aspects of the project analysis, presented using metrics and tools which are familiar and relevant to them.

Protocols for data collection and comparison

We found no established protocols, so instead we use the findings of the literature review and Cooremans work to propose a way of establishing protocols in the future.

There is no one agreed list of multiple benefits from energy efficiency for industrial firms. Different authors use different categories and definitions, which may be partly because the field is still immature. A synthesis of benefits and categorizations is shown in Table 1, complemented by an analysis of their possible contribution to a firm's competitive advantage (as proposed in Cooremans, 2011).

Table 1: Initial classification of multiple benefits of energy efficiency investments in goods manufacturing and services in relation to components of competitive advantage

BENEFITS OF ENERGY-EFFICIENCY PROJECTS (This list is based on proven benefits of past projects)	IMPACT ON RISKS	IMPACT ON COSTS	IMPACT ON VALUE PROPOSITION
Waste			
Reduced waste heat		x	
Reduction hazardous waste	x	x	
Reduced sewage volume	x	x	
Reduced sewage pollution level	x	x	
Reduced product waste	x	x	
EMISSIONS			
Reduced dust emissions	x	x	x
Reduced CO, CO2, NOx, SOx emissions	x	x	x
Reduction of refrigerant gases emissions	x	x	x
PRODUCTION			
Reduced malfunction or breakdown of machinery and equipment	x	x	x
Improved equipment performance	x	x	x
Longer equipment life (due to reduced wear and tear)		x	
Improved product quality	x	x	x

Increased production reliability (due to better control)	x	x	x
Larger product range			x
Reduced customer service costs (due to better quality)		x	x
Improved flexibility of production	x	x	x
Improved temperature control	x	x	x
Improved air filtration system	x	x	x
Reduced raw material need	(x)	x	
Reduced water consumption	(x)	x	
Reduced consumables	(x)	x	
Shorter production cycle (shorter process cycle time)		x	x
Increased production yields		x	x
OPERATIONS and MAINTENANCE			
Reduced maintenance cost		x	
Reduced machinery and equipment wear and tear	x	x	
Reduced engineering control cost		x	
WORKING ENVIRONMENT			
Reduced noise	x	x	x
Air quality improvement	x	x	x
Improved temperature control (thermal comfort)	x	x	x
Improved lighting (visual comfort)	x	x	x
Improved workforce comfort	x		x
Improved workforce productivity	x	x	x
Reduced absenteism	x	x	x
Reduction of health costs		x	
Reduced need for protective equipment		x	
RISK REDUCTION			
Reduced risk of accident and occupational disease	x	x	
Reduced CO2 and energy price risks	x	x	
Reduced water price risk	x	x	
Reduced commercial risk	x	x	
Reduced legal risk	x	x	
Reduced disruption of energy supply risk	x	x	
OTHERS			
Increased installation safety	x	x	x
Improved staff satisfaction and loyalty	x	x	x
Reduced staff turnover	x	x	x
Delayed or reduced capital expenditure		x	
Reduced insurance cost		x	
Additional space		x	x
Simplification and automation of customs procedures		x	x
Contribution to company's vision or strategy			x
Improved image or reputation	x		x

Source: Cooremans, 2011

The development of protocols will require two further developments of the list in Table 1:

1. A regular update of the list to include new benefits, as evidence is found for them, and also to cross-check the analysis of the relevance of each benefits to the components of competitive advantage.
2. Where practitioners and researchers have the opportunity to carry out assessments and analysis ex-ante (i.e. at the beginning of an energy-efficiency measure evaluation), they could usefully write up their methods (used to evaluate non-energy benefits in monetary terms or qualitative terms), and reflect on the effectiveness of their work (and the results of the final investment decisions, where that information is available).

It follows from this that all data collection / case study generation / interviews undertaken by M-BENEFITS need to include information about the relevance of investment options to companies' competitive advantage, not only information that is of interest to energy efficiency advocates. Otherwise the data collection undertaken will not be addressing the key aims of this project.

Development of training materials and other resources for practitioners

The task of operationalising a 'multiple benefits' approach at project level is still uncertain and poorly developed[1], While some researchers and practitioners have some of the relevant knowledge and experience to do the work, it is partial (incomplete) and fragmented: no repository of genuine experience and insight exists about how to do this kind of work well.

The exact skills gaps may be uncertain still, but an initial analysis of the types of training that would help can be done by considering the skills required to carry out all the stages of the work identified in Figure 1. The categories from Figure 1 are reproduced in Table 2, which also provides an analysis of the broad types of skills needed.

Table 2: Analysis of the additional skills needed to carry out an assessment of multiple benefits from the perspective of the firm

Level/type of analysis	Topic	Skills needed	Comments
Firm	Strategic priorities	Business management Sector-specific knowledge	
	Investment context	Business management	
Project	Strategic impacts	Business management	
	Operational impacts	Facilities management Technical knowledge	Closest to the typical skill set of existing energy efficiency experts
	Financial criteria for assessing and selecting investment projects	Business management Finance/accounting	Energy experts may need to un-learn the habits of cost-benefit analysis as well as learning the classical textbook financial method to assess capital investment
Communication	All	Communication and negotiation skills Change management skills	Especially: listening; qualitative (interview) skills

[1] To the significant exception of Swiss canton of Vaud, where continuous efforts and collaboration between Dr Cooremans, Eco'Diagnostic Geneva and the Lausanne Energy Office in the past five years have led to the development of a methodology to be used by companies and energy auditors to include not only energy benefits but also non-energy benefits in their energy-efficiency project assessments.

From this analysis, several new areas of knowledge and skills are apparent if energy experts are to become effective at carrying out this kind of assessment:

- Business management
- Finance/accounting
- Communication and negotiation skills
- Change management skills
- Sector-specific knowledge (varying from firm to firm)

In theory, this analysis could start from understanding the firm's competitive advantage (using the value propositions, costs, risks framework), and therefore what benefits could be strategic. However, given that the practitioners are energy experts, it seems more realistic to begin with the characteristics of the proposed energy investment, and then look at how these can add to competitive advantage, beyond just reducing energy costs.

Criteria and procedures for evaluation of projects

Typically, a firm's investment choice is not between engineering options (eg more or less efficient equipment, possible building upgrades, management / control systems). Rather, the choice is between any number of possible decisions, which are all competing with other uses of the organisation's capital and managerial attention.

There is simply insufficient evidence to support a general statement on criteria and procedures for the evaluation of projects being considered for investment. Instead, a few general principles can be put forward:

- Understand the decision-maker's value system and priorities
- Find out what tools and analytical methods are used by the decision-maker, and aim to use those as much as possible for analysis and communication on possible investment decisions
- Where terms, concepts and methods are unfamiliar, take the time to learn them thoroughly
- The diversity of firms and sectors means that the approach will need to be adapted to suit: 'one size does not fit all'
- The energy analyst needs to have a highly developed ability to self-evaluate: Is my approach being effective? If not, how does it need to change? What additional expertise and resources do I need?

References

Cooremans, C. (2011) Make it strategic! Financial investment logic is not enough. *Energy Efficiency,* 4 (4), pp. 473-492.

ANNEX A

M-BENEFITS Work Package 2: Literature review - results

Gavin Killip, University of Oxford
Tina Fawcett, University of Oxford
Catherine Cooremans, University of Lausanne
Subramani Krishnan, University of Utrecht
Wina Crijns-Graus, University of Utrecht
Fabian Voswinkel, Fraunhofer Institute ISI

© The Multiple Benefits of Energy Efficiency project and its partners

Document number: v1.0

Publishing date: 31 August 2018
Project deliverable: D2.2

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Project partners

Fraunhofer ISI

Environmental Change Institute, University of Oxford

UNIL | Université de Lausanne

Graz Energy Agency

Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
FH Zentralschweiz

BPIE

BORGOCO

european council for an energy efficient economy

Hes·so
Haute Ecole Spécialisée de Suisse occidentale
Fachhochschule Westschweiz
University of Applied Sciences and Arts Western Switzerland

IREES
Institute for Resource Efficiency and Energy Strategies

FIRE
FEDERAZIONE ITALIANA PER L'USO RAZIONALE DELL'ENERGIA

National Technical University of Athens

KAPE

Utrecht University

ISR - University of Coimbra

www.mbenefits.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Table of Contents

Figures

Tables

1 Introduction

The key objective of the EU Horizon 2020 project M-BENEFITS is to increase the uptake of energy efficiency investment projects by organizations, especially for-profit businesses operating in the manufacturing and services sectors, by proposing a multiple benefits (MB) approach. The aim is specifically at projects and investment decisions level for individual firms, rather than at the level of policy (international, national, regional or local). Since the effectiveness of national level policy implementing institutions varies among individual countries, so does the level of support among different levels of government (national, regional, local) (UNEP, 2017).

The aim of this literature review is to bring together the best available evidence to support the contention that a multiple benefits approach can help increase the uptake of energy efficiency investment projects using evidence from a variety of academic disciplines. This review forms the basis for task 2.2 which involves creating a set of guidelines for protocols for data collection and comparison, development of training materials and other resources for practitioners, criteria and procedures for evaluation of projects. Areas of discipline within the literature review include organisational decision-making; business strategy and investment decision; policies and evaluation programmes for energy efficiency in industry and commercial sectors; communication and negotiation strategies in business. The literature review explores these concepts to look for innovative approaches to include multiple benefits in energy efficiency investment projects to improve their frequency of uptake.

In order to conceptualise a decision-making framework and identify a range of relevant multiple benefits, six research questions were devised:

1. Q1: How has a multiple benefits approach to energy efficiency been used? What were the effects on investment decisions? Were any strategic benefits of energy efficiency specifically recognised?
    a. Q1a. What examples of good practice or innovative use of a multiple benefits approach exist?
    b. Q1b: What evidence is there of difficulties with implementing a multiple benefits approach (i.e. for instance, interest but lack of reliable figures, or lack of management interest, etc.)?
2. Q2: Are there contextual factors which seem important to the rate at which MBs are operationalised, making the use of an MB approach more/less likely (e.g. the presence/absence of a strong champion, either within the company or in an external advisory role)?
3. Q3: For which energy efficiency measures and technologies has the MB approach been used? How do the MBs identified differ between measures and technologies?
4. Q4. Does use of MB differ by company structure, company size, sector or other organisational characteristics?
5. Q5: How could a multiple benefits approach to energy efficiency investments in organisations be operationalised?
6. Q6. How could a strategic understanding of the multiple benefits approach to energy efficiency investments in organisations be operationalised?

We have favoured the term ‘multiple benefits’ (MB/MBs) over other terms, but several other terms do exist; the different terms appear to be used interchangeably. In the process of conducting the literature review, we also use the term ‘non-energy benefits’ (NEB/NEBs) and ‘ancillary benefits’ at times, where those terms have been used by the authors we are citing.

2 Methodology

The search for relevant literature was carried out by setting clear criteria defining what was within and outside the scope of the project:

Within scope:

- All investments in energy efficiency related to the operation of firms, whether defined as innovative or not.
- Investments in energy efficiency technology.
- Energy efficiency improvements which are not physical assets - e.g. energy management programmes, employee behaviour change programmes.
- Publications from 1999 onwards.

Out of scope:

- An overview of the prevalence of use of MB in decision-making, or a general understanding of organisational decision-making.
- The agricultural sector
- The public sector and quasi-public sector (e.g. universities)
- The literature about the energy efficiency of the products and services produced by firms. Only literature about firms' decision-making around the energy use of their own operations should be included.
- The general 'barriers to energy efficiency' literature will not be a focus, unless it specifically concentrates on multiple benefits understandings of energy efficiency.

Once the criteria were set, several types of searches were conducted in order to provide a broad coverage of academic and non-academic literature. These include expert identification, database searching, conference proceedings, snowballing. The results from the searches were combined and duplicates or near duplicates (e.g. a conference paper and journal article covering the same material) were omitted, resulting in a database of 295 documents.

Once an initial list of 295 documents was identified, the next step involved reviewing these documents and narrowing them down to 30-40 documents for a detailed reading and inclusion in the literature review. This process being iterative, all articles and abstracts were re-read with reference to the research questions and resulted in about half of the 295 documents being discarded, based on expert judgement of the quality and relevance of the document to the research questions. A further step in quality measurement was taken to inform a more detailed reading of remaining papers. Documents were primarily chosen from a more detailed reading and comparison with the research questions and the aims of the project.

This process finally resulted in 31 documents to be thoroughly analysed and synthesized. This process was conducted with the aid of a data extraction template and the findings were synthesized and are detailed in this literature review.

Extensive details on the full methodology (methods, databases and sources, search techniques, templates) can be found in D2.1.

3 Literature review

This review is organised thematically. Section 3.1 elaborates on the context of energy efficiency investment decision-making by highlighting the current and future potentials of energy efficiency investment and the energy efficiency gap between investment opportunities and the level of investment in energy efficiency in most countries. This section also addresses the different barriers and drivers that influence investment decision making and the different decision-making frameworks that currently exist.

Section 3.2 focuses on the multiple benefits of energy efficiency investment derived from the literature review. This section tries to identify, classify and provide value to multiple benefits and details some solutions to overcome barriers to include multiple benefits in project assessment.

Section 3.2 aims at synthesizing the findings and providing a few key general lessons that can be drawn from the literature review.

3.1 The contexts of energy-efficiency investment decision-making

In order to provide the context of energy efficiency investment decision-making, section 3.1.1 briefly discusses the current potential of energy efficiency investments among firms to highlight the gap between investment opportunities for energy efficiency and the level of investment in energy efficiency. Section 3.1.2 delves into the various barriers and drivers that influence investment decision-making within a firm; and section 3.1.2 details the current decision making frameworks that exist, based on the literature review.

3.1.1 The potential of energy efficiency and the energy efficiency gap

The literature review provides some evidence that there is great potential for energy efficiency investment within organisations but they are mostly not realised and therefore such investments are not considered and undertaken.

McGinley et al. (2015) use data from five case studies with US mining companies to suggest that there is good energy efficiency potential for common types of technologies in this sector.

UNEP (2017) reports the findings of an international survey with 339 responses from 85 countries. They include 230 responses from 47 UNECE member states, of which 27-28% represent the business community followed by non-governmental organisations (14%) and shares ranging from 10 to 13 percent for national governments, academia, international organisations and independent experts. A smaller share of respondents represents regional or municipal authorities (5%) and financial institutions (2-3%).

There is high potential for energy efficiency investment but there is a significant gap between investment opportunities for energy efficiency and the level of investment in energy efficiency in most countries.

The effectiveness of national level policy implementing institutions varies among individual countries and so does the level of support among different levels of government (national, regional, local).

It is therefore imperative to identify and understand barriers to bridge the energy efficiency knowledge gap.

3.1.2 The language of barriers and drivers

According to UNEP's report (2017), the financial environment is not very favourable for investments in energy efficiency due to a lack of familiarity of financial institutions with financing energy efficiency projects and measures. Risk associated with energy efficiency projects is viewed as high by financial institutions. The incentive related to the price of energy if often considered insufficient due to varying energy prices per country. Low awareness about non-energy benefits (NEBs) is viewed as the main barrier to increasing the rate of energy efficiency investment followed by a lack of understanding of energy efficiency financing by banks and other financial institutions; administrative barriers and bureaucracy; and low energy prices.

The report does not provide any discussion on how the inclusion of MBs will increase the uptake of energy efficiency but instead highlights the main factors that can lead to increasing energy-efficiency investment viability. Tax incentives and low-interest loans for energy efficiency projects are viewed as the most important factors to increase energy-efficiency project investment viability. This is followed by stricter energy-efficiency standards; training and awareness programmes; improved legislation and de-risking of investments through Government support programmes.

Sandberg & Söderström (2003) conducted in-depth interviews with representatives from a number of energy-intensive companies and non-energy-intensive companies from different sectors in Sweden. Their focus was on possible support needed to help firms make energy efficiency investments. One need that was identified was the improvement of working methods in order to support the decision-making process. Here, external players seem to be playing an increasingly important role. Access to correct information, better follow-up activities, and transparent, understandable calculations were also considered to be important.

McLain and Skumatz (2007:1080) highlight the fact that benefits are not evenly distributed, with the cost-benefit logic being complicated by split incentives and factors that are hard, if not impossible, to quantify: ‘From a program perspective, the return on investment in terms of NEBs from rebates is strong. However, the program costs accrue to the states and programs, while the NEBs accrue to the building stakeholders and occupants. The ROI [return on investment] to the program expenditures will depend on the energy savings or other direct benefits. However, the NEBs provide a way to improve the cost-effectiveness of the programs because NEBs encourage program participation, presumably reducing the marketing and outreach expenditures – and potentially reducing the level of rebate needed to achieve participation’.

Skumatz & Gardner (2005) note that ‘even though non-energy benefits (NEBs) are often ignored, they are an important set of benefits. In fact energy efficiency / conservation benefits are often not the highest valued benefits participants derive from programs. The authors find that commercial / industrial participants value other benefits such as fewer maintenance repairs, improved productivity, and fewer tenant complaints more’ (Skumatz & Gardner, 2005:6.175).

Rasmussen (2014:742) argues that ‘including NEBs in the decision-making process may be one way to meet and hopefully overcome known barriers for energy-efficiency investments and thus enhance the probability rate of adoption for this investment category’.

Cooremans (2012) identifies four types of barriers, reflecting different levels at which barriers can be observed and are embedded in decision-makers’ assumptions and culture about the relative importance of energy efficiency and wider decision-making (Table 1).

Table 1 Four types of barriers to energy efficiency observed among investment decision-makers (adapted from Cooremans, 2012:514)

Type	Description
Base barriers	information, or rather, the lack of knowledge regarding energy efficiency measures, as well as regarding their technical and financial aspects
Symptom barriers	relates to deeper, invisible problems or of mistaken interpretation. E.g. Hidden costs, are said to lower energy-efficiency investments’ profitability but they are not quantified; or risk is said to be high, when in fact it is not even assessed.
Real barriers	the non or low strategic character of energy efficiency projects for companies, as they feel these projects do not add to their competitive advantage.
Hidden barriers	various cultural influences which drive (in a subconscious manner) organizations and their decision makers to consider energy-efficiency investments as weakly strategic.

Cooremans argues that the task of overcoming under-investment in energy efficiency needs to address all of these different types of barriers. It is important to re-cast energy efficiency as a 'strategic' investment choice since the low strategic character of energy efficiency investment for companies is the main barrier in the implementation of energy efficiency investments. Cooremans' concept of 'strategicity' is discussed in the next section dedicated to decision-making frameworks.

Andrews & Johnson (2016), conducted a review of literature on decision-making behaviours among firms, and concluded that most of the barriers to energy efficiency investments are neither technical nor economic but behavioural. For instance: "lack of integrated design and whole-system thinking; lack of data to verify that building systems were sized appropriately; inadequate commissioning and operating documentation; lack of training of building operators; appraisals that do not include energy efficiency; split incentives between owners and tenants; and short time periods of leases" (Andrews & Johnson, 2016:202). The authors also report the difficulty of quantifying the value of energy efficiency investments.

