Energy Efficiency Networks:

Towards good practices and guidelines for effective policies to stimulate energy efficiency

Working Paper

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Introduction

'Knowledge is the only treasure that increases when shared.'

- Professor Eberhard Jochem, IREES

Energy efficiency is a crucial pillar of the global energy transition and should be considered a priority measure in achieving the goal of building and reinforcing resilient energy systems that are economically and ecologically sustainable.

Within the context of Germany's G7 Presidency in 2015, the German Federal Ministry for Economic Affairs and Energy (Bundesministerium für Wirtschaft und Energie, BMWi) and German industry worked together to introduce and discuss the concept of business-to-business energy efficiency networks (EENs) at an international level.

The G7 Energy Ministerial in May 2015 agreed to collaborate on three concrete energy efficiency initiatives, one of which focused on EENs. As a first step, the International Partnership for Energy Efficiency Cooperation (IPEEC) developed a report in January 2016 to take stock of existing EENs, highlighting their best practices and success factors (IPEEC, 2016). This served as an inquiry into the development of international good practices and guidelines for EENs in order to lead the scale up of EENs internationally. On 15 September 2016, IPEEC and BMWi co-hosted a workshop in Berlin on this topic which brought together 50 leading experts and policy makers.

This report summarises key findings from the workshop on the benefits of EENs, key challenges and elements of success, and provides a basic toolkit for consideration by policy makers and industry to scale up EENs.

Background

The context for industrial energy efficiency

Energy efficiency will need to contribute about 50% in energy-related carbon dioxide (CO2) emissions reductions for the world to be on track for the 2°C trajectory set out by the Paris Agreement adopted in December 2015 (IEA, 2015). This goal, along with the United Nations Sustainable Development Goal #7 and the G20 Energy Efficiency Leading Programme endorsed by G20 Leaders in 2016, frames the context for accelerated progress on energy efficiency globally. According to the International Energy Agency (IEA), global annual energy intensity improvements (i.e. reductions) need to increase from the current level of 1.8% to 2.6% per year between 2016 and 2030 to achieve global climate change goals (IEA, 2016a).

In 2016, final energy demand from industry reached 152 EJ, totaling 39% of global total energy demand (IEA, 2016b). As such, it is an inevitable area for focused energy efficiency improvements. Indeed, it is estimated that 24% of current energy use in the industrial sector could be saved today using best available and economically viable technologies (IEA, 2014) - this points towards large and profitable energy saving potential in the industrial sector[1].

Energy efficiency delivers significant multiple benefits – especially in industry. These include improved product quality, optimised capacity utilisation, reduced maintenance, and improved work environment and safety, among others.

Yet, much of this potential remains untapped. Realising energy efficient solutions in industry is often hindered by decision routines, prioritisation of core business areas, lack of specific knowledge and market overview, and high transaction cost. There is also a lack of communication, exchange of experiences and knowledge. Oftentimes companies or energy managers search for energy efficiency solutions on their own rather than seeking the support of energy efficiency experts or pooling their knowledge and experience.

Energy efficiency networks (EENs), as peer-to-peer business-to-business networks, have been designed to overcome these barriers and tap into the energy efficiency potential in the industrial sector.

1 Profitability may vary between industrial branches, companies and countries.

The context for Energy Efficiency Networks

What are Energy Efficiency Networks

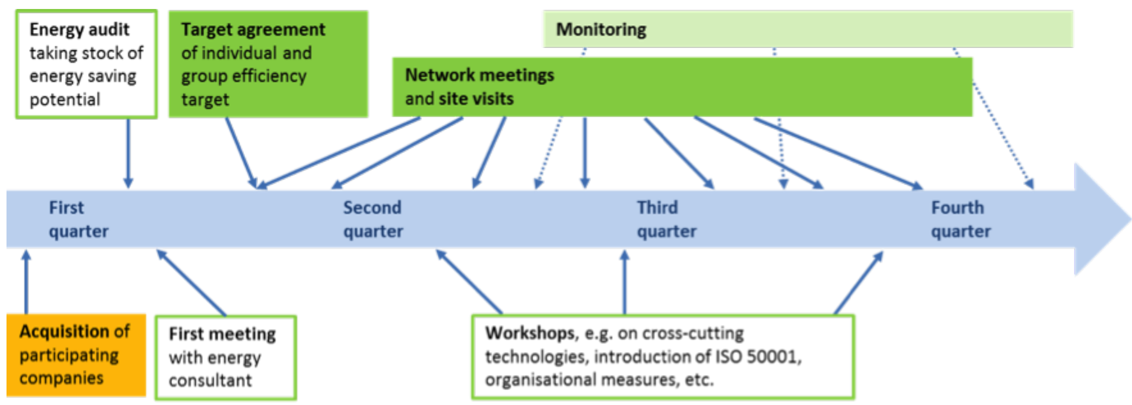
Broadly speaking, EENs are network platforms and mechanisms that bring companies together (from a region, sector, supply-chain, or within a corporate group) to exchange experiences and undertake steps together to improve energy efficiency. EENs work on a voluntary basis, but are often incentivised by existing regulatory and policy frameworks. As such, they can exist with or without government intervention. There is an inherent simplicity and flexibility to EENs, which allows them to be implemented in a variety of forms in terms of their structure, focus, scope and policy context across a number of developed and emerging economies, making them a useful and flexible tool for policy makers to improve energy efficiency in industry.