Banks et al. (2012) provide a review of published literature in OECD countries on five themes:

- evaluations of government policies to improve energy efficiency behaviours;
- organisational strategies for driving energy efficiency;
- business investment and barriers to implementing energy efficiency;
- identifying the benefits and pitfalls of action on energy efficiency; and
- differences between organisations
- Banks et al. review identifies the following barriers to energy efficiency
- There are a number of circumstances, which explain why energy is not salient nor its efficient use a strategic objective. The strategic value of energy efficiency is linked to the salience of energy consumption in the organisation which is itself linked to the energy intensity of the organisation (units of energy consumed per unit of productive output), the size of the organisation and its sector or sub-sector.
- Other barriers lie in the way that efficiency savings are framed as a "gain" compared with the theoretical counterfactual case (of not investing in efficiency). This is because organisations are found to devote proportionally more resources to avoiding losses rather than making gains. Efficiency investments fall prey to this dynamic because they can only offer a theoretical gain with a risk attached and organisations are also risk averse. This suggests that reframing efficiency savings as "avoided losses" may be effective.
- Energy consumption is often found to be invisible to senior managers
- Energy efficiency investments are often classified as discretionary maintenance costs rather than investments in productive capacity.

Russell (2015:7) gives a rather stark – although realistic – image of energy use in large business organisations: they tend to lose awareness of energy use among their many other daily priorities. If staff have little or no accountability for energy performance, then potential energy-derived value is often squandered. Not every business enterprise employs a professional energy manager. Most energy managers may only influence and advise rather than compel the rest of their organization's energy choices. Top business managers vary widely in their perception of benefits as well as in their motivation to measure and attain them (Russell and Young 2012; Birr and Singer 2008). Business leaders who underestimate energy value may delegate responsibility to staff with little authority to encourage its capture. Low-level staff may also have limited conceptual thinking of energy efficiency, expecting nothing more than reduced utility bills. Limited management awareness further complicates researchers' efforts to document multiple benefits.

Therefore, we can conclude that under-investment in energy efficiency projects can be related to various barriers like: base, symptom, real and hidden barriers. Examples include:

- efficiency investments which are termed as a 'gain' rather than loss minimization
- energy efficiency investments often being classified as discretionary maintenance costs rather than investments in productive capacity and
- the lack of knowledge and awareness on energy related issues thereby leading to low accountability for energy performance.

The next step is to investigate the different decision making frameworks that exist within the selected literature in order to come up with a conceptual framework to curb these barriers and increase the uptake of energy efficiency investment projects.

3.1.3 Different decision-making frameworks

While much recent interest in MBs has focused on making financial logic more attractive by including more data from multiple benefits in the equations, some research has also questioned the premise on which financial logic is commonly based, i.e. that investment decisions are made on the basis of financial returns. In this literature, two emerging themes can be identified: 1) a focus on strategic and core business objectives (regardless of energy or other resource issues); 2) the importance of uncertainty and risk in shaping investment decisions, and the ways in which decision-makers think about and assess future impacts of their decisions.

UNEP (2017) argue that energy efficiency decisions in companies are often made by the same people as core business decisions and often indicate a low priority for energy efficiency as it is not in line with core business objectives. ClimateWorks (2014) makes a similar point when they identify factors impeding the uptake of energy efficiency opportunities as an intersection between 'company capability', 'company motivation' and 'project attractiveness'.

Andrews & Johnson (2016) identify three levels at which decisions within organisations can be considered:

- individuals acting within organisational settings, taking into consideration personal influences in their behaviour (for instance attitudes, beliefs, values, habits, etc.).
- Characteristics of the organisations themselves, both formal and informal that encourage, constrain, or otherwise influence the behaviour of the individuals within them (for instance organizational goals and expectations, structures and procedures, group norms, incentives, etc.).
- Institutional rules, structures and logics that form the larger context in which the organisation and its members act (for instance markets, government regulations, sectoral and professional norms, "conventional wisdom" among business and professional peers, etc.)

Individuals within organisations, organisations and institutional forces influence organisations' behaviour and so their energy behaviour. Individuals' behaviour is influenced by internal factors and by norms and actions of those around them with whom they identify, according to the norms of their workgroup and larger organisation as well as by their broader networks of professional peers. Business organisations influence agents of energy behaviour on multiple levels (e.g. their own employees, customers, and even suppliers).

Bailey et al. (2009) identify both technical and non-technical problems with conventional approaches: they advocate both a better understanding of organisational behaviour among energy experts, and the integration of risk and risk management into energy audits.

Fleiter et al. (2012) propose a classification scheme dor energy efficiency measures (EEMs) composed of 12 characteristics, which can be grouped into three areas: relative advantage, technical context and information context. Non-energy benefits are one of the characteristics included in the Relative Advantage area (together with "Internal rate of return", "Payback period" and "Initial expenditure"). The authors find that "non-energy benefits describe the benefits of EEMs beyond energy savings. They are commonly not captured in the economics of EEMs, although they might have considerable influence and in certain cases even be the real reason for adopting an EEM." Despite finding that the classification scheme is generally useful, Fleiter et al. also note that it can be an information-intensive process, and data availability is low for certain EEMs regarding the financial characteristics. "The classification of the characteristics is always a trade-off between data availability and accuracy" (p.511).

Cooremans (2011) makes a distinction between 'mainstream' and 'alternative' energy investment literature. Mainstream literature considers financial factors as the most important factor in energy-efficiency investment decisions while alternative literature highlights numerous other factors that influence energy-efficiency investments:

- **organisational factors** such as size, geographical location, financial performance, structure, energy management system, corporate energy culture and power relationships
- **individual factors** such as existence and skills of an energy manager in an organisation, attitude towards energy
- **external factors** such as energy prices
- **structural factor** such as centralised decision-making
- **conjectural factors** such as price change

Cooremans (2011) reviews this alternative energy literature and capital investment decision-making literature and concludes that financial factors play only a partial or even secondary role in investment decisions. Cooremans (2012:499) proposes a new model of investment decision-making, represented in Figure 1.

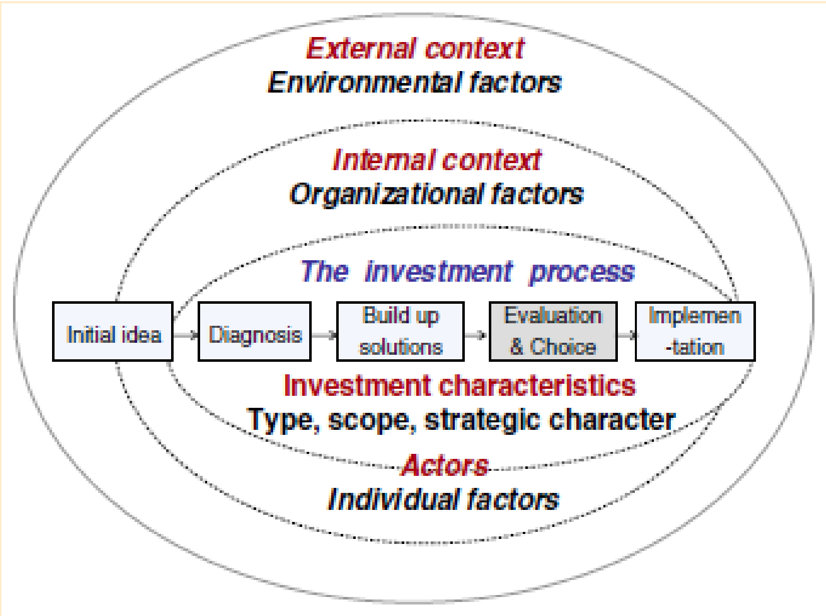


Figure 1 A new model of investment decision-making (Cooremans, 2012:499)

According to the model, and as shown in Figure 1, investment decision making must be considered not as a point in time but as the result of a decision-making process. This process is influenced by organizational and external contexts, actors involved, and by characteristics of the investment and of the investment decision to be made. Among investment characteristics, strategic character is a key factor influencing decision making. But strategic character is not given; it is interpreted by actors (individuals and groups) and by organizations, due to the action of several filters.

According to Cooremans' model, the strategic character of an investment (defined as the contribution of this investment to a company's competitiveness in performing its core business) is the main influence on decision-making. This holds true for energy efficiency investment projects just as much as for other kinds of investments. This argument has far-reaching consequences for the energy efficiency community, as it represents a fundamental criticism of the conventional approach based on a narrow financial viewpoint (concerned with investment return). The approach framed in terms of payback (cost-benefit analysis) may actually make the arguments less persuasive, because they are not linked to the core business and strategic focus of business decision-makers. Cooremans therefore proposes that practitioners (e.g. energy auditors), scholars and public program developers should approach energy efficiency investment projects from a strategic perspective rather than from a classical financial perspective, based on financial payback.

This conclusion is shared by Pye & McKane (2000). According to these researchers, energy efficiency is generally “not a primary driver in industrial decision making [...] it is generally the productivity gains that will motivate industry to take action” (Pye & McKane, 2000:175). When efficiency advocates understand the business decision-making perspective and can communicate with management using financial and strategic arguments for energy efficiency, the case for energy efficiency is greatly strengthened. There are no guarantees that management will implement energy efficiency projects even if they make sense from a financial perspective. Other investments or projects may have greater financial returns than energy efficiency projects, capital may be unavailable, or certain projects may not fit with a company’s strategic plan. However, if advocates do not manage to make a business case for energy efficiency, it may continue to be perceived by many business people as a warm and fuzzy but costly and unnecessary extravagance. “Probably the most effective way to get management’s attention is to not even mention energy efficiency or pollution prevention, but to call it simply ‘efficiency’ or ‘productivity,’ which have always had a positive connotation in the business community” (Pye & McKane, 2000:182).

Cooremans (2012) surveyed managers with responsibility for energy and finance managers among 35 major electricity consumers in various commercial and industrial sectors in the canton of Geneva, Switzerland. Analyses of these different perspectives on commercial decision-making suggest that the way a project is categorised influences the procedure and the profitability assessment method as well as the profitability requirements of the project in question and the methods for financing. The strategic character of investment projects is confirmed as the primary driver of investment choices, while investment profitability appears as a generally necessary but insufficient condition.

The three dimensions of competitive advantage –thus the key dimensions to be evaluated in an investment project– are: a more convincing value proposition (entailed, for instance, by an investment contribution to better product quality and reliability), reduced costs (for instance due to reduced rejection rate or maintenance cost), and reduced risks (due for instance to increased workplace safety).

Cooremans and Schönenberger (2017), describing the findings of the research project M_Key-Management as a Key Driver of Energy Performance[1], investigate the incidence of formalised energy management among 305 large-scale energy consuming firms in Switzerland. Again strategic character is confirmed as key in investment decision-making: the more strategic a firm’s perception of energy efficiency investment is, the higher their level of energy management, and the better the chances for energy efficiency investments to be implemented. In contrast, when an investment is not seen as strategic, the financial criteria applied to select investment projects become more restrictive.

Other factors also have a positive influence on the number of energy efficiency investments made, including: the network relations/knowledge exchange within the sector; cantonal energy policies for large consumers; rising energy prices (in particular for electricity). Undergoing an energy audit seems also to be a key factor in the process of a firm adopting an energy management system. Cooremans and Schönenberger (2017) conclude that

1 M_Key research project is part of the National Research Programme "Managing Energy Consumption" (NRP 71) of the Swiss National Science Foundation (SNSF). Further information on the National Research Programme can be found at www.nrp71.ch. M_Key reports are available on http://www.nrp71.ch/en/projects/module-2-economy-enterprises/investing-in-energy-efficiency

government has a role in encouraging firms to adopt energy management, for example by offering subsidies for energy audits.

Russell (2009) takes a slightly different approach from Cooremans, although the starting point is essentially the same: an observation that energy efficiency is often perceived as secondary in importance due to a poor link with "core business". Russell argues that one consequence of this is that success for a facilities manager is gauged by keeping emergency failures to a minimum, which in turn leads to a focus on allocating resources to contingency plans for possible failure, rather than to energy efficiency investment projects which could improve a process. Russell emphasises the diversity of perspectives within an organisation, identifying conflicting departmental priorities as one source of the low uptake of energy efficiency measures in industrial firms.

Russell's 'strategic profit model' is proposed as a way to coordinate the engineering, operations and finance decisions needed to maximize energy efficiency investments, based on the untested assertion that all departments seek to 'make profit' in different ways. Components of the model are different aspects of the financial context in which a firm operates: tax burden, interest burden, operating margin, asset turnover and financial leverage. Where Cooremans suggests that financial logic is insufficient to explain or justify strategic decisions, Russell's model retains the financial logic, but expands the domains in which returns (and losses) are reported. For Russell, energy efficiency investments would increase if the financial logic were extended to domains of corporate accounting beyond capital investment and operating costs. Russell's model is purely hypothetical, however, and there is no primary evidence (e.g. from case studies or surveys) to support the arguments put forward in support of the 'strategic profit' perspective.

Russell (2013) argues that capital investment decision-making activities depend on the workplace culture of individual companies, business units, and facilities, so very similar companies may have very different strategies for capital investment. The heterogeneity of business leads Russell to conclude that "energy efficiency programs will need to evolve to a new level of interaction with industry." This assertion confirms similar findings of previous research on the importance of corporate culture and sub-cultures in organisational decision-making (Cooremans, 2011, 2012).

MBs are not a focus of the review by Banks et al. (2012), however their review does present a lot of useful background evidence on energy-related decision-making in organisations. There are 35 headline findings from their report. Those which are most directly relevant to the research in the M-Benefits project, are those that mention multiple benefits or the importance of company strategy and mentioned here.

According to Banks et al. (2012), again, the strategic value of energy efficiency (conferring competitive advantage) may be the key influence on whether investment in efficiency will take place rather than profitability. Unprofitable investments still go ahead if they can be shown to be strategic. Judgement of what constitutes a "strategic" investment will involve some degree of qualitative assessment, subjectivity and a view on the organisation's purpose.

Differences between organisational energy behaviours are strongly linked to size (as found also by Cooremans and Schönenberger, 2017) and sector[2]. Energy efficiency strategies differ across organisations and reflect their different motivations. Investment decision-making is usefully understood as a process with a beginning, middle and an end.

As stated in Banks et al. (2012), "our evidence base suggests that an account of behaviour which highlights the strategic, rather than profit maximising characteristics of investment decision-making, will suggest avenues for development of both more effective application of existing policies and new policy approaches". Making energy use visible and salient is an important first step on the way to energy efficiency becoming a strategic objective. This means policy should encourage further institution of monitoring and reporting practices and, if appropriate, combine energy efficiency messaging with a broader eco-efficiency agenda.

2 Influence of size is often confirmed by research works contrary to the influence of sector, not demonstrated as playing a role in Cooremans research (Cooremans, 2012).

Based on these findings, Banks et al. (2012) identify a problem with the language of efficiency, which is centred around payback rather than net present value (NPV). The classification of energy efficiency investments as costs rather than assets plus organisational tendencies to be risk averse all bias organisations away from investment in efficiency over alternative investments, which more clearly add to the bottom line and productive capacity. There is a potential role for government in influencing how efficiency is reframed and how it is handled in organisations' financial accounting,

As advocated in Cooremans (2011, 2015), the non-energy benefits of energy-efficiency projects enable "bridging between the fields of energy efficiency and strategic management" (Cooremans, 2011:487), since they can be integrated and analysed along the three dimensions – value proposition/cost/risk – of the competitive advantage framework. Banks et al. (2012) emphasize that non-energy benefits of energy efficiency, such as improved public image or comfort for staff are critical to raising the strategic value of energy efficiency – particularly in non-energy intensive sectors such as commercial offices where cost savings from improved efficiency will not make a significant difference to the organisation's cost base. Russell (2015:5) notes that "greater business-sector awareness of energy efficiency's multiple benefits may stimulate demand for energy improvements that are achieved independently of efficiency program incentives. Such knowledge may also inspire larger project investments, further leveraging limited incentive and rebate dollars".

From this section we can conclude that the narrow energy-savings financial perspective to calculate energy efficiency gains is insufficient as it mostly considers secondary criteria in a firm's investment decision-making process. It is more important to link an investment to the core business values of a firm, thereby linking energy efficiency investments to the components of competitive advantage (value, risk, cost). This gives energy efficiency investment projects a strategic character.

3.2 Multiple benefits of energy efficiency investment

In this section we identify, classify and provide value to multiple benefits based on the information provided in the selected literature

3.2.1 Identification: evidence of MBs being realised

MBs can be found at an aggregate level. As such they are labelled, for instance, "macroeconomic" (IEA, 2014); national or sectoral (Worrell, 2003); societal (Skumatz and Gardner, 2005). In business-sector activities, they can also be found at facility level or project level (which is the focus and level of interest of the M-BENEFITS project). At project level, they are again described in different ways by the authors: "productivity benefits" (Worrell et al., 2003); "ancillary and production benefits" (Lung et al., 2005); "non-energy benefits" (Pye & McKane, 2000; Hall & Roth, 2003; Cooremans, 2011; Banks et al., 2012; Nehler & Rasmussen, 2016; Cooremans & Schönenberger, 2017), business benefit (Russell, 2015). The term "non-energy benefits" seemed to have prevailed as the most common terminology used by scholars, until the IEA, in its 2014 report on the subject, proposed a formula eliminating the negation and encompassing all energy-efficiency impacts –i.e. both energy and non-energy- : "multiple benefits". This term is increasingly being used (Russell, 2015) and is the term of choice of M-BENEFITS.

With a focus on US utility programs, Skumatz and Gardner (2005) identify a third group of NEBs, alongside societal NEBs and participant NEBs: Utility NEBs, a category which can be included in that of the IEA (2014) "energy-delivery impacts".

At a very early stage of the literature, on the benefits of energy-efficiency projects, Pye and McKane (2000) describe how positive it would be to include NEBs ex-ante in an investment project's financial calculations (and not only ex-post as they have done in their analysis). The need for communicating investment projects in financial and strategic arguments is underlined by the paper but the term "strategic" is not defined.

Worrell et al. (2003) analyse 77 case studies[3] with sufficiently documented non-energy benefits and find that "only 52 have sufficient data to quantify or assign a monetary value to some portion of the reported non-energy benefits". The authors find that despite the small sample, it is clear that including the non-energy benefits of a project, and incorporating that information into the engineering analysis when making a decision about a capital upgrade, may have a profound effect upon the decision-making process of a given project. A look at the 52 monetized case studies reveals a 4.2-year payback time based only on the energy savings. This falls to a 1.9-year payback time for projects when including the full productivity impacts of a project (i.e., dividing the total investment by both the energy savings and the non-energy benefits of a project) (Worrell et al., 2003:1085). However, the authors note that productivity improvements are often not reported, and even if they are, they are most often not quantified.

Building on Worrell et al. (2003), Lung et al. (2005) analyse 81 case studies that were developed by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) between 1998 and 2004[4]. They find that MBs are quantifiable in 54 of the case studies in the sample (67.8%). In a second step, the authors focus on an energy-efficiency project in a cement plant and find that, in this example, when ancillary benefits are included in the financial assessment, the simple payback time for the project falls from 4.64 to 1.64 years, a figure close to the one found by Worrell et al. (2003; see above). They conclude that "the analysis shows that for projects where ancillary savings and production benefits are part of the calculation, the CCE (Cost of Conserved Energy) is less than the cost of energy, which signifies that in such cases it is more cost-effective to implement energy efficiency projects than to buy more energy" (Lung et al., 2005:6-103). "This demonstrates that when ancillary savings and production benefits resulting from energy efficiency efforts are incorporated into payback models, the business case for implementing such efforts is more compelling" (ibid, 6-114).

Newberger et al. (2007) review energy efficiency projects for non-electrical energy in 63 projects supported by a utility program in the US state of Massachusetts. They find that both *ex ante* and *ex post* assessments of multiple benefits are needed.

McLain and Skumatz (2007) find several significant MBs in the commissioning of projects for energy efficiency in buildings. The commissioning process provides ex-post evaluation data for utility program managers and salient evidence of benefits for stakeholders.

Bement & Skumatz (2007) conducted over 300 interviews with multiple decision-makers in order to estimate the value of US utility programs beyond bill or energy savings. Owners/ occupants and facility managers were asked about NEB valuations based on experience. Specifiers/ decision-makers were asked about their perceptions of the value of NEBs to owners, as well as the use of NEBs in decision-making. Results show that bill savings or energy benefits are important – but may not always be the most important program benefit to program participants. NEBs can be equal to or exceed the value of the direct energy savings associated with the program. The paper illustrates applications for program refinement and marketing – positive effects for marketing, and negative values that have implications for detailed barriers analysis and program improvement. Differences in perception by group may indicate other types of useful program refinements.

In their wide-ranging review of published literature, Banks et al. (2012) find evidence of clear non-energy benefits to energy efficiency. These non-energy benefits may serve as

3 These case studies were drawn from reports or studies from the American Council for an Energy Efficient Economy, IEA/CADDET database, the US Environmental Protection Agency's Climate Wise case study compendium, the US Department of Energy Office of Industrial Technologies and other scholar sources. The case studies selected included the full spectrum of manufacturing activities (Food manufacturing, building materials, steel manufacturing, paper manufacturing, chemicals manufacturing, textile manufacturing).

4 The plants in which the projects occurred represent a wide range of manufacturing activities, with 52 of them (64%) falling under at least one of the US Department of Energy's energy intensive, Industries of the Future (IOF) categories. Seventeen others are classified as general manufacturing with food processing, textiles and utilities accounting for the remainder. In addition, the data set in the study provides a fairly balanced distribution of project sizes based on total annual savings – 16% have annual project savings of $49,000 or less, 44% have annual project savings between $50,000 and $249,000, 20% have annual project savings between $250,000 and $499,000, 9% have annual project savings between $500,000 and $749,000, and 9% have annual project savings that exceed $750,000.

additional incentives to adoption of behaviours and are particularly important for non-energy intensive sectors where there is less direct financial incentive to invest in energy efficiency.

Stevens et al. (2013) identify multiple benefits across around 800 energy efficiency measures[5] (EEMs), based on data collected in a survey of 505 commercial and industrial participants (in 2010) in Massachusetts's prescriptive and custom electric and gas programs. Stevens et al.'s survey used self-reported responses given during in-depth interviews to derive quantitative estimates of Non-Energy Impacts (NEI) organised in 13 categories. NEIs, mainly positive, were identified for each EEM category (precise figures are given in the paper). The analysis clearly demonstrates statistically significant correlations between the Massachusetts's utility programs savings and the level of NEIs reported. Stevens et al.'s conclusion is that NEIs can contribute positively to program effectiveness when programs use NEIs to help promote energy efficiency decisions, but can contribute to free ridership if the NEIs are well known to customers without program assistance.

Based on interviews of North American subject matter experts, plus a literature search (86 information sources in total, with two-thirds from the United and one third from Canada), Russell's study (2015) aims at describing the current understanding of non-energy benefits that accrue to businesses. He concludes that "most survey respondents can be characterised as being interested in the concept of multiple benefits and any future findings, but are currently able to provide little data, if any" (Russell, 2015:6).

Cagno et al. (2016) use interview data from five Italian manufacturing firms to highlight some of the negative impacts of energy efficiency investments, as well as reporting many positive effects. They identify that impacts can be felt during the implementation phase of energy efficiency measures, not only during the operational phase.

The questionnaire submitted to large Swiss energy consumers by the research project M_Key[6] (Cooremans and Schönenberger, 2017) provided a list of thirty-one potential NEBs to choose from. 256 firms answered the question; on average, firms include nine to ten non-energy benefits in their investment assessment. The highest score is obtained by "reduction of maintenance cost and technical control of equipment" entailed by energy-efficiency investment (selected by 133 companies out of the 305 having answered the questionnaire), followed by "impact on reputation and corporate image" (115 companies). "Improved security and working conditions" comes in third position (113 companies) and "Lower CO_2 tax or tax exemption" in fourth position (110 companies).

The case studies presented in this sub-section show that after an ex post analysis, the inclusion of multiple benefits in energy efficiency investment decision making provides considerable savings for firms thereby providing a positive outlook for energy efficiency investments with the inclusion of multiple benefits.

3.2.2 Classification: impact and technology

Several authors in the field (Pye & McKane, 2000; Hall and Roth, 2003; Worrell et al., 2003; Lung et al., 2005) agree, with some variations, on the following broad categories of NEBs: Production, Operation and maintenance (O&M), Working environment, Environment (including Waste, Emissions) and Other.

Authors then further refine the content of these broad categories:

Hall et al. (2003) offer a classification system for NEBs in industrial firms: maintenance; employee morale; equipment life; waste generation; productivity; non-energy costs; sales; personal needs; injury or illness; defects or errors.

[5] EEMs are grouped in two broad categories: electric measures and gas measures. Electric measures include: HVAC, lighting, Motors and Drives, Refrigeration and Other. Gas measures include Building Envelope, HVAC, Water Heather, Other.
[6] The project "M_Key - Management as a key driver of energy performance," is one of the 19 projects which are part of the national research programme "Managing Energy Consumption" (NRP 71, 2013-2018), funded by the Swiss Research Fund.
http://www.snf.ch/en/researchinFocus/nrp/nrp-71-managing-energy-consumption/Pages/default.aspx

McLain and Skumatz (2007) list the following benefits that make up the majority of the value from building commissioning: correcting operational deficiencies, increasing knowledge for O&M staff, reducing time to optimise the system, and indoor air quality benefits. The first two represent 31 % of all attributed benefits, and the latter two add another 16%. Improvements in comfort, contractor call-backs, and equipment maintenance were also highly rated (adding another 19%) and this list represents potentially effective benefits to recommend commissioning.

Banks et al. (2012) identify the following non-energy benefits from improving the energy efficiency of buildings: improved staff productivity; tenant satisfaction; comfort; appearance; quality of light; better indoor air quality; ease of selling or leasing; and better equipment performance. Benefits identified from improving operational energy efficiency include: improved environmental awareness of employees, positive stakeholder perception of the company, enhanced corporate reputation and improved employee morale and productivity.

Woodroof et al. (2012) analyse 63 survey responses, mainly from educational establishments in the USA, to identify how often different multiple benefits are reported: reduced maintenance costs (92%); reduced maintenance labour costs (71%); avoided procurement costs (63%); enhanced image (44%); avoided capital investment (33%); avoided purchases of carbon offsets (10%).

Cooremans (2015:124) notes that existing categorisations remain too vague to build up a convincing business case for energy-efficiency projects. She suggests a categorisation of energy-efficiency investments according to their contribution to the three dimensions of competitive advantage, since "by evaluating the positive contribution of an investment to a company's value proposition, cost reduction and risk reduction, we assess its contribution to competitive advantage; in other words, we assess its strategicity" (Cooremans, 2015:125).

Russell (2015) classifies multiple benefits for business activities in four main categories: revenue enhancement; expense reduction, income enhancement; capital performance enhancement; risk mitigation. Similarly to Cooremans (2011; 2015), this categorization not only takes into consideration an energy-efficiency project's impact on cost reduction, but also on revenue increase and on risk mitigation.

Rasmussen (2014) develops a categorisation matrix for NEBs according to their quantifiability and time frame. In this way they can be included in the decision making process at the right stage. In Figure 2 the time frame is shown horizontally and the level of quantifiability is shown vertically. Three levels of quantifiability are applied; high, medium and low, where high refers to those benefits that are easily quantified and low refers to those that are difficult or not possible to quantify. The time scale is divided into short term and long term. The framework is designed so that "NEBs of a low quantifiability level, especially those of a strategic character, can serve as extra arguments at a later step in the decision-making process to select between similar investment opportunities."

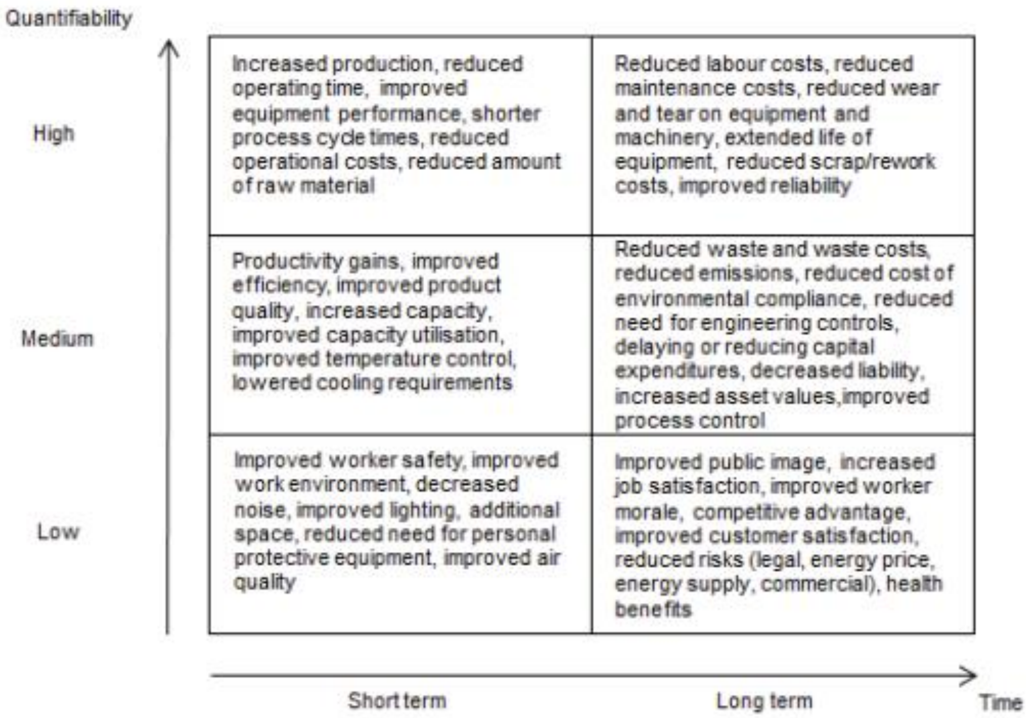


Figure 2 Matrix defining industrial NEBs. (Rasmussen, 2014)

There is no general agreement on the multiple benefits categories to be used, although broad themes seem to be common to many authors (with variations): Operations and Maintenance; Production or Productivity; Work environment; Environmental (a category which includes waste and emissions).

3.2.3 Valuing: methods and results

Some researchers retain the traditional logic of cost-benefit analysis, and add new kinds of information to make the analysis of benefits more complete. If the health or productivity effects of a particular kind of energy efficiency investment can be quantified (monetised), then that quantification can be added to the energy cost saving. The result is often favourable, and the change can be dramatic, notably where the non-energy benefit outweighs the energy cost saving by a substantial factor.

In these studies, the calculus of cost-benefit remains the same, and the cost information is likewise unchanged; the novelty is in seeking to include more effects on the 'benefit' side of the equation. It is worth noting that the effects may be negative or positive, although in practice the observed effects are predominantly positive in the domains where most of the research has been conducted (health and jobs).

This is the case of Worrell et al. (2003) and Lung et al. (2005): studying respectively 77 and 81 case studies of energy-efficiency projects in US industry, they enlarge the scope of analysis from energy only to non-energy impacts of the projects. In order to achieve that, Worrell et al. (2003) propose a framework for evaluating the productivity benefits of energy efficiency technologies, which is "useful for making the cost calculations and makes the evaluation process transparent for the analyst" (Worrell et al., 2003:1088). The framework comprises four steps:

1. Identify and describe the productivity benefits associated with a given measure aside from energy savings;
2. Quantify these impacts as much as possible. Here the benefits identified above should be quantified in the most direct terms possible. For example, if one benefit is the extended lifetime of electrodes in electric steelmaking, estimate the change in lifetime or the reduced electrode consumption per tonne of steel. A benefit may be deemed 'non-

quantifiable'. For example, adopting a technology may enhance a firm's reputation as an innovator and leader, but this is too intangible to quantify.

3. Identify all the assumptions needed to translate the benefits into cost impacts. The quantities identified above should be direct measures of benefits, but these may not be directly applicable to the production costs of the firm. Making this connection to production costs will require certain assumptions or intermediate values.
4. Calculate cost impacts of productivity benefits. Relying on assumptions identified in the previous step (assumptions differ per industry), the magnitude of the productivity benefits can be calculated in cost terms. This cost value can now be incorporated into the cost calculation for the efficiency measure or technology.

Once benefits have been evaluated based on the method described above, they can be included in the modelling parameters at industry level to evaluate the cost-effective potential for energy efficiency improvement. This is done using the concepts of CSC (Conservation Supply Curve) and CCE (Cost of Conserved Energy)[7]. Worrell et al. (2003) give an example of application of the methodology for the iron and steel industry in the US. For correct interpretation of results, it must be noted here that the financial evaluation method proposed - CSC (conservation supply curve) and CCE (cost of conserved energy) – often do not match companies financial practices for evaluating investment project profitability (which are mostly based on Net Present Value (NPV), Internal Rate of Return (IRR) and payback evaluation).

To overcome the frequent lack of data, sometimes linked to proposals for changes to quantification methods, Hall and Roth (2003) suggest that average figures for NEBs should be used for firms who found that they were unable to report quantified savings (thereby making a number of implicit assumptions about the transferability of results in different contexts).

Hall and Roth (2003) describe a study based on 74 interviews with participants in a Wisconsin utility program with industrial customers. Regarding the criteria of importance placed on NEB by the participating partners, injury or illness (8.85 out of 10), Sales (8.75 out of 10) and productivity (8.84 out of 10) scored the highest while personnel needs (6.33 out of 10) scored the lowest. Overall 90 % of the reported changes in costs related to NEBs were positive except for changes in personnel costs, indicating several energy efficient technologies installed through the program results in more labour costs, at least in the short term. To summarise, 69 out of the 74 businesses interviewed reported some level of change in NEBs (i.e. *ex post* compared with *ex ante*). An average of 3.27 benefits were reported per partner with dollar savings from NEBs equivalent to about 2.5 times the level of energy benefits.

An initial comparison of the 'two fold' combining ex ante and ex post assessments showed a 22% increase in projects reporting NEBs compared with the traditional approach based on ex ante estimates only. However, Hall et al. also offer some words of caution: uncertainty associated with the results can be due to the use of interview techniques and the risk of the interviewee's misunderstanding of the questions and the misinterpretation of the data by the interviewer. This could lead to issues such as double counting, both false positive and false negative NEBs being reported and on-time costs or benefits being reported as annual.

McLain and Skumatz (2007) suggest that 'the ongoing difficulty in NEB research is converting the value of qualitative benefits into a unit, such as dollars, than can be compared to other more quantitative benefits for further cost/benefit analyses.' (p.1075) They criticise the use of Willingness To Pay (WTP) as a quantification method because it

---

7 "Bottom-up energy conservation supply curves (CSCs) were developed in the 1970s as a means of ranking energy conservation investments alongside energy supply investments in order to assess the least cost approach to meeting energy service demands. In these curves, the amount of energy conserved is plotted against the cost of attaining this conservation, with costs expressed on a per energy unit basis. The CCE represents the sum of the annualized capital costs and the incremental operating and maintenance costs, divided by the annual energy savings. By expressing the CCE on a per-energy-unit basis, it can be compared to the energy price. If the CCE of a given investment at a given discount rate is below the energy price, it is cheaper to make the investment in the energy-efficient technology and conserve energy than it would be to purchase the energy" (Worrell et al., 2003:1089).

provides very volatile numbers and respondents have an extremely difficult time understanding the concept of stating a dollar amount they would be willing to pay for these benefits. Skumatz & Gardner (2005) make a similar point about WTP, suggesting that comparative or relative valuations perform substantially better and more consistently than direct WTP methods (p.172). The responses are more conservative and less volatile. Also, respondents can readily answer whether these other benefits are more valuable or less valuable than energy savings or another benchmark.

Skumatz & Gardner (2005) note that few figures are available ex-post regarding non-energy benefits of energy-efficiency measures (EEMs). Most commercial and industrial companies have not conducted studies to evaluate NEBs. When values are available, they are not representative. This paper works to establish and detail a set of best practices for measuring and valuing NEBs, or more precisely to assess the net effects of both positive and negative impacts of EEMs. To determine the impact due to the program, the respondents need to be asked about the NEBs for the new efficient equipment relative to the base non-efficient equipment that otherwise would have been purchased. Appropriate comparisons are generally not to the old equipment in place. (Skumatz & Gardner, 2005:165).

Christiansen et al. (2016) describe the development of an on-line tool for decision-making, based on research from 112 implemented energy efficiency investments. Across the dataset, savings are on average 1.4 times higher, when non-energy benefits are included, compared with the energy cost savings alone.

Russell (2015) mentions a different way to including non-energy benefits in the project, which overcomes the absence of data: the “prescribed NEB values” which express non-energy benefits per unit of energy saved. These values are “the product of expert consensus. They are expressed as a percentage (generally between 7.5 and 15%; Russell, 2015:20) of the total energy saving values tabulated for the energy improvements achieved in total by a certain economic sector.

Cooremans (2014) describes the rationale and content of a continuing education program – the Certificate of Advanced Studies in Energy Management[8], which focuses on enabling the participants to frame efficiency opportunities in ways that they communicate strategic value to the company. Students undertaking the course provided positive feedback and the paper provided examples of students using their learning to influence uptake of energy efficiency measures by presenting them in business terms.

Cooremans (2011, 2012, 2015) argues that the concept of competitiveness and its components (value, risks and costs) is a good basis for analysing the impacts of energy-efficiency measures. Based on this conceptual framework, Cooremans (2015) proposes a method to identify, classify and evaluate in operational, strategic and financial terms the benefits of energy-efficiency projects. Concrete examples (in an industrial bakery and an aluminium producer) illustrate how non-energy benefits can contribute to competitiveness through increased value proposition and decreased risks and costs.

Focusing on real estate, Bozorgi (2015) suggests a systematic value-based assessment process to analyse full costs and benefits associated with energy retrofit options in the context of value, while clearly articulating the risk and uncertainty. The methods and hypotheses suggested in this paper are primarily based on an extensive literature review, author's experience with energy efficiency analytics and tools development, and discussion with real estate experts in the field regarding the lack of tools and business models for a comprehensive analysis of energy efficiency impacts on the bottom line financial performance.

Bozorgi (2015) shows how much there is to learn and assimilate when trying to combine the traditional techno-economic approach to energy efficiency with the financial-managerial approach of property valuation professionals. Key terms and concepts (e.g. capitalisation rate) are needed to translate the energy efficiency case into a form of language that is more familiar (and therefore salient) to the target audience. Bozorgi (2015) does not comment on

[8] The Certificate of Advanced Studies in Energy Management is a continuing education programme of University of Geneva (15 ECTS credits). There have been 5 editions of this program, from 2013 to 2017. http://www.unige.ch/formcont/cours/cas-management-de-l-energie-2019

the amount of additional work involved, but expertise is clearly needed in three domains in order to achieve the three-way analysis described:

- the presentation of building energy retrofit options
- modelling of property values using discounted cash flow (DCF)
- reporting uncertainty and risk using probability functions (Monte Carlo simulation)

The combined method is summarised in Figure 3.

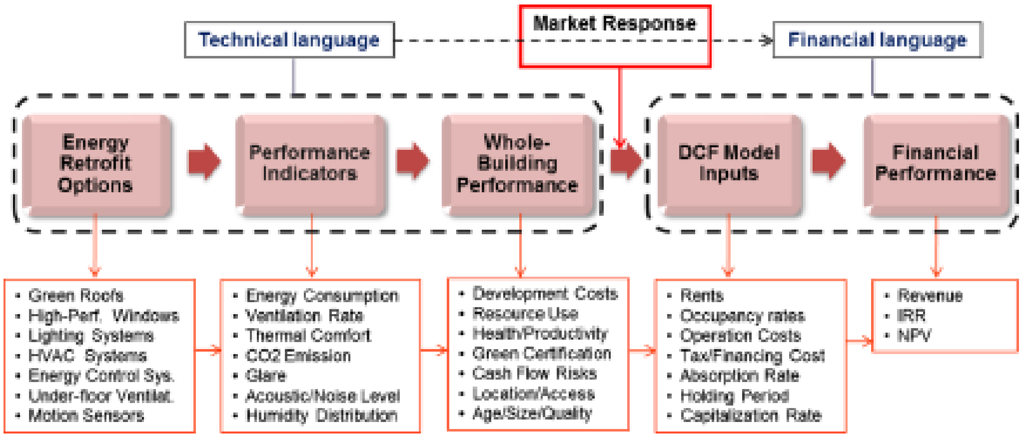


Figure 3 A value-based assessment process for deriving the financial performance of energy retrofit options (Bozorgi 2015: 1025)

One implication of this is that energy costs may be so small and uncertain when compared with other variables, that the conclusion of property valuation professionals to ignore energy is in fact perfectly logical and rational. This point is not made directly by Bozorgi (2015), but his novel multi-disciplinary method may in fact support an inconvenient truth about energy efficiency that has been known about in the energy community for decades: other considerations and priorities mean that energy efficiency is generally a low-priority topic.

3.2.4 Barriers and solutions to including MBs in project assessment

Several authors provide reasons explaining why MBs are rarely included in energy-efficiency project assessment.

Worrell et al. (2003) identified four limitations or difficulties related to MBs assessment:

- There is a general lack of both time-series and plant level data on the appropriate mix of inputs by which we might more accurately assess the productivity impacts resulting from a changing pattern of investments and energy consumption.
- Not all these benefits are easily quantified in financial terms.
- It is reasonable to expect variation between plants in the benefits observed. Many of the benefits are not just a function of the efficiency measure, but also of site-specific factors, such as the scale of the project, the maintenance schedule of the facility, and the capacity at which the equipment is operated.
- There may also be negative impacts associated with energy efficiency measures that will offset some of the benefits. These impacts may be just as difficult to quantify as productivity benefits. One potential offset to the benefits of an energy-efficiency measure is that if it involves new technology, there will be some risk in making the investment. Firms may need to train personnel to use the new equipment, and may have difficulty maintaining or repairing the equipment. Additionally, a new project may require a shutdown of production during implementation, leading to production losses. Since these negative impacts will certainly play a role in the decision making of the

investor at the firm level, they should be included in the assessment of total energy conservation potential. (Worrell et al., 2003:1095).

Lung et al. (2005) also identify four potential reasons explaining why ancillary cost savings are often omitted in the financial assessment of energy-efficiency projects:

- ancillary savings are not achieved consistently. While such savings often accrue in the wake of an energy efficiency improvement, the same benefits are not obtained each time a project is implemented.
- Time and skill are required to track such benefits accurately. Industrial plants need to develop baselines of their ancillary costs and doing so may be outside of a project's scope of work.
- If the ancillary savings turn out to be minor, then tracking them may not be worth the expense.
- Quantifying certain ancillary benefits can be difficult. Benefits such as longer equipment life, increased production reliability, better worker safety/morale, reduced noise levels, and improved air quality can be subjective or intangible. For instance, as noted by Lung et al. (2005:6-113) regarding the cement plant energy-efficiency project: "regrettably, the production benefits from the reduced production stoppages were not quantified. This was due in part to the fact that the costs imposed by the production stoppages had not always been measured. The stoppages were of varying length and did not always affect the same production processes, which made it exceedingly complex to attempt to quantify them".

In their review of 63 energy-efficiency projects in the US state of Massachusetts, Newberger et al. (2007) find that companies' staff lack the knowledge and experience to identify NEBs *ex ante* sufficiently consistently and fully. A lack of data is also an issue, but the bigger problem is with people and skills, leading these authors to recommend training in NEB identification and quantification. This conclusion meets Cooremans and Schönenberger's (2017) recommendation, who argue for a stronger focus on training present and future energy managers to improve their managerial, analytical and communication skills.

Based on his analysis of projects described in the literature (Worrell et al., 2003; Lung et al., 2005) or of utilities or public energy-efficiency programs (BC Hydro, CADDET, IAC Database) , Russell (2015:9) points out a general lack of data and of methodology regarding multiple benefits:

- "Facility-level data for actual projects are not only scarce, but also fraught with inconsistent definitions and contextual interpretations of both energy and non-energy improvements. Available project data are limited to a handful of isolated examples, quantities far below the threshold needed for reliable statistical inference. The potential for synthesizing existing project data for inferential purposes is almost nil".
- "Information documenting the project-level coincidence of energy and non-energy value creation is derived mostly from case studies that are prepared independently of each other and without reference to a standard methodology. Case studies are inconsistent in project definition".

Russell (2015) advocates the development of a consistent analytical approach, a conceptual framework which must "provide guidance to facilities that enables staff to recognize and monitor the multiple benefits that manifests in their business process" (Russell, 2015:23).

As described by Russell (2015:22), "beginning at the level of individual energy improvement projects, the analytical framework for clarifying multiple energy benefits should define energy-related business outcomes that:

- Directly support current and future business goals
- Are achievable within current business constraints
- Demonstrate a calculable magnitude and rate of return

- Are urgent by virtue of their alignment with current priorities"

Thus Russell (2015) strongly emphasises the need to align energy-efficiency –or energy use- with business goals and priorities. Based on new tools to be developed (i.e. appropriate performance metrics based on available data and methodologies for baseline scenarios), multiple benefits findings and figures should be effectively translated and communicated so that the information "becomes integral to business decision-making" (Russell, 2015:23).

In conclusion, Russell (2015:25) points out that "the task of developing a protocol for quantifying facility-level multiple benefits is daunting. The volume of data required to generate statistically reliable information about multiple benefits is enormous. A single utility's customer portfolio is too small to generate a statistically adequate volume of data. To accumulate the volume needed for current purposes, a continent-wide or larger effort may be in order. Any utility that maintains industrial project feasibility studies to support the provision of rebates and incentives is a potential contributor. Collaboration can also enhance the defining and measuring of multiple benefits. Collaboration would facilitate data collection, methodological consistency, and cost control.

In this section the potential, barriers, decision-making frameworks and types of multiple benefits related to energy efficiency investment projects have been identified and discussed. The next section synthesises our findings and provides a few general lessons that can be drawn from the literature review and find out whether the research questions could be answered.

3.3 Discussion / Synthesis

We start this section by referring back to our research questions and discussing the results based on the literature review. Thereafter we draw general conclusions and lessons learned.

Five research questions were proposed at the start of the literature review:

- Q1: How has a multiple benefits approach to energy efficiency been used? What were the effects on investment decisions? Were any strategic benefits of energy efficiency specifically recognised?

The literature review does not provide any evidence of a multiple benefits approach for energy efficiency being used but provides ex post analysis of the non-energy benefits that arise for energy efficiency investments. The only exception is the methodology developed by Cooremans (2015) but it is only partially applied[9]. This makes it difficult to analyse the strategic benefits and effects on investment decisions and allows the reviewers to only infer the positive effects on investment decisions if an ex ante analysis was conducted.

- Q2: Are there contextual factors which seem important to the rate at which MBs are operationalised, making the use of an MB approach more/less likely (e.g. the presence/absence of a strong champion, either within the company or in an external advisory role)?

The main findings from the literature review state that the frequency of investment projects (regardless of energy efficiency projects) being undertaken by a firm mainly depends on its link to the firms core business since investment decisions are made by the same people involved in the firm's core business decisions. Therefore accounting for and relating MBs of energy efficiency projects to these components can help operationalise energy efficiency projects. Barriers other than the priorities of decision makers include: base barriers; symptom barriers; (strategic) barriers and hidden (cultural) barriers. Other issues that could arise are a lack of time-series and plant level data, MBs that are difficult to quantify in financial terms and negative impacts associated with energy efficiency measures that can offset some benefits.

- Q3: For which energy efficiency measures and technologies has the MB approach been used? How do the MBs identified differ between measures and technologies?

---

[9] In the Swiss canton of Vaud: https://www.vd.ch/themes/environnement/energie/entreprises/programme-des-audits-energetiques/grands-consommateurs/

MBs were recorded and analysed for energy efficiency measures undertaken in manufacturing industries like food manufacturing, building materials, steel manufacturing, paper manufacturing, chemicals manufacturing and textile manufacturing. Other sectors involved were the utility and building (residential & non-residential) sector. There is no general agreement on the multiple benefits categories to be used, although broad themes seem to be common to many authors (with variations): Operations and Maintenance; Production or Productivity; Work environment; Natural environmental (a category which includes waste and emissions).

- Q4. Does the use of MB differ by company structure, company size, sector or other organisational characteristics?

There was not much information in the literature about the actual use of an MB approach. However, from the findings we can conclude that the perspectives of others are necessarily heterogeneous. One consequence of adopting other perspectives is that there are multiple sets of lessons to learn and new ways of thinking to adopt. But it ultimately depends on the sector being analysed. So the common approach is to understand what is of strategic value to the sector in question and the metrics used to measure it.

- Q5: How could a multiple benefits approach to energy efficiency investments in organisations be operationalised?
- Q6. How could a strategic understanding of the multiple benefits approach to energy efficiency investments in organisations be operationalised?

The main findings from the literature review state that the frequency of investment projects (regardless of energy efficiency projects) being undertaken by a firm mainly depends on their link to the firm’s core business and competitive advantage. Therefore accounting for and relating MBs of energy efficiency projects to these components can help operationalise energy efficiency projects. The literature review shows evidence that there is a lack of knowledge and experience in companies to identify MBs ex ante and therefore, the development of a consistent analytical approach is advocated. This shall provide guidance to facilities and enable its staff to recognise and monitor MBs that manifests in their business process.

A few key general lessons can be drawn from this review:

1. Non-energy benefits do exist. Many research works document the existence of non-energy-benefits in manufacturing industries in OECD countries. Studies have demonstrated that very considerable multiple benefits / non-energy benefits have been experienced by firms adopting energy efficiency measures.

2. Multiple benefits categories. There is no general agreement on the multiple benefits categories to be used, although broad themes seem to be common to many authors (with variations): Operations and Maintenance; Production or Productivity; Work environment; Natural environmental (a category which includes waste and emissions); Other.

3. Non-energy benefits positively and significantly influence financial assessment of energy-efficiency projects. When the multiple benefits resulting from energy efficiency efforts are incorporated into payback models, the financial figures are significantly improved and the business case for implementing such efforts is more compelling. A database of more than 100 investment case studies showed savings are on average 1.4 times higher when non-energy benefits are included, compared with the energy cost savings alone. Other studies show even higher savings when MBs are monetised; up to 2-3 times greater than the financial benefit of energy savings. Even a relatively simple extension of current cost-benefit analysis to include a limited number of monetised MBs, can demonstrate considerable extra benefits to the firm, and can influence decision making.

4. Multiple benefits of energy-efficiency projects are generally not reported, not quantified and not included in project assessment. Although they sometimes propose detailed methods to analyse the multiple benefits – or impacts – of energy-efficiency projects, all papers describe benefits identified ex-post, and point out that these benefits are often not reported, and even if they are, they are mostly not quantified and included in project assessment. Therefore financial managers are often not even aware of NEBs and therefore do not adopt energy efficiency measures.

5. Several obstacles make it difficult to include non-energy benefits in project assessment. There is a general lack of both time-series and plant-level data. There are some evidence-based average figures for non-energy benefits available, which could be used where using firm-specific figures is unrealistic. Not all benefits are easily quantified in financial terms. Benefits are not achieved consistently. Sometimes they turn out to be minor, and then tracking them may not be worth the expense. They are very often associated to energy-efficiency improvement projects, but the same benefits are not obtained each time a project is implemented because many of the benefits are not just a function of the efficiency measure, but also of site-specific factors. Time and skill are required to accurately track such benefits. Data collection requires time but time is lacking. There is also a lack of managerial, analytical and communication skills of energy specialists in charge of evaluating energy-efficiency projects.

6. The conventional financial approach on energy-efficiency projects prevails. When including non-energy benefits in their analyses, most authors adopt a conventional approach by considering that financial considerations exclusively determine companies' investment decision-making. With some significant exceptions (Pye & McKane, 2000; Cooremans, 2011, 2012; Russell, 2015), the contribution of an energy efficiency project to companies' strategic interests is not considered.

The risk impact of energy-efficiency projects is very rarely assessed, but when it is mentioned – generally in vague terms – it is always in negative terms: i.e. the impact on risk is deemed to be negative, even though many positive impacts on companies' risks can be identified. Cooremans (2011, 2015) and Russell (2015) are the only authors to consider a positive contribution of energy-efficiency projects to companies' risk mitigation.

The methods and arguments developed by the energy conservation community do not match the interests, concepts and languages of top decision-makers in firms.

7. A need to switch to a strategic approach of energy-efficiency projects. Conceptually, the strategic character of an investment can be defined as the contribution of this investment to a company's competitive advantage (Cooremans, 2011). Competitiveness is made of three dimensions: the value proposition(s) offered to customer segments (which translates into revenue) and the costs and risks borne to producing this value proposition. Strategic analysis of an investment project thus consists in assessing the potential contribution of this investment to these three dimensions. Strategic analysis encompasses financial analysis, since cost and value impacts can most generally be translated into figures (although often hypothetically, as it is the case in any type of investment project).

Some multiple benefits may be both important financially and/or strategically to companies, but are difficult to put in monetary terms. A method for recognising and including these benefits in a qualitative way must be developed. McLain and Skumatz (2007) criticise the use of Willingness To Pay (WTP) as a method to quantify qualitative benefits and suggest that comparative or relative valuations perform substantially better and more consistently than WTP methods (p.172)

In conclusion, there is a need to adopt a very different perspective to identifying, analysing and communicating energy-efficiency projects, which should be based on practices beyond the energy efficiency community.

This implies the need for training and education for energy experts, so that they are better able to analyse decision options in ways that resonate with decision-makers. New course development indicates ways in which this training can be delivered.

Even with better trained, more rounded advocates of energy efficiency in place, there is no guarantee that energy efficiency will be adopted more widely; indeed, there is a chance that all the additional training and work may do little more than explain to the energy community why other stakeholders view energy as a low-priority issue.

The perspectives of others are necessarily heterogeneous, so one consequence of adopting other perspectives is that there are multiple sets of lessons to learn and new ways of thinking to adopt. But it ultimately depends on the sector being analysed. So the common approach is to understand what is of strategic value to the sector in question and the metrics used to measure it.

Decision-making in firms around energy efficiency is likely to be undertaken by people who do not share the values, decision-making tools and frameworks, or language of those who identify the investment opportunity.

Translating between the language of energy efficiency and strategic value may be challenging, but it is possible, with successful cases presented. This translation can be done by differentiating between value, cost and risk impacts since they can be used as the three main components of competitive advantage for a firm.

References

Andrews, R.N.L. and Johnson, E. (2016) Energy use, behavioral change, and business organizations: Reviewing recent findings and proposing a future research agenda. *Energy Research & Social Science,* 11, pp. 195-208.

Bailey, M., Lauman, R., Wickes, G. and Crumrine, B. (2009) Get 'er Done! How to Implement Energy Efficiency Projects by Understanding Organizational Behavior and Decision Making. *ACEEE Summer Study on Energy Efficiency in Industry,* American Council for an Energy Efficient Economy

Banks, N., Fawcett, T. and Redgrove, Z. (2012) *What are the factors influencing energy behaviours and decision-making in the non-domestic sector? A rapid evidence assessment.* London: Department of Energy and Climate Change

Bement, D. and Skumatz, L. (2007) New Non-Energy Benefits (NEBs) results in the commercial/industrial sectors: Findings from incentive, retrofit, and technical assistance/new construction programs. ECEEE Summer Study, European Council for an Energy Efficient Economy, pp. 1551.

Bozorgi, A. (2015) Integrating value and uncertainty in the energy retrofit analysis in real estate investment. *Energy Efficiency,* 8, pp. 1015-1034.

Cagno, E., Trianni, A. and Moschetta, D. (2016) Only non-energy benefits when adopting an EEM? Cases from industry. *ECEEE Industrial Summer Study Proceedings,* European Council for an Energy Efficient Economy, pp. 281

Christiansen, I.S., Dyhr-Mikkelsen, K. and Gudbjerg, E. (2016) New robes for NEB research – open and expanding data. *ECEEE Industrial Summer Study,* European Council for an Energy Efficient Economy, pp. 417.

ClimateWorks (2014) Energy management and company competitiveness, Australian Government Department of Industry, ClimateWorks, Investor Group on Climate Change Australia

Cooremans, C. (2015) Competitiveness benefits of energy efficiency: a conceptual framework. *ECEEE Summer Study,* European Council for an Energy Efficient Economy, pp. 123.

Cooremans, C. (2014) CAS in energy management: an innovative continuing education program as a tool to market transformation. *ECEEE Industrial Summer Study,* European Council for an Energy Efficient Economy, pp. 67

Cooremans, C. (2012) Investment in energy efficiency: do the characteristics of investments matter? *Energy Efficiency,* 5 (4), pp. 497-518.

Cooremans, C. (2011) Make it strategic! Financial investment logic is not enough. *Energy Efficiency,* 4 (4), pp. 473-492.

Cooremans, C. and Schönenberger, A. (2017) Energy management: a key driver of energy-efficiency investment? *ECEEE Summer Study* European Council for an Energy Efficient Economy, pp. 221

Fleiter, T., Hirzel, S. and Worrell, E. (2012) The characteristics of energy-efficiency measures – a neglected dimension. Energy Policy, 51, pp. 502-513.

Hall, N.P. and Roth, J. (2003) Non-energy benefits from commercial and industrial energy efficiency programs: energy efficiency may not be the best story *2003 Energy Program Evaluation Conference, Seattle,* International Energy Program Evaluation Conference, pp. 689.

IEA (International Energy Agency) (2014). Capturing the multiple benefits of energy efficiency. OECD/IEA, Paris.

Lung, R.B., et al., Ancillary Savings and Production Benefits in the Evaluation of Industrial Energy Efficiency Measures. 2005 ACEEE Summer Study on Energy Efficiency in Industry, 2005.

McClain, E., Skumatz, L.A. and Jennings, J. (2007) Commissioning in public sector building – Non-Energy Benefits (NEBs), not savings, are the selling point. *ECEEE Summer Study,* European Council for an Energy Efficient Economy, pp. 1073.

McGinley, K., Geary, P. and Dodenhoff, J. (2015) Striking Gold: How Innovations and Productivity Improvements in the Mining Industry Leverage Energy Efficiency Technologies. *Summer Study on Energy Efficiency in Industry,* American Council for an Energy Efficient Economy, pp. 6-1.

Nehler, T. and Rasmussen, J. (2016) How do firms consider non-energy benefits? Empirical findings on energy-efficiency investments in Swedish industry. *Journal of Cleaner Production,* 113, pp. 472-482.

Newberger, J., Hall, N., Roth, J., Horowitz, P. and Weber, D. (2007) Custom NEBs: Are They Worth It? - Experiences, Challenges, and Directions in Massachusetts. *2007 Energy Program Evaluation Conference, Chicago* International Energy Program Evaluation Conference, pp. 701.

Pye, M. and McKane, A. (2000) Making a stronger case for industrial energy efficiency by quantifying non-energy benefits. *Resources, Conservation and Recycling,* 28 (3), pp. 171-183

Rasmussen, J. (2014) Energy-efficiency investments and the concepts of non-energy benefits and investment behaviour. *ECEEE Industrial Summer Study,* European Council for an Energy Efficient Economy, pp. 733

Russell, C. (2015). Multiple Benefits of Business-Sector Energy Efficiency: A survey of Existing and Potential Measures. American Council for an Energy-Efficient Economy, Washington DC. Report IE1501.

Russell, C. (2013) Corporate Protocols for Capital Investment: Implications for Industrial Energy Program Design. *ACEEE Summer Study on Energy Efficiency in Industry,* American Council for an Energy Efficient Economy, pp. 2-1

Russell, C. (2009) What's in It for Me? The Financial Dynamics of Corporate Energy Management. *ACEEE Summer Study on Energy Efficiency in Industry,* American Council for an Energy Efficient Economy, pp. 2-24.

Sandberg, P. and Söderström, M. (2003) Industrial energy efficiency: the need for investment decision support from a manager perspective. Energy Policy, 31 (15), pp. 1623-1634.

Skumatz, L.A. and Gardner, J. (2005) Methods and Results for Measuring Non-Energy Benefits in the Commercial and Industrial Sectors. ACEEE Summer Study on Energy Efficiency in Industry, American Council for an Energy Efficient Economy

Stevens, N., Foley, L., Weber, S., Rathbun, P. and Goldberg, M. (2013) Using In-depth Interviews to Estimate Non-energy Impacts Resulting from Commercial and Industrial Energy Efficiency Measures. *International Energy Program Evaluation Conference, Chicago* IEPEC, pp. 1

UNEP DTU 2017 Overcoming barriers to investing in energy efficiency, United Nations, New York and Geneva

Woodroof, E.A., Turner, W.C., Heffington, W. and Capehart, B. (2012) Energy Conservation Also Yields: Capital, Operations, Recognition, and Environmental Benefits. *Energy Engineering,* 109 (5), pp. 7-26.

Worrell, E., Laitner, J. A., Ruth, M. and Finman, H. (2003). Productivity benefits of industrial energy efficiency measures. Energy 28 (11): 1081–1098

Multiple benefits of energy efficiency

ANNEX B

M-BENEFITS Work Package 2: Literature review - full list of sources consulted, prior to final choice for review

Gavin Killip, University of Oxford

Tina Fawcett, University of Oxford

Catherine Cooremans, University of Lausanne

Subramani Krishnan, University of Utrecht

Wina Crijns-Graus, University of Utrecht

Fabian Voswinkel, Fraunhofer Institute ISI

Matthias Reuter, Fraunhofer Institute ISI

© The Multiple Benefits of Energy Efficiency project and its partners

Document number: v1.0

Publishing date: 31 August 2018

Project deliverable: D2.2

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Project partners

Fraunhofer ISI

Environmental Change Institute – eci – University of Oxford

Unil – UNIL | Université de Lausanne

Graz Energy Agency

Lucerne University of Applied Sciences and Arts – Hochschule Luzern – FH Zentralschweiz

BPIE

BORGOCO

eceee – european council for an energy efficient economy

Hes·so – Haute Ecole Spécialisée de Suisse occidentale – Fachhochschule Westschweiz – University of Applied Sciences and Arts Western Switzerland

IREES – Institute for Resource Efficiency and Energy Strategies

FIRE – Federazione Italiana per l'uso razionale dell'energia

National Technical University of Athens

KAPE

Utrecht University

ISR - University of Coimbra

www.mbenefits.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 785131. This document only reflects the authors' views and EASME is not responsible for any use that may be made of the information is contains.

Full list of references consulted in detail before choosing final list for review

Abdou et al. (2016). EM&V Roadmap to Quantifying Challenging Non-Energy Impacts. International Journal of Energy Economics and Policy 6-2. https://search.proquest.com/docview/1787066094?accountid=13042
Abdou et al. (2015). Non-Energy Impacts Provide Powerful Marketing Tools for Energy Efficiency Programs. Journal of Corporate Real Estate 17-2 134-156. https://search.proquest.com/docview/1680397884?accountid=13042
ADEME (2011). 49 exemples de bonnes pratiques énergétiques en entreprise. Facilities 19-13/14 464-475. https://search.proquest.com/docview/219654673?accountid=13042
Aden, N., Bradbury, J., Tompkins, F. (2013). Energy Efficiency and Industrial Competitiveness: The Case of Midwest Pulp and Paper Mills. Smart and Sustainable Built Environment 3-2 110-131. https://search.proquest.com/docview/1651538610?accountid=13042
Allen and Gaffney (2010). Strategies and Challenges in Mesasuring Non-Energy Benefits from a Low-Income Weatherization Program. Journal of Property Investment & Finance 32-4 396-414. https://search.proquest.com/docview/1660769666?accountid=13042
Alschuler et al. (2016). Appraising green: show me the market value. Industrial Management & Data Systems 116-1 65-86. https://search.proquest.com/docview/1753967782?accountid=13042
Andrews R.N.L., Johnson E. (2016). Energy use, behavioral change, and business organizations: Reviewing recent findings and proposing a future research agenda. Business and Economic Horizons 13-3 295-311. https://search.proquest.com/docview/1968985877?accountid=13042
Archibald, K. (2015). Moving from energy management best practice to sustainability – New Zealand's leaders in sustainability. Academy of Management Journal 43- 717-736. https://search.proquest.com/docview/199822589?accountid=13042
Arens M., Worrell E., Eichhammer W. (2017). Drivers and barriers to the diffusion of energy-efficient technologies—a plant-level analysis of the German steel industry. Tourism and Hospitality Research 13-4 226-238. https://search.proquest.com/docview/1519571236?accountid=13042
Baatz (2016). Utility System Benefits of Energy Efficiency: Current Experience in the U.S.. Energy Policy 31-15 1623-1634. https://search.proquest.com/docview/205312462?accountid=13042
Backlund et al. (2012). Energy efficiency potentials and energy management practices in Swedish firms. The American Behavioral Scientist 50-8 1070-1087. https://search.proquest.com/docview/214762900?accountid=13042
Backman F. (2017). Barriers to energy efficiency in Swedish non-energy-intensive micro- and small-sized enterprises - A case study of a local energy program. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Abdou.pdf
Bailey, M., Rich Lauman, Geoff Wickes, Brian Crumrine (2009). Get 'er Done! How to Implement Energy Efficiency Projects by Understanding Organizational Behavior and Decision Making. IEPEC Long Beach. https://www.iepec.org/wp-content/uploads/2015/papers/143.pdf
Baker, G. (2017). Tools to Build the Framework for Engaging Employees in Making Industrial Buildings Better. ACEEE Industry. http://aceee.org/files/proceedings/2013/data/index.htm
Balaban, Osman, Puppim de Oliveira, Jose A. (2017). Sustainable buildings for healthier cities: assessing the co-benefits of green buildings in Japan. IEPPEC Paris. https://www.iepec.org/conf-docs/papers/2010PapersTOC/papers/057.pdf#page=1
Banks, N., Fawcett, T., Regrove, Z. (2012). What are the factors influencing energy behaviours and decision-making in the non-domestic sector? A rapid evidence assessment. ACEEE Buildings. http://aceee.org/files/proceedings/2016/data/index.htm
Bansal, P. and R. Kendall (2000). Why companies go green: A model of ecological responsiveness. ACEEE Industry. https://aceee.org/files/proceedings/2015/data/index.htmBarrager S.M. (2016). A new

engineering profession is emerging: Decision coach. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Baatz.pdf

Bellia, L.; Boccia, G.; Fazzito, M.; Di Serafino, G.; Fragliasso, F.; Migiarra, P.; Moscarella, L.; Stefanizzi, E. (2016). A lighting retrofit intervention for energy savings and comfort optimization in an industrial building. ECEEE Industry Study.

Bement, D.; Skumatz, L. (2007). New Non-Energy Benefits (NEBs) results in the commercial / industrial sectors: Findings from incentive, retrofit, and technical assistance / new construction programs. ACEEE Industry. http://aceee.org/files/proceedings/2009/start.htm

Benn S. et al. (2014). Networks of Practice for Energy Efficiency: a Role for Boundary Objects. ACEEE Industry.

Bergmann A., Rotzek J.N., Wetzel M., Guenther E. (2017). Hang the low-hanging fruit even lower - Evidence that energy efficiency matters for corporate financial performance. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896

Bleyl et al. (2018). Incorporating Multiple Project Benefits into Life-Cycle Cost-Benefit Analyses of Deep Energy Retrofits in Office Buildings. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_7/7.318/paper.pdf

Bleyl, J. W. , Markus Bareit, Miguel A. Casas, Johan Coolen, Benjamin De Bruyn, Albert Hulshoff, Sarah Mitchell & Mark Robertson (2017). Building deep energy retrofit: Using dynamic cash flow analysis and multiple benefits to convince investors. Academy of Management Proceedings. https://journals.aom.org/doi/10.5465/ambpp.2014.13055abstract

Blumer Y, Wemyss D, Moser C (2015). How cities can foster local action in energy efficiency by utilizing middle actors – insights from a Swiss case study. IEA Workshop on MBs Paris.

Boley, B and U. Muzaffer (2013). Competitive synergy through practicing triple bottom line sustainability: Evidence from three hospitality case studies. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/6-buildings-policies-directives-and-programmes/building-deep-energy-retrofit-using-dynamic-cash-flow-analysis-and-multiple-benefits-to-convince-investors/

Bozorgi, A. (2015). Integrating value and uncertainty in the energy retrofit analysis in real estate invesment . ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/3-local-action/how-cities-can-foster-local-action-in-energy-efficiency-by-utilizing-middle-actors-8211-insights-from-a-swiss-case-study/

Brown M.A., Baer P., Cox M., Kim Y.J. (2014). Evaluating the risks of alternative energy policies: A case study of industrial energy efficiency. IEPEC Long Beach. https://www.iepec.org/wp-content/uploads/2015/papers/123.pdf

Browne (2015). https://www.iepec.org/wp-content/uploads/2015/papers/123.pdf. IEA Workshop on MBs Paris.

Bruce, T. et al. (2015). Evaluating the health benefits of weatherization. IEA Workshop on MBs Paris.

Brunke J.-C., Blesl M. (2015). Energy efficiency in the German cement industry against the background of more stringent energy policy targets and rising energy costs-Part 1. IEPPEC Rome. https://www.iepec.org/conf-docs/papers/2012PapersTOC/papers/041.pdf#page=1

Burns, P. (2015). Boilers on prescription. ECEEE Industry Study.

Buso T., Dell'Anna F., Becchio C., Bottero M.C., Corgnati S.P. (2017). Of comfort and cost: Examining indoor comfort conditions and guests' valuations in Italian hotel rooms. IEPEC Baltimore. http://www.iepec.org/2017-proceedings/65243-iepec-1.3717521/t002-1.3717983/f002-1.3717984/a017-1.3718124/an063-1.3718127.html

Cagno E., Moschetta D., Trianni A. (2016). Only non-energy benefits when adopting an EEM? Cases from industry. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/8-monitoring-and-evaluation-building-confidence-and-enhancing-practices/productivity-impact-from-multiple-impact-perspective/

Cagno E., Trianni A. (2014). Evaluating the barriers to specific industrial energy efficiency measures: An exploratory study in small and medium-sized enterprises. ACEEE

Industry. http://aceee.org/files/proceedings/2009/start.htm
Cagno E., Trianni A., Spallina G., Marchesani F. (2017). Drivers for energy efficiency and their effect on barriers: empirical evidence from Italian manufacturing enterprises. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_3/3.320/paper.pdf
Campbell et al. (2012). Spreading the Net: Evaluating the Multiple Benefits Delivered by Energy Efficiency Policy. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_7/7.303/paper.pdf
Cano et al. (2012). Strategic model for energy systems optimisation: aspects of energy efficiency and risk management. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/047.pdf#page=1
CEE (?). Motor Management Case Studies: Water-Wastewater. IEPPEC Rome. https://www.iepec.org/conf-docs/papers/2012PapersTOC/papers/105.pdf#page=1
CEE (?). Motor Management Case Studies: Lumber and Wood Products. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/1-foundations-of-future-energy-policy/competitiveness-benefits-of-energy-efficiency-a-conceptual-framework/
CEE (?). Motor Management Case Studies: Paper and Allied Products. ECEEE Buildings. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_1/1.177/
CEE (?). Motor Management Case Studies: Various Industries. ACEEE Buildings. http://aceee.org/files/proceedings/2006/data/papers/SS06_Panel7_Paper04.pdf
Chan et al. (2017). Saving Lives through Energy Efficiency: Valuing the Health- and Safety-Related Benefits of Weatherization in Low-Income Homes. BECC BALTIMORE.
Chatterjee, S. & Diana Ürge-Vorsatz (2017). Productivity impact from multiple impact perspective. IEA Workshop on MBs Paris.
Christiansen I.S., Gudbjerg E., Dyhr-Mikkelsen K. (2016). New robes for NEB research - Open and expanding data. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/1-foundations-of-future-energy-policy/energy-management-a-key-driver-of-energy-efficiency-investment/
Ciccaterie, J. (2009). Lean, Clean and Green: British Columbia's Approach to Energy Efficiency in Small and Medium Size Manufacturers. ECEEE Industry Study.
Clarke O.L. (2005). Don't even say energy conservation–it's "energy productivity". ACEEE Industry. http://aceee.org/files/proceedings/2011/start.htm
Clarke O.L. (2005). Part one of a two-part series: Don't even say energy conservation - The manufacturing initiative. ACEEE Industry. http://aceee.org/files/proceedings/2013/data/index.htm
Coghlan, A.; Skumatz, L. (2007). Green Campus: Innovative approaches to energizing the "Next Generation" toward energy efficiency and green behaviors. Academy of Management Proceedings. https://journals.aom.org/doi/10.5465/ambpp.2013.241
Coito, F.; Allen, D. (2007). Why industrial customers don't implement cost-effective energy efficiency opportunities: A closer look at California's cement industry. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896
Collins, M. and Joe Loper (2013). Kicking the Can: How First-Year Impact Evaluation Transfers Cost and Uncertainty. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/8-monitoring-and-evaluation-building-confidence-and-enhancing-practices/comparing-energy-efficiency-scoreboard-methodologies-and-results/
Cook P., Khare A. (2009). The link between continuous commissioning and sustainable growth: A sustainable business model. ECEEE Industry. https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2014/1-programmes-to-promote-industrial-energy-efficiency/large-industrials-serious-engagement-for-deep-savings/
Cooney et al. (2012). Applied Framework for Evaluation of Benefits and Costs of Smart Grid Investments: A Regional Case Study. ECEEE Summer Study.

https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/8-monitoring-and-evaluation-building-confidence-and-enhancing-practices/adapting-an-english-methodology-to-assess-health-cost-benefits-of-upgrading-energy-inefficient-french-dwellings/

Cooremans C. (2014). CAS in energy management: An innovative continuing education program as a tool to market transformation. IEA Workshop on MBs Paris.

Cooremans C. (2012). Investment in energy efficiency: Do the characteristics of investments matter?. IEA Workshop on MBs Paris.

Cooremans, C. (2015). Competitiveness benefits of energy efficiency: a conceptual framework. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2005c/Panel_4/4228feldman/paper.pdf

Cooremans, C. (2007). Strategic fit of energy-efficiency (strategic and cultural dimensions of energy-efficiency investments). IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896

Cooremans, C. (2006). Modeling firms' energy-efficiency investment drivers in commercial buildings. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_4/4.322/paper.pdf

Cooremans, C. (2016). Energy-Efficiency Investment: Why Do Firms Apply Such Restrictive Financial Methods and Selection Criteria?. IEA Workshop on MBs Paris.

Cooremans, C. (2014). Categorizing NEBs of energy efficiency. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_3/3.315/paper.pdf

Cooremans, Catherine (2011). Make it strategic! Financial investment logic is not enough. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/042.pdf#page=1

Cooremans. C. & Alain Schönenberger (2017). Energy management: a key driver of energy-efficiency investment? . ECEEE Industry Study.

Copenhagen Center for energy-efficiency (2016). Tools for Energy Efficiency in buildings. A guide for policy-makers and experts. Conference: 8th IAEE International Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx

Crittenden, P. (2012). Integrating energy efficiency into core business practices – an institutional work perspective on the implementation of energy management systems. IEA Workshop on MBs Paris.

Dalla Mora T., Peron F., Romagnoni P., Almeida M., Ferreira M. (2018). Tools and procedures to support decision making for cost-effective energy and carbon emissions optimization in building renovation. Conference: NAEE/IAEE Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx

Cash, D. et al. (2002). Salience, Credibility, Legitimacy and Boundaries: Linking Research, Assessment and Decision Making. IEPEC Seattle. https://www.iepec.org/conf-docs/papers/2003PapersTOC/papers/077.pdf

de Fátima Teles M., de Sousa J.F. (2014). Integrating Environmental Policies into Business Strategy: The Problem Structuring Stage in a Framework for Decision Support. IEA Workshop on MBs Paris.

De Groot H.L.F., Verhoef E.T., Nijkamp P. (2001). Energy saving by firms: Decision-making, barriers and policies. IEPPEC Rome. https://www.iepec.org/conf-docs/papers/2012PapersTOC/papers/042.pdf#page=1

DECC (2014). Research to assess the barriers and drivers to energy efficiency in small and medium sized enterprises. ECEEE Summer Study.

Deitchman, B., Brown, M., Baer, P. (2011). Green Jobs from Industrial Energy Efficiency. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2013/5b-cutting-the-energy-use-of-buildings-policy-and-programmes/fuel-poverty-alleviation-as-a-co-benefit-of-climate-investments-evidence-from-hungary/2013/5B-485-13_TiradoHerrero.pdf/

Dodenhoff, J., Hoda, M. (2013). Technology Drivers of Improved Energy Productivity inManufacturing Process Enhancement Projects. ACEEE Industry. http://aceee.org/files/proceedings/2003/data/index.htm

Dowell, G., Muthulingm, S. (2013). Behavioral and Institutional Influences on Energy Saving Initiatives . IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896

Dragon, V. (2016). Energy performance contracting, the royal road to increasing the competitive advantage of businesses by improving energy efficiency. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2003c/Panel_4/4180jakob/paper.pdf

Drechsel M., Bornschlegl M., Spreng S., Bregulla M., Franke J. (2013). A new approach to integrate value stream analysis into a continuous energy efficiency improvement process. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/b2dd8b84-36d6-42d6-b3cf-7a02aa2a25cb/language-en/format-PDF/source-70707892 ; https://publications.europa.eu/en/publication-detail/-/publication/a2641e89-f58e-4681-8019-5911e1f56c5b/language-en/format-PDF/source-70707896

Eichhammer,W., Shruti Vaidyanathan, Meegan Kelly & Barbara Schlomann (2017). Comparing energy efficiency scoreboard methodologies and results . ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/1999/Panel_3/p3_11/paper.pdf

Epstein. G., Lucy Neiman, Mark D'Antonio, Jeffrey Perkins (2014). Large industrials: serious engagement for deep savings. IEA Workshop on MBs Paris.

Ezratty et al. (2017). Adapting an English methodology to assess health cost benefits of upgrading energy inefficient French dwellings. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_7/7.048/paper.pdf

Ezratty et al. (2018). Health cost benefits of energy upgrades in France. ACEEE Buildings. http://aceee.org/files/proceedings/2004/data/papers/SS04_Panel3_Paper10.pdf

Fawcett, T. (2018). Communicating energy efficiency to European policymakers: What works?. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2013/5b-cutting-the-energy-use-of-buildings-policy-and-programmes/monetising-the-multiple-benefits-of-energy-efficient-renovations-of-buildings-in-the-eu/

Fawcett, T., Killip, G. (2017). INBEE Project: D2.4 Intangible benefits of energy efficiency: Final report. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2003c/Panel_4/4133jutsen/paper.pdf

Feldman, S.; Hoefgen, L.; Wilson-Wright, L.;Li, A. (2005). Modelling the effects of U.S. ENERGY STAR (R) appliance programs. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Reid.pdf

Ferreira et al. (2015). Increasing the efficiency of high temperature furnaces through a topping cycle cogeneration - A case study. IEPEC Denver. https://www.iepec.org/conf-docs/papers/1999PapersTOC/papers/075.pdf

Ferreira M., Almeida M., Rodrigues A. (2017). Impact of co-benefits on the assessment of energy related building renovation with a nearly-zero energy target. ACEEE Industry. http://aceee.org/files/proceedings/2017/data/polopoly_fs/1.3687896.1501159072!/fileserver/file/790274/filename/0036_0053_000039.pdf

Finman H., Laitner J.A. (2001). Industry, energy efficiency and productivity improvements. IEPEC Baltimore. http://www.iepec.org/2017-proceedings/65243-iepec-1.3717521/t002-1.3717983/f002-1.3717984/a022-1.3718074/an085-1.3718077.html

Fisk, W. (2000). Health and Productivity Gains from Better Indoor Environments and Their Relationship with Building Energy Efficiency. IEPEC Long Beach. https://www.iepec.org/wp-content/uploads/2015/papers/124.pdf

Fleiter, T, S. Hirzel and E. Worrell (2012). The characteristics of energy-efficiency measures - a neglected dimension. ACEEE Buildings. http://aceee.org/files/proceedings/2014/data/papers/8-320.pdf

Foggia, G. di (2016). Effectiveness of Energy Efficiency Certificates as Drivers for Industrial Energy Efficiency Projects. ACEEE Buildings. http://eta-publications.lbl.gov/sites/default/files/incorp-nonenergy-benefits-aceee.pdf

Franco, D. (2016). Can Energy Efficiency Services in buildings be seen as a Clean technology?. ACEEE Industry.
Freeman, D.; Skumatz, L. (2007). Attributable effects from information and outreach programs: Net to gross, NEBs, and beyond. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/1-foundations-of-future-energy-policy/mobilizing-climate-finance-to-support-energy-efficiency/
Friege, J., Chappin, E. (2014). Modelling decisions on energy-efficient renovations: A review. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_1/1.113/paper.pdf
Gallagher, L. (2018). Beyond energy savings. IEA Workshop on MBs Paris.
Galvin R., Terry N. (2016). Selling energy savings in the United Kingdom: A case study of top-down pro-environmental behaviour change in commercial office buildings. IEA Workshop on MBs Paris.
Gardner, J.; Skumatz, L. (2007). Economic impacts from energy efficiency programs - Variarions in multiplier effects by program type and region. ACEEE Industry. http://aceee.org/files/proceedings/2013/data/index.htm
Garforth P. (2006). Energy productivity in the high-energy industries: Uncompetitive cost, survival or competitive advantage?. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896
Gliedt T., Hoicka C.E. (2015). Energy upgrades as financial or strategic investment? Energy Star property owners and managers improving building energy performance. ACEEE Industry.
Glinsmann and Provencher (2013). I can't use a Randomized Controlled Trial – NOW WHAT? Comparison of Methods for Assessing Impacts from Opt-In Behavioral Programs. Conference: 31st IAEE International Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx
Glumac, B., Oosterbaan, M., Schaefer, W. F. and Kairi, S. (2015). Implementing energy saving measures. Conference: NAEE/IAEE Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx"
Goldberg et al. (2012). Promoting energy savings and GHG mitigation through industrial supply chain initiatives. ECEEE Industry Study.
Graves, K. and Carol A. Dahl (1986). Title: Financial Evaluation of Energy Conservation Investments under Alternative Economic Conditions. IEPEC Portland. https://www.iepec.org/conf-docs/papers/2009PapersTOC/papers/098.pdf#page=1
Gudbjerg E., Dyhr-Mikkelsen K., Andersen C.M. (2014). Spreading the word - An online non-energy benefit tool. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/027.pdf#page=1
Gudbjerg, E. (2014). Industrial NEBs in Denmark. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/6-buildings-policies-directives-and-programmes/understanding-building-renovation-passports-customised-solutions-to-boost-deep-renovation-and-increase-comfort-in-a-decarbonised-europe/
Gurcan Gulen (2008). Title: The Link Between Capital Flows and Commercial Frameworks. IEPEC Seattle. https://www.iepec.org/conf-docs/papers/2003PapersTOC/papers/041.pdf
Hall and Roth (2003). NON-ENERGY BENEFITS FROM COMMERCIAL AND INDUSTRIAL ENERGY EFFICIENCY PROGRAMS: ENERGY EFFICIENCY MAY NOT BE THE BEST STORY. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_5/5.313/paper.pdf
Hamilton, I (2018). Health impact assessment of energy efficiency: A UK Case Study. ACEEE Industry. https://aceee.org/files/proceedings/2015/data/index.htm
Heffner and Campbell (2012). Evaluating Energy Efficiency Benefits for Energy Providers and Customers. ACEEE Industry. https://aceee.org/files/proceedings/2015/data/index.htm
Herrero et al. (2011). Co-benefits quantified: employment, energy security and fuel poverty implications of the large-scale, deep retrofitting of the Hungarian building stock.

ACEEE Industry. http://aceee.org/files/proceedings/2017/data/polopoly_fs/1.3687925.1501159101!/fileserver/file/790288/filename/0036_0053_000011.pdf
Herrero et al. (2013). Fuel poverty alleviation as a co-benefit of climate investments: evidence from Hungary. Academy of Management Proceedings. https://journals.aom.org/doi/10.5465/ambpp.2013.14448abstract
Houghton A. (2011). Health impact assessments a tool for designing climate change resilience into green building and planning projects. BECC BALTIMORE. https://beccconference.org/wp-content/uploads/2016/10/EhrhardtMartinez_presentation.pdf
Hugh Falkner, Vestal Tutterow (2003). Maintenance Decisions Matter: An Alternative Approach to Stimulating Energy Savings. ACEEE Industry. http://aceee.org/files/proceedings/2007/start.htm
Iboh, A.; Mottawa, I. (2016). Investigating the impacts of community energy projects on local stakeholders. ACEEE Buildings. http://aceee.org/files/proceedings/2000/data/papers/SS00_Panel2_Paper18.pdf
IEA (2014). Capturing the multiple benefits of energy efficiency. ECEEE Summer Study. https://eta.lbl.gov/sites/all/files/publications/erin_beardsley_-_lbnl-_40426_-_energy-efficiency_options_for_insurance_loss_prevention.pdf
Jakob, M.; Nutter, S. (2003). Marginal costs, cost dynamics and co-benefits of energy efficiency investments in the residential buildings sector. ACEEE Buildings. https://pdfs.semanticscholar.org/4b7f/b0615723c5faf6e2150cee8dfea975203436.pdf?_ga=2.47153895.1784994831.1528882964-1383019662.1528882964
Jakob, M; Baumgartner, A.; Jochem, E., Menti, U.; Plüss, I. (2006). Integral planning of energy efficiency, cost and comfort - a comprehensive cost and benefit evaluation. ACEEE Buildings. https://pdfs.semanticscholar.org/0306/0c025c12655da7071e4a4f203a7f3ef22cef.pdf?_ga=2.48522342.1784994831.1528882964-1383019662.1528882964
Janda, K. (1999). Re-inscribing design work: architects, engineers, and efficiency advocates. ACEEE Industry. http://aceee.org/files/proceedings/2009/start.htm
Jenkins, S. (2015). Incorporationg health benefits into ex-ante project appraisal. ACEEE Industry. http://aceee.org/files/proceedings/2013/data/index.htm
Johansson, B.; Modig, G.; Nilsson, L. (2007). Policy instruments and industrial responses - experiences from Sweden. Conference: 36th IAEE International Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx
Jones, C. and Gordon K. (2004). Efficient lighting design and office worker productivity. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/b2dd8b84-36d6-42d6-b3cf-7a02aa2a25cb/language-en/format-PDF/source-70707892 ; https://publications.europa.eu/en/publication-detail/-/publication/a2641e89-f58e-4681-8019-5911e1f56c5b/language-en/format-PDF/source-70707896
Joyce et al. (2013). Monetising the multiple benefits of energy efficient renovations of buildings in the EU. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/1999/Panel_2/p2_9/paper.pdf
Jutsen, J.; Feldman, S. (2003). The need for a better approach to business management: engaging decision makers. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896
Kats et al. (2003). The costs and financial benefits of green buildings, A Report to California's Sustainable Building Task Force. IEPEC Chicago. https://www.iepec.org/conf-docs/papers/2007PapersTOC/papers/81_1085_ab_600.pdf
Kennington et al. (2016). Developing a Non-Energy Benefits Indicator Framework for Low Income Energy Efficiency Programs in New South Wales. IEA Workshop on MBs Paris.
Khanwaja and Koss (1999). Assessment of Non-Energy Benefits of Low-Income Programs: The Indiana REACH Program. ECEEE Industry. https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2014/6-business-models-to-improve-industrial-efficiency-global-perspective/understanding-and-addressing-the-client8217s-needs-how-can-we-frame-energy-efficiency/

Kleinhenz, P., Mohammed, A.Q., Tatari, M., (2017). Co-Benefits of Detailed M&V: Piggybacking Off Required Measurement and Verification to Improve System Savings and Performance. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/1-foundations-of-future-energy-policy/making-non-energy-benefits-a-real-asset-and-changing-professionals8217-habits-renew-the-partnership-approach-through-the-decadiese-method/
Kluczek A., Olszewski P. (2017). Energy audits in industrial processes. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/067.pdf#page=1
Kociolek (2017). Evaluating Strategic Energy Management – Lessons Learned. IEPPEC Berlin. https://www.iepec.org/conf-docs/papers/2014/Jerrold%20Oppenheim.pdf
Koson et al. (2015). Better Buildings, Better Economy: An Economic Impact Analysis of a Federal Retrofit Program. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Osso.pdf
Krstić , H.& K. Čulo (2008). Cost Benefit Analysis Of Energy Efficient Family Houses. BECC SACRAMENTO. https://beccconference.org/wp-content/uploads/2017/11/Outcault_presentation.pdf
Larsen et al. (2014). Current policies and practices related to incorporation of non-energy benefits in energy saving performance contract projects. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/1-foundations-of-future-energy-policy/capturing-the-8220multiple-benefits8221-of-energy-efficiency-in-practice-the-uk-example/
Larsen et al. (2012). Incorporating non-energy benefits into energy-savings performance contracts. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/bd498a67-281e-4ef5-ae5c-50e8c8f7d1b7/language-en
Layne McWilliams, Jennifer Eskil, Dawn Lesley (2015). Using Sector Specialists to Drive Increased Efficiency in the Water Industry. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_1/1.080/paper.pdf
Lebot, B., Jurei Yada, Zoe Lagarde, Ailin Huang & Enrui Zhang (2017). Mobilizing climate finance to support energy efficiency. Conference: 15th IAEE European Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx
Lechtenböhmer, S.; Perrels, A.; Bunse, M.; Scholten, A. (2007). The blessings of energy efficiency in an enhanced EU sustainability scenario. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2005c/Panel_1/1099neves/paper.pdf
Lefley, F. (2013). The appraisal of ICT and non-ICT capital projects: A study of the current practices. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/b2dd8b84-36d6-42d6-b3cf-7a02aa2a25cb/language-en/format-PDF/source-70707892 ; https://publications.europa.eu/en/publication-detail/-/publication/a2641e89-f58e-4681-8019-5911e1f56c5b/language-en/format-PDF/source-70707896
Lemoine P. et al. (2018). How does energy efficiency help occupant health in commercial buildings? Some key drivers, impacts and trade-offs. . IEECB. https://publications.europa.eu/en/publication-detail/-/publication/b2dd8b84-36d6-42d6-b3cf-7a02aa2a25cb/language-en/format-PDF/source-70707892 ; https://publications.europa.eu/en/publication-detail/-/publication/a2641e89-f58e-4681-8019-5911e1f56c5b/language-en/format-PDF/source-70707896
Lemoine, P. (2018). Healthy commercial buildings. International Conference on Energy Production and Management. https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/131/20909
Lemoine, P. (2015). Valuing MB for utility and government planning purpose. IEA Workshop on MBs Paris.
Li S., Ngniatedema T., Chen F. (2017). Understanding the Impact of Green Initiatives and Green Performance on Financial Performance in the US. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/8-monitoring-and-evaluation-building-confidence-and-enhancing-practices/a-comprehensive-indicator-set-for-measuring-multiple-benefits-of-energy-efficiency/
Lilly Patrick, Pearson Dennis (1999). Determining the full value of industrial efficiency

programs. IEPPEC Berlin. https://www.iepec.org/conf-docs/papers/2014/Boris%20Reynaud.pdf
Lipp, S., Montalbano, R., LaPalme, G. (2013). ’s Goals with Energy EfficiencyMerging of the Industrial Customer. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/06df7803-6367-4bc8-8b1b-43f35102380c/language-en/format-PDF/source-70707896
Lohse, R.; Zhivov, A. (2016). Business an Technical Models for Deep Energy Retrofit - Findings from IEA Annex 61. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2003c/Panel_4/4071rosenberg/paper.pdf
Loosemore, M and Hsin, Y Y (2001). Customer-focused benchmarking for facilities management. IEPEC Baltimore - -. http://www.iepec.org/2017-proceedings/65243-iepec-1.3717521/t002-1.3717983/f002-1.3717984/a017-1.3718124/an062-1.3718129.html
Lundhild, E., Ian Shaw (2015). A Portfolio Approach to Securing Internal Financing for Energy Efficiency. ACEEE Industry. http://aceee.org/files/proceedings/2009/start.htm
Lung et al. (2005). Ancillary savings and production benefits in the evaluation of industrial energy-efficiency measures. IEPEC Portland. https://www.iepec.org/conf-docs/papers/2009PapersTOC/papers/080.pdf#page=1
Machiel Mulder, Robert Haffner (2008). Title: Costs And Benefits Of Investments In Interconnection: A Decision-making Framework. ACEEE Industry. http://aceee.org/files/proceedings/2011/start.htm
Mahama Kappiah (2008). Title: Commercial Frameworks for Energy Investment. ACEEE Industry. http://aceee.org/files/proceedings/2013/data/index.htm
Mahmood & Meyhoefer (2012). Introduction of management system approach in implementing energy efficiency improvement in the textile industry: experience from Pakistan. IEPPEC Berlin. https://www.iepec.org/conf-docs/papers/2014/Nina%20Campbell.pdf
Mahone and Bos (2009). A New Energy Efficiency Portfolio - Developing an Expanded Evaluation Approach. ACEEE Buildings. http://aceee.org/files/proceedings/1998/data/papers/0823.PDF
Malmgren, I. (2013). Incorporating Non-Energy Benefits into Cost-Effectiveness Screening: The Vermont Story. Indoor Air Conference. https://eta.lbl.gov/publications/impact-co2-human-decision-making
Mariangiola Fabbri (2017). Understanding building renovation passports: customised solutions to boost deep renovation and increase comfort in a secarbonised Europe. ACEEE Industry. http://aceee.org/files/proceedings/2011/start.htm
Martin et al. (2003). Study of Energy Savings Generated by Clients of the Industrial Assessment Center Program. LBNL Webinar . http://eta-publications.lbl.gov/sites/default/files/emv_webinar_nei_december_2016_final.pdf
Mayne, R. (2016). Theories of change relating to energy efficiency. IEPEC Long Beach. https://www.iepec.org/wp-content/uploads/2015/papers/142.pdf
McArthur J.J., Jofeh C.G.H. (2016). Portfolio retrofit evaluation: A methodology for optimizing a large number of building retrofits to achieve triple-bottom-line objectives. IEPEC Denver. https://www.iepec.org/conf-docs/papers/1999PapersTOC/papers/034.pdf
McArthur J.J., Jofeh C.G.H. (2015). Strategic Retrofit Investment from the Portfolio to the Building Scale: A Framework for Identification and Evaluation of Potential Retrofits. IEPEC Seattle. https://www.iepec.org/conf-docs/papers/2003PapersTOC/papers/076.pdf
McClain, E.; Skumatz, L.; Jennings, J. (2007). Commissioning in public sector building - Non-Energy Benefits (NEBs), not savings, are the selling point. IEPEC Chicago. https://www.iepec.org/conf-docs/papers/2001PapersTOC/papers/010.pdf
McGinley. K., Paul Geary, James Dodenhoff (2015). Striking Gold: How Innovations and Productivity Improvements in the Mining Industry Leverage Energy Efficiency Technologies. ACEEE Buildings. https://aceee.org/files/proceedings/2016/data/papers/6_1147.pdf
McKane, A., P. Scheihing, T. Evans, S. Glatt (2015). The Business Value of Superior Energy Performance. BECC SACRAMENTO. https://beccconference.org/wp-content/uploads/2013/12/BECC_skumatz.pdf

McKnight, D. (2014). Minimizing energy risk in manufacturing. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2005c/Panel_4/4262skumatz/paper.pdf
McWilliams, L., Jones, S., Bugarkse, R. (2017). Let's Think Outside the Box. Wait . . . What's IN the box?—AnExploration of Water System Energy Efficiency. IEA Workshop on MBs Paris.
Meath, C. et al. (2013). Barriers and Motivators to the Adoption of Energy Savings Measures for SMEs. IEA Workshop on MBs Paris.
Meistad, T. (2014). How energy efficient office buildings challenge and contribute to usability. IEPEC Portland. https://www.iepec.org/conf-docs/papers/2009PapersTOC/papers/063.pdf#page=1
Meyer, A. (2016). Online Energy Portals for Businesses: How Well Do They Align with the Values and Perspectives of Small and Medium Business. IEPEC Boston. https://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/048.pdf#page=1
Michael Socks, Brenda Kelly (2007). Solid as Granite: A Coordinated Approach to Productivity, Pollution Prevention, and Energy Efficiency Program Delivery. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/17d7fd18-b013-4857-8edd-190bcc5c29b1/language-en/format-PDF/source-70707896
Mihlmester et al. (2000). Transforming the Market for Energy-Efficient Windows. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/014.pdf#page=1
Mills and Knoepfel (1997). Energy-efficiency options for insurance loss preventions. IEPPEC Berlin. https://www.iepec.org/conf-docs/papers/2014/Noel%20Stevens.pdf
Mills and Rosenfeld (1994). Consumer non-energy benefits as a motivation for making energy-efficiency improvements. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Stevens.pdf
Mills E., Shamshoian G., Blazek M., Naughton P., Seese R.S., Tschudi W., Sartor D. (2008). The business case for energy management in high-tech industries. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2007/Panel_9/9.314/paper.pdf
Mills, E. (2003). The insurance and risk management industries: newplayers in the delivery of energy-efficient and renewable energy products and services. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/1-foundations-of-future-energy-policy/change-from-within-carbon-management-in-commercial-real-estate/
Mills, E. (2004). Amplifying Real Estate Value through Energy & Water Management: from ESCO to "energy services partner". IEPPEC Berlin. https://www.iepec.org/conf-docs/papers/2014/Felix%20Suerkemper.pdf
Mills, T. A. (2009). Starting Small Is Beautiful: Using Incremental Energy Efficiency to Convince the Plant Manager. IEPEC Seattle. https://www.iepec.org/conf-docs/papers/2003PapersTOC/papers/078.pdf
Milward, R., Gilless, C., Wickes, G. (2013). Lean, Energy, and Savings: Energy Impacts of Lean Manufacturing. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/9-dynamics-of-consumption/new-directions-for-energy-and-behaviour-whither-organizational-research/
Morrissey, J., Dunphy, N and MacSweeney, R. (2014). Energy efficiency in commercial buildings: capturing added-value of retrofit. BECC BALTIMORE.
Naoko Doi, Yuji MATSUO & Shigeru SUEHIRO (2013). Title: Investment requirements for energy savings and low-carbon emiting technologies in East Asia – Benefits and costs. IEPEC Chicago. https://www.iepec.org/conf-docs/conf-by-year/2013-Chicago/135.pdf#page=1
Nathwani, A. (2006). "Green buildings" - investment benefits. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Thema.pdf
Nehler T., Rasmussen J. (2016). How do firms consider non-energy benefits? Empirical findings on energy-efficiency investments in Swedish industry. IEA Workshop on MBs Paris.
Nehler T., Thollander P., Ottosson M., Dahlgren M. (2014). Including non-energy benefits in investment calculations in industry – Empirical findings from Sweden. ECEEE Summer

Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/8-monitoring-and-evaluation-building-confidence-and-enhancing-practices/more-than-energy-savings-quantifying-the-multiple-impacts-of-energy-efficiency-in-europe/

Nehler, T. (2018). Linking ee measures in industrial compressed air systems with NEBs - A review. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2003c/Panel_4/4046thorne/paper.pdf

Nehler, T., Parra, R., Thollander, P. (2018). Implementation of energy efficiency measures in compressed air systems: barriers, drivers and non-energy benefits. IEA Workshop on MBs Paris.

Neij, L. (1999). Evaluation of Swedish market transformation programmes. IEPEC Portland. https://www.iepec.org/conf-docs/papers/2009PapersTOC/papers/073.pdf#page=1

Neri A., Cagno E., Trianni A. (2016). Barriers to energy efficiency measures and the role of industrial sustainability. ECEEE Industry. https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2014/5-the-role-of-energy-management-systems-education-outreach-and-training/improving-industrial-energy-efficiency-by-changing-the-energy-culture/

Nesbit, M. Paquel, K.; Illes, A.; le Den, X. (2016). Energy efficiency in public buildings under the EU Cohesion Policy in the 2007-2013 programming period - insights from the ex post evaluation. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_1/1.316/paper.pdf

Newberger et al. (2007). Custom NEBs: Are They Worth It? - Experiences, Challenges, and Directions in Massachusetts. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/bd498a67-281e-4ef5-ae5c-50e8c8f7d1b7/language-en

Nhamo, G. & A. Bimha (2011). Energy Efficiency In South Africa: Policy Perspectives And The Path To Low Carbon Growth. IEECB. https://publications.europa.eu/en/publication-detail/-/publication/c7d108ea-ccdd-424e-b37a-435f5d99a134/language-en/format-PDF/source-70707896 ; https://publications.europa.eu/en/publication-detail/-/publication/508d76d6-8945-4bd2-8bca-aef323d577a9/language-en/format-PDF/source-70707896

Nicolle, R. (2018). Building 4 People: Health, Wellbeing & Productivity in Europe. Conference: 12th IAEE European Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx

Nilsson, H., Charlotte Ruhbaum (2014). Understanding and addressing the client's needs: how can we frame energy efficiency?. ECEEE Industry Study.

Nosperger, S., Mazoyer, J. L., Vitt, E. (2015). Making non-energy benefits a real asset and changing professionals' habits: renew the partnership approach through the DECADIESE model. IEPEC Boston. https://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/003.pdf

Ochsner et al. (2013). Capturing Savings Down the Production Line: Measuring the Impacts of Energy Management Programs. IEPEC Denver. https://www.iepec.org/conf-docs/papers/1999PapersTOC/papers/036.pdf

Oppenheim and MacGregor (2014). Accounting for Health Benefits, Jerrold Oppenheim and Theo MacGregor, Democracy and Regulation. BECC SACRAMENTO. https://beccconference.org/wp-content/uploads/2017/11/Brown_presentation.pdf

Orji, I. and Wei, S. (2016). A detailed calculation model for costing of green manufacturing. IEPEC Chicago. https://www.iepec.org/conf-docs/papers/2001PapersTOC/papers/022.pdf

Osso et al. (2016). Regional efficiency programme valuating energy and multiple benefits: a balance between bill and comfort and far beyond. ACEEE Industry. http://aceee.org/files/proceedings/2011/start.htm

Outcault, S. (2017). Teacher Knows Best? Balancing Energy Savings, Air Quality, and Comfort in Schools. IEPPEC Amsterdam. http://www.ieppec.org/wp-content/uploads/2016/05/weinsziehr_paper.pdf

Parra R., Thollander P., Nehler T. (2016). Barriers to, drivers for and non-energy benefits for industrial energy efficiency improvement measures in compressed air systems. ECEEE Summer Study. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2011/

3-energy-use-in-industry-the-road-from-policy-to-action/quantifying-non-energy-benefits-of-a-carbon-reduction-initiative-for-a-glassware-company/

Payne J, Weatherall D, Downy F (2015). Capturing the "multiple benefits" of energy efficiency in practice: the UK example. IEPEC Chicago. https://www.iepec.org/conf-docs/papers/2007PapersTOC/papers/82_1084_ab_599.pdf

Pellegrini-Masini, G.; Jenkins, D.; McLaren, Gary; Bowles, G.; Buchan, R. (2010). Economic barriers to low-carbon refurbishments. IEA Workshop on MBs Paris.

Persson. A., Anders Göransson, Erik Gudbjerg (2009). Bridge over troubled water – spanning the energy-effi ciency gap. Conference: 31st USAEE/IAEE North American Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx

Piotr Saluga (2017). Title: VALUATION OF MANAGERIAL FLEXIBILITY AND STRATEGIC VALUE OF COAL GASIFICATION PROJECTS WITH THE OPTION-TO-SWITCH . Conference: 39th IAEE International Conference. http://www.iaee.org/en/publications/proceedingssearch.aspx

Pires Neves, L.; Henggeler Antunes, C.; Cândido Dias, L.; Gomes Martins, A. (2005). Development of multicriteria models to classify energy efficiency alternatives. ECEEE Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2003c/Panel_4/4108zavody/paper.pdf

Poel, B.; van Cruchten, G. (2006). EPA-NR, tools for the assessment of Energy Performance in Non-Residential Buildings in the European countries. Journal of Cleaner Production 163- S68-78-. http://www.sciencedirect.com/science/article/pii/S0959652616001359

Poel,B.; Feld, B.; Sonnemans, E; Prins, S.; Bouten, E. (2006). Incorporating energy in facility management; experiences of the Dutch Ministry of Defence. Department of Energy and Climate Change, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65601/6925-what-are-the-factors-influencing-energy-behaviours.pdf

Pye M., McKane A. (2000). Making a stronger case for industrial energy efficiency by quantifying non-energy benefits. Energy Efficiency 8-5 1015-1034-.

Pye Miriam, McKane Aimee (1999). Enhancing shareholder value: Making a more compelling energy efficiency case to industry by quantifying non-energy benefits. Energy Efficiency 4-4 473-492-. http://dx.doi.org/10.1007/s12053-011-9125-7

Ruegg, R.T. & G. B. Jordan (2010). New Benefit-cost Methodology For Evaluating Renewable And Energy Efficiency Programs Of The US Department Of Energy. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=372280

Ruegg, R.T. & G. B. Jordan (2010). New Benefit-cost Methodology For Evaluating Renewable And Energy Efficiency Programs Of The US Department Of Energy. Department of Energy and Climate Change, London.

Rasmussen J. (2014). Energy-efficiency investments and the concepts of non-energy benefits and investment behaviour.

Rasmussen, Josefine (2017). The additional benefits of energy efficiency investments—a systematic literature review and a framework for categorisation. Energy Efficiency 8-1 85-95.

Reid, M. (2018). The Multiple Benefits of Energy Efficiency in NSW, Australia. Annual Review of Energy and the Environment 25 537-566. https://www.annualreviews.org/doi/pdf/10.1146/annurev.energy.25.1.537

Reuter. M., Constantin Müller, Barbara Schlomann & Wolfgang Eichhammer (2017). A comprehensive indicator set for measuring multiple benefits of energy efficiency . Energy Policy 51- 502-513-.

Reynaud et al. (2014). Energy and Non-Energy Impacts of a Demand-Side Management Program: Case Study of the Program éco21, Geneva, Switzerland, Gilles Garazi and Cedric Jéanneret, Services Industriels de Genève. Renewable and sustainable Energy Reviews 39 196-208.

Rietbergen M.G., Opstelten I.J., Blok K. (2017). Improving energy and carbon management in construction and civil engineering companies—evaluating the impacts of the CO2 Performance Ladder. International Energy Agency.

Rivas, S.; Melica, G.; Kona, A. et.al. (2016). Covenant of Mayors Initiative an in-depth analysis of selected Sustainable Energy Action Plans (SEAPs). http://www.calrecycle.ca.gov/GreenBuilding/Design/CostBenefit/Report.pdf

Rosenberg, M. (2003). Mid-market transformation programs: programs to promote best practices in system specification and installation. WIT Transactions on Ecology and the Environment 113- 191-199-. https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/113/19210

Ross et al. (2017). Painting the Whole Picture: Understanding the Impacts of Energy Efficiency Using CostEffectiveness Testing and Economic Impact Assessments. 6-3 505-533.

Russel, C (2009). What's in it for me. The financial dynamics of corporate energy management. IEA workshop on Multiple Benefits, Paris, March 2018.

Russell C.H. (2017). Discerning the Multiple Business Benefits of Energy Efficiency. .

Russell et al. (2009). Evaluating Energy Savings from Industrial Behavior Change in the Context of Market Transformation. INBEE project: Assessment frameworks for multiple impacts of energy efficiency.

Russell, C. (2015). Multiple Benefits of business-sector energy efficiency: a survey of existing and potential measures.. Energy Policy 31 1257-1272. https://pdfs.semanticscholar.org/6d19/6529b0f9eaa53c50b1f928215730f592cf04.pdf?_ga=2.82142038.1784994831.1528882964-1383019662.1528882964

Russell, C. (2011). Energy Efficiency’s Role in Business Investment. Renewable and sustainable Energy Reviews 89 72-87.

Russell, C., ACEEE (2013). Corporate Protocols for Capital Investment: Implications for Industrial Energy Program Design. Energy Efficiency, June 2018 11-5 1281–1302. https://link.springer.com/article/10.1007/s12053-018-9647-3

Ryan and Campbell (2014). Estimating the Macroeconomic Benefits of Energy Efficiency Policy, Nina Campbell, IEA and Lisa Ryan . WIT Transactions on Ecology and the Environment 144- 389-401-. https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/144/21959

Sajter, D. (2017). Methods of evaluating the long-term financial effects of energy efficiency projects *. WIT Transactions on Ecology and the Environment 131- 95-106-. https://www.witpress.com/elibrary/wit-transactions-on-ecology-and-the-environment/131/20909

Sandberg P., Söderström M. (2003). Industrial energy efficiency: The need for investment decision support from a manager perspective. Energy Efficiency 10-6 1401-1418. https://doi.org/10.1007/s12053-017-9528-1

Sandberg, A. (1998). Promoting and quntifying non-energy benefits - A method to achieve energy-efficiency in Sweden. Aceee, Washington.

Sandberg, P. and Soderstrom, M. (2003). Industrial energy efficiency: The need for investment decision support from a manager persepctive. IEEP for the coalition of energy savings, Brussels.

Satish et al. (2011). Impact of CO2 on human decision making and productivity. . https://doi.org/10.1287/mnsc.35.3.321

Satler, G. (2011). Achieving Corporate Financing for Energy Efficiency Projects:Considerations to Maximize Approval Rates. Applied Energy 179- 1409-1426-. https://www.sciencedirect.com/science/article/pii/S0306261916309680

Sauter, R., and Volkery, A. (2013). Review of costs and benefits of energy savings. Task 1 Report, IEEP. France. http://www.ademe.fr/49-exemples-bonnes-pratiques-energetiques-entreprise-tertiaire-industrie-agriculture

Schiller et al. (2016). Evaluating and Quantifying the Non-Energy Impacts of Energy Efficiency. USA. https://library.cee1.org/content/motor-management-case-studies-water-wastewater

Sergeev I., Mineeva A., Lebedeva O. (2017). Investment valuation of energy efficiency measures within mining companies. USA. https://library.cee1.org/content/motor-management-case-studies-lumber-and-wood-products

Skumatz (2015). NEBs: The Latest in Results, Applications, and Best Practices for State Cost-Effectiveness Tests. USA. https://library.cee1.org/content/motor-management-case-studies-paper-and-allied-products

Skumatz and Dickerson (1999). What Do Customers Value? What Benefits Utilities? Designing To Maximize Non-Energy Benefits From Efficiency Programs In The Residential Sector. USA. https://library.cee1.org/content/motor-management-case-studies-various-industries

Skumatz et al. (2003). Non-Energy Benefits (NEBs) in Offices and Schools: Do They Influence Building Design and Decision-making?1. . https://www.usgbc.org/sites/default/files/Tools-Energy-Efficient-Buildings-A-Guide-for-

Policy-Makers-and-Experts.pdf
Skumatz et al. (2001). Evaluating Multi-Resource Audit Programs to Demonstrate Sustainability, Payback, and Customer Benefits: Incorporating Non-Energy Benefits (NEBs). London. https://www.ukgbc.org/wp-content/uploads/2018/01/Capturing-the-Value-of-Sustainability.pdf
Skumatz L. (2016). Non-Energy Benefits / NEBs - Winning at Cost-Effectiveness Dominos: State progress and TRMs. https://www1.eere.energy.gov/femp/pdfs/buscase_section1.pdf
Skumatz L.A., Dickerson C.A., Coates B. (2000). Non-energy benefits in the residential and non-residential sectors - Innovative measurements and results for participant benefits. Washington. https://www1.eere.energy.gov/femp/pdfs/buscase_section2.pdf
Skumatz L.A., Gardner J. (2005). Methods and results for measuring non-energy benefits in the commercial and industrial sectors. https://www1.eere.energy.gov/femp/pdfs/buscase_section3.pdf
Skumatz, L. (2013). What Drives Program Uptake? Looking Beyond Savings to Bundles of Features: Latest in Non-Energy Benefits (NEBs) and Indirect Impacts . USA. https://www.usgbc.org/sites/default/files/2016-1222-State-of-Health-in-CRE.pdf
Skumatz, L. (2005). Techniques for getting the most from an evaluation: Review of methods and results for attributing progress, non-energy benefits, neto to gross and cost-benefit. USA. https://www.usgbc.org/sites/default/files/2015%20Green%20Building%20Economic%20Impact%20Study%20-%20Key%20Findings.pdf
Skumatz, L. (2018). Methods, evidence, policy support - Multiple Benefits/NEIs. USA. https://www.usgbc.org/resources/grid/advocacy-policy
Skumatz, L. (2015). Monetizing MB in buildings. DENMARK. https://www.velux.com/health/healthy-homes-barometer-2017
Skumatz, L. A. (2009). Do Energy Efficiency Strategies Outperform Recycling in GHG Mitigation and Job Creation?. Energy Research and Social Science 11- 195-208. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946129349&doi=10.1016%2fj.erss.2015.09.001&partnerID=40&md5=0e1264fb3483fca8af16f16dd529756f
Smith et al. (2011). Impact Evaluation of Behavior Change in the Industrial Sector. Energy Efficiency 10-2 441-457. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84982950723&doi=10.1007%2fs12053-016-9465-4&partnerID=40&md5=3d39fea8352e2cbcd3b9f53c1152b7e3
Solem, H. (2012). From technically feasible to realizable energy efficiency potential in Norwegian non-residential buildings. Energies 10-1. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85035055011&doi=10.3390%2fen10010100&partnerID=40&md5=c2dc44644aff0bcc672fb48caabdfd4c
Stathakis E., Bandekas D.V., Adoniadis P., Arsenos P., Vordos N. (2011). An empirical estimation of the contribution of energy saving systems (ESS) toward cost reduction and efficiency: Productivity improvement in thracian SME'S. IEEE Engineering Management Review 44-2 33-40. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84978209238&doi=10.1109%2fEMR.2016.2568765&partnerID=40&md5=bb387b187ba968477e7e866a0e2c00ca
Sterman, J.D. (1989). Modeling Managerial Behavior: Misperceptions of Feedback in a Dynamic Decision Making Experiment . Journal of Cleaner Production 147- 66-74. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85013638607&doi=10.1016%2fj.jclepro.2017.01.074&partnerID=40&md5=7834806aa7166802b5ea1ecdf7884fc7
Stevens (2013). Using In-depth Interviews to Estimate Non-energy Impacts Resulting from Commercial and Industrial Energy Efficiency Measures. Energy Efficiency 7-1 1-22. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84891748291&doi=10.1007%2fs12053-013-9196-8&partnerID=40&md5=3b04650181dd71dd92e40c5b5e3029aa
Stevens et al. (2014). Non-energy impacts of C&I energy efficiency measures provide substantial program benefits above carbon reduction, Noel Stevens, DNV GL . ZKG International 68-3 56-71. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84928501398&partnerID=40&md5=e3bbee07bcf616ec458100dba3df605b

Stevens et al. (2016). Life-Cycle Cost Analysis Provides Powerful Tool for Estimating Non-Energy Impacts of Energy Efficiency Measures in New Construction Programmes. Energy Research and Social Science 32- 94-111. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85011589867&doi=10.1016%2fj.erss.2017.01.006&partnerID=40&md5=076364ec20adfd00e84d62f886ad9e70

Stoecklein, A.; Skumatz, L. (2007). Zero and low energy homes in New Zealand: The value of non-energy benefits and their use in attracting homeowners. Eceee Industrial Summer Study Proceedings 2016-September- 281-292. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045474395&partnerID=40&md5=3f06c525ae8c3b05190dc2e08243d5aa

Strachan M, Janda K, McKeown B (2015). Change from within? Carbon management in commercial real estate. Journal of Cleaner Production 82- 70-83. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905909260&doi=10.1016%2fj.jclepro.2014.06.057&partnerID=40&md5=7c33a3a94bf12f41eba9db2011a0d1e8

Suerkemper et al. (2014). An Ex-ante Evaluation of the Economy-wide Benefits of the Thai Energy Efficiency Action Plan, Felix Suerkemper, Wuppertal Institute for Climate, Environment and Energy . Energy Efficiency 10-4 855-869. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84992206512&doi=10.1007%2fs12053-016-9488-x&partnerID=40&md5=963fdd4443e260435cfe6bef36eceac1

Sumi et al. (2003). An Approach to Quantifying Economic and Environmental Benefits for Wisconsinís Focus on Energy. Eceee Industrial Summer Study Proceedings 2016-September- 417-426. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045464894&partnerID=40&md5=68b579755c6710640e9ee035d9e8d3e7

Sumi T. (2009). Co-existing environment and economy of manufacturing industry in Japan. Strategic Planning for Energy and the Environment 25-1 17-33. https://www.scopus.com/inward/record.uri?eid=2-s2.0-28444440293&doi=10.1080%2f10485230509509678&partnerID=40&md5=01abd347f2da18c4d6171bc3a71b94cf

Taylor M, Janda K (2015). New directions for energy and behaviour: whither organizational research?. Strategic Planning for Energy and the Environment 24-4 57-65. https://www.scopus.com/inward/record.uri?eid=2-s2.0-19044393685&doi=10.1080%2f10485230509509674&partnerID=40&md5=0a173a48dea5dc9d0f636da996cd5605

Teja, A. (2016). Market Transformation: Changing Behaviors in Residential New Construction in the Northwest. Intelligent Buildings International 1-2 142-155. https://www.scopus.com/inward/record.uri?eid=2-s2.0-79954556688&doi=10.3763%2finbi.2009.0017&partnerID=40&md5=7365f48724ad61959b5647d5fdd86413

Thalappully et al. (2013). Evaluating Impact of Retrofit Programs on Commercial Buildings: Results from the Energize Phoenix Project. Eceee Industrial Summer Study Proceedings 2- 677-681. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045436387&partnerID=40&md5=635ffd91d0d8dbcf6503f7dc47b20aee

Thema et al. (2016). Widening the Perspective: An Approach to Evaluating the Multiple Benefits of the 2030 EU energy efficiency potential. Energy Efficiency 5-4 497-518. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84867872339&doi=10.1007%2fs12053-012-9154-x&partnerID=40&md5=9ae7fd261e783f344bc2ea8840fc4294

Thema, J. (2018). Estimating impacts of energy efficiency - More than energy and greenhouse gas savings. Energy and Buildings 167- 200-215. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85043354377&doi=10.1016%2fj.enbuild.2018.02.030&partnerID=40&md5=b64afed2e603877dedc205b48aeed133

Thema, J., Felix Suerkemper, Stefan Thomas, Jens Teubler, Johan Couder, Souran Chatterjee, Diana Ürge-Vorsatz, Stefan Bouzarovski, Nora Mzavanadze & David von Below (2017). More than energy savings: quantifying the multiple impacts of energy efficiency in Europe . Lecture Notes in Business Information Processing 184 LNBIP-90-103. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84906890015&doi=10.1007%2f978-3-319-11364-

7_9&partnerID=40&md5=55d54d28b9108efe415d53adc1b8a3d4
Thorne, J.; Nadel, S.; Sachs, H.; Prindle, B.; Elliot, N. (2003). Market transformation in the "New World": what's worked, what hasn't. Energy Economics 23-6 717-740. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0035500342&doi=10.1016%2fS0140-9883%2801%2900083-4&partnerID=40&md5=caa48bff729b5a6f55c436010ee78e18
Tobias, S. and Hermelink, A. (2018). Indoor climate and health. A public affairs case. IECON Proceedings (Industrial Electronics Conference) 7502-7507. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84893577373&doi=10.1109%2fIECON.2013.6700382&partnerID=40&md5=e52af5cdcfd5486d67d328a069ab44be
Tolkin et al. (2009). What Else Does an ENERGY STAR® Home Provide? Quantifying Non-Energy Impacts in Residential New Construction. Energy and Buildings 152 587-601. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85026813744&doi=10.1016%2fj.enbuild.2017.07.066&partnerID=40&md5=71f7971b9128160c32bda0d360608bf9
Trianni A., Cagno E., Farné S. (2016). Barriers, drivers and decision-making process for industrial energy efficiency: A broad study among manufacturing small and medium-sized enterprises. Proceedings ACEEE Summer Study on Energy Efficiency in Industry 1 561-570. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0035712152&partnerID=40&md5=e2246a27d44e52c733a20f74a110548b
Trianni A., Cagno E., Marchesani F., Spallina G. (2017). Classification of drivers for industrial energy efficiency and their effect on the barriers affecting the investment decision-making process. Energy Research and Social Science 11- 155-163. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84945279193&doi=10.1016%2fj.erss.2015.10.001&partnerID=40&md5=ff7aa816c2239a27722370e878eb97de
UKGBC (2018). Capturing the value of sustainability: Identifying the links between sustainability and business value. UNITECR '05 - Proceedings of the Unified International Technical Conference on Refractories: 9th Biennial Worldwide Congress on Refractories 534. https://www.scopus.com/inward/record.uri?eid=2-s2.0-33645164808&partnerID=40&md5=b69d05e7988448b4c64a7810a4a3a507
Ulrika Wising, Sohpie Chirez, Bart Adams (2014). Improving industrial energy efficiency by changing the energy culture. Applied Energy 147 430-443. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84925061515&doi=10.1016%2fj.apenergy.2015.02.028&partnerID=40&md5=ea3e79f75c79f3b8873f062b08663775
Ürge-Vorsatz, D., Aleksandra Novikova, Maria Sharmina (2009). Counting good: quantifying the co-benefits of improved efficiency in buildings. Eceee Industrial Summer Study Proceedings 1 171-178. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045454017&partnerID=40&md5=1fbf1bb5c3f49e4223b147e557ed116a
Ürge-Vorsatz, D.; Korytarova, K. (2010). Energy savings potential in the Hungarian public buildings for space heating. Journal of Green Building 6-2 66-87. https://www.scopus.com/inward/record.uri?eid=2-s2.0-79960454109&doi=10.3992%2fjgb.6.2.66&partnerID=40&md5=ad8af96a19354ead74f9ad9ccac05e6f
Ürge-Vorsatz, D.; Novikova, Aleksandra (2008). Non-residential buildings for combating climate change: Summary of the findings of the Intergovenmental Panel on Climate Change. Journal of Cleaner Production 142 3437-3453. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006355152&doi=10.1016%2fj.jclepro.2016.10.123&partnerID=40&md5=64f568760e7394cd712ca674ca080bc2
Ürge-Vorsatz, Diana; aAgnesKelemenaSergioTirado-HerrerobcStefanThomasdJohannesThemadNoraMzavanadzecDorotheaHauptstockdFelixSuerkemperdJensTeublerdMukeshGuptaaSouranChatterjeea (2016). Measuring multiple impacts of low-carbon energy options in a green economy context. Business Strategy and the Environment 26-6 776-790. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85016389592&doi=10.1002%2fbse.1948&partnerID=40&md5=64deac4e04c7546e893342fdcc6dc1b2

US EERE (?). Introduction: sustainable design and construction. Proceedings ACEEE Summer Study on Energy Efficiency in Industry - 349-362. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0033351325&partnerID=40&md5=03bf48372fd2aaf0cc90567a1a95b0bc
US EERE (?). The economic benefits of sustainable design. Sustainable Cities and Society 27- 263-274. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84962245141&doi=10.1016%2fj.scs.2016.03.011&partnerID=40&md5=e616da9d07bf7d8c879a20cbe4b4abe4
US EERE (?). The social benefits of sustainable design. Procedia Engineering 118- 1068-1076. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84948403603&doi=10.1016%2fj.proeng.2015.08.550&partnerID=40&md5=6891d80b5a1290ccfb9bd09183933b9e
USGBC (2016). The State of Health Considerations in the Commercial Real Estate Sector: An initial look at results from the GRESB Health and Well-being Module. Technical Paper - Society of Manufacturing Engineers TP14PUB24- -. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84946073787&partnerID=40&md5=e5a686e94d616bc222fdc1835800eba1
USGBC (2016). 2015 Green building economic impact study: key findings. Energy Efficiency 1-1 5-20. https://www.scopus.com/inward/record.uri?eid=2-s2.0-64349089467&doi=10.1007%2fs12053-007-9000-8&partnerID=40&md5=b409d719049c176011afdb90139da620
USGBC (?). All references mixed in USGBC website Advocacy and Policy-makers section. Journal of Cleaner Production 113- 472-482. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84951046610&doi=10.1016%2fj.jclepro.2015.11.070&partnerID=40&md5=65a20379bcf3cb5787c52f1cd99c700b
Valentina Bosetti, Enrica De Cian, Elena Verdolini (2012). Title: What drives green investments and innovation? An integrated assessment of population, economic growth, and fossil fuel resource availability. Eceee Industrial Summer Study Proceedings 2- 711-719. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044170667&partnerID=40&md5=af6c0021b4f20305c40554e1c23c8221
VELUX (2017). Healthy Homes Barometer 2017. Eceee Industrial Summer Study Proceedings 2016-September- 233-242. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045434998&partnerID=40&md5=70a6c879f550989c75c662f6a53924db
Vermeeren R. (2016). Steam, energy and management practices: How is industry doing? And what can we do to make them do better?. Eceee Industrial Summer Study Proceedings 2016-September- 293-304. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045453721&partnerID=40&md5=3c861dfe95aa15309933c5497359fb45
Vetromile & Richardson (2012). It’s all about the margins: Where does energy efficiency fit for industrial segments?. Resources, Conservation and Recycling 28-43193 171-183. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0033983409&doi=10.1016%2fS0921-3449%2899%2900042-7&partnerID=40&md5=d1b3f730065cb73c3876b2c1f14dcd76
Vickery and Dessi (2011). Improving Industrial Energy Efficiency: how Australia is addressing barriers to change among the country’s largest energy users. Proceedings ACEEE Summer Study on Energy Efficiency in Industry - 325-336. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0033318633&partnerID=40&md5=4f502506043e36cc22b7d700a91b69a7
Vine, E. and Jayant Sathaye (1999). The Impact of Climate Change on the Conduct of Evaluation: The Establishment of New Evaluation Guidelines. Eceee Industrial Summer Study Proceedings 2- 733-744. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85044115063&partnerID=40&md5=e4c31d56f800bccd6ec278f6e520c51c
Wade Brown, B. (2017). Understanding the Impact of Non-Energy Benefits in the United States. Energy Efficiency 10-1 55-79. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84961210286&doi=10.1007%2fs12053-016-9436-9&partnerID=40&md5=b23d04205ee493766a6ce5057a6d0a2a
Weber, L (2001). An Evaluation of Energy-Relevant Decision-Making in Office

Organisations. Strategic Planning for Energy and the Environment 36-4 24-40. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85014703479&doi=10.1080%2f10485236.2017.11863770&partnerID=40&md5=44e71dde3ef5917e133ce871ded89267

Weber, S., Vetromile, J., Friedmann, R. (2011). Driving Business Decisions:A Look at Business Driversof Industrial Energy Efficiency. Energy Policy 31-15 1623-1634. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0043068001&doi=10.1016%2fS0301-4215%2802%2900228-8&partnerID=40&md5=42a673209461ff351d0ef621ef175869

Weinsziehr and Skumatz (2016). Evidence for Multiple Benefits or NEBs: Review on Progress and Gaps from the IEA Data and Measurement Subcommittee. Journal of Advanced Research in Law and Economics 8-2 601-611. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85030127147&doi=10.14505%2f%2fjarle.v8.2%2824%29.31&partnerID=40&md5=ae7be2b5bd0225112770e4cd955da5da

Werle R., Brunner C.U., Cooremans C. (2014). Financial incentive program for efficient motors in Switzerland: Lessons learned. Proceedings ACEEE Summer Study on Energy Efficiency in Buildings 8- [d]8.353-8.364. https://www.scopus.com/inward/record.uri?eid=2-s2.0-0034581815&partnerID=40&md5=3efb65e48371044029ebfe8659fe1204

Willoughby et al. (2011). Quantifying non-energy benefits of a carbon reduction initiative for a glassware company. Proceedings ACEEE Summer Study on Energy Efficiency in Industry - 6-163-6-176. https://www.scopus.com/inward/record.uri?eid=2-s2.0-31844447493&partnerID=40&md5=76f50a3af29ecaff711bcb0ff9b1fd7f

Wobus et al. (2007). Exploring the Application of Conjoint Analysis for Estimating the Value of Non-Energy Impacts1. International Research Journal of Finance and Economics 81- 89-97. https://www.scopus.com/inward/record.uri?eid=2-s2.0-83455236097&partnerID=40&md5=28ffa6fb8ecc437bb0be7780802c54af

Woodroof E.A., Turner W.C., Heffington W., Capehart B. (2012). Energy conservation also yields: Capital, operations, recognition, and environmental benefits: “core” benefits are highly probable and worth a double-digit improvement to energy savings. PICMET: Portland International Center for Management of Engineering and Technology, Proceedings - 2349-2355. https://www.scopus.com/inward/record.uri?eid=2-s2.0-70450201624&doi=10.1109%2fPICMET.2009.5261825&partnerID=40&md5=67eec56e45f1ff7704f5d9e432d92be9

Woodroof, E. (2014). Non-utility benefits - Survey results. Applied Energy 162- 1537-1551. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84926375569&doi=10.1016%2fj.apenergy.2015.02.078&partnerID=40&md5=4cfb3d7ea6f16fbc2f24408ebf94e146

Woolsey, B., N. Lutzenhiser, L. Lutzenhiser (2007). Economic Sociology and the Social Problem of Energy Inefficiency. Energy Efficiency 10-1 199-215. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84966699801&doi=10.1007%2fs12053-016-9455-6&partnerID=40&md5=941618d438101773b42fbdcc30353ded"

Worrell E., Laitner J.A., Ruth M., Finman H. (2003). Productivity benefits of industrial energy efficiency measures. Eceee Industrial Summer Study Proceedings 2016-September- 433-441. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85045456604&partnerID=40&md5=0203c71e3d717d1e8c4e3052f97cb446

Yueming Qiu, Matthew Harding (2012). Title: Industrial Firms’ Choices of Energy Efficiency Investments: A Mixed Multinomial- Poisson Approach. Eceee Industrial Summer Study Proceedings 1- 67-73. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85006742361&partnerID=40&md5=6e0c8c4adb5e06897715601c54608b3d

Yuliya Karneyeva (2016). Title: If You Do What You Always Did, Do You Get What You Always Got? Performance Implications of Status Quo Bias in Swiss Energy Investments. Energy Engineering: Journal of the Association of Energy Engineering 109-5 7-26. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84864131666&doi=10.1080%2f01998595.2012.10531820&partnerID=40&md5=12bcf2d98cdb2d8d508699ce4df9c9b9

Yushchenko A., Patel M.K. (2017). Cost-effectiveness of energy efficiency programs: How to better understand and improve from multiple stakeholder perspectives?. Energy 28-11 1081-1098. https://www.scopus.com/inward/record.uri?eid=2-s2.0-

0038757619&doi=10.1016%2fS0360-5442%2803%2900091-4&partnerID=40&md5=ec3c7a8cce2d5cdcd38e4c3970bfd33d

Zavody, Z. (2003). How are new technologies brought into energy efficiency programmes?. Energy Policy 108- 538-550. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85033376538&doi=10.1016%2fj.enpol.2017.06.015&partnerID=40&md5=d9a7c2abb3cef890fddf27183573d47d

Zhelev T.K. (2005). On the integrated management of industrial resources incorporating finances. Journal of Cleaner Production 13-5 SPEC. ISS. 469-474. https://www.scopus.com/inward/record.uri?eid=2-s2.0-10444262050&doi=10.1016%2fj.jclepro.2003.09.004&partnerID=40&md5=00a673c7abc9a629d56cc64f35c3e367