The concept of EENs originated in Switzerland in the 1980s and was initiated by industry actors that found significant potential for economically feasible energy efficiency improvements and benefits through collective action. The first pilot network demonstrated clear benefits of peer-to-peer learning and pressure, which over time led to a formalisation of the network process, first in Switzerland, then in Germany, and has spread to many other industrialised and emerging economies – always through close partnership between industry and government.

The network process can vary greatly in terms of length, financing method and number of meetings conducted, but it mostly follows the broad structure outlined in Figure 1 below.

Before launching a network, enough interested companies have to be acquired – usually between eight and fifteen companies. Once launched, the participating companies contract an energy consultant to conduct an energy audit to take stock of the energy saving potential. With these results in hand, companies then meet to agree on both individual and network-wide energy efficiency targets, which are non-binding (IEEN, 2015). Based on the agreed target and measures, companies proceed to implementing them and in parallel meet regularly to engage in a moderated exchange, share insights, go on site visits, and monitor progress. The costs of network participation vary depending on the size of the company and the country in which it operates (some governments subsidise network participation, particularly during the pilot demonstration phase of EENs). In Switzerland, the cost of network participation is set with an annual membership fee of EUR 3,000 for SMEs and EUR 8,000 for large companies (Eberle, 2016). In Germany, the annual cost for network participation ranges between EUR 1,500 to 2,000 for SMEs to EUR 4,500 to 7,000 for large companies (LEEN, 2016)[2].

Figure 1: the network process



2 In the Annex, we provide examples of different forms of networks that have been implemented internationally, including from Switzerland, Canada, Sweden, German, Mexico, China, and the US.

Roles within the network process

There are a number of roles in the network process which can, depending on the context, be carried out by different actors. A clear definition and communication of the tasks of each participant, along with setting a shared vision for, objectives and methodologies of the EEN, is one of the most critical requirements for the success of the network. Delineating roles and responsibilities is particularly important at the level of the implementing partners such as the project carrier and the consultancy, as they need to jointly act as motivator for the participating companies. EEN carriers (e.g. associations, industry parks, energy utilities companies) need to appreciate and understand the EEN as service concept being delivered to their interest groups (e.g. members, customers);

The table below outlines key roles and potential actors in an EEN (IEEN, 2015).

Energy Efficiency Network				
Roles	**Network Operator**	**Moderator**	**Energy Consultant**	**Participant**
Responsibilities	Members acquisition, initiation of network and follow through of network process	Organises, moderates and follows up with the network meetings, including supporting the agreement of a target	Conducts the energy audit and advises on the solution/ measures and energy saving target	Participate!
Actors	- Company - Utility - Association - Chambers of commerce - Communes - Service providers - Energy agencies - Etc.	- Company - Utility - Network operator - Energy consultant - Etc.	- Qualified energy consultant - Qualified internal staff - Qualified external energy contractor - Utility	- Company - Utility - Public service - Production sites

Micro

The multiple benefits of Energy Efficiency Networks

There are many benefits of EENs from the micro-level, i.e. at the level of the company, to the macro-level, i.e. of relevance to policy makers at the national and international level.

Raising awareness for energy efficiency potentials and capacity building: Apart from energy-intensive industries, energy efficiency is rarely seen as a priority for companies. Many companies, where energy use does not represent a major cost component, do not have a clear view on their energy consumption, missing opportunities to reduce energy demand and optimise energy use. The participation of company representatives in EENs raises the awareness of efficiency potentials within companies as well as on corresponding investment opportunities.

Reducing energy costs: Companies participating in EENs can achieve significant energy efficiency improvements. In Germany, for example, companies participating in EENs have doubled their energy productivity progress compared to the industry average. The networks as a whole were able to reduce their energy consumption by roughly 10% over 4-5 years, resulting in significant financial savings (Koewener et al., 2011). Networks have also had a great impact in emerging economies: two Resource and Energy Efficiency Networks (REEF) in Brazil achieved annual energy savings of more than 26,000 MWh, resulting in annual cost savings of approximately EUR 4.3 million, and a payback period of less than three years for the initial investment of more than EUR 9.5 million (Arqum, 2016).

Improving productivity and competitiveness through enhanced product quality and reducing production rejects: Controlled process temperatures or low heat losses through targeted energy management and energy efficiency improvements can lead to benefits in the production process. It can help to ensure consistent product quality, reduce the share of production rejects and off-specification batches, and to increase operation hours of kilns and furnaces. These co- effects can lead to similar or even higher cost savings than the energy cost savings themselves and have been reported by experienced energy managers who participated in EENs. Improved working conditions and occupational safety have also been side effects. These effects of EEN activities can deliver significant benefits by enhancing competitiveness, profitability, production capacity use, and improving environmental compliance.

Increasing market shares of energy efficient solutions and related services: For technology producers, EEN activities are a driver of more sales of energy-efficient solutions and cost reductions through economies of scale. This correspondingly leads to increased demand for experts, planners, installers and maintenance staff.

Networking: In addition to energy audits and implementation of energy efficiency improvement measures, participants value the networking opportunity through exchange of experiences with other companies and site visits, which over 80%of participants rated as ‘very good’ and ‘good’ experiences in a recent study (Koewener, 2016). The ties created in the network also extend beyond the EEN setting, with more than 50% of participants in contact with each other outside of meetings (Jochem et al., 2016).

Fostering innovation: Participation in EENs can generate new ideas for both technological and organisational measures. EnergyScouts, for instance, is an Energy Saving Apprenticeship Programme that was developed in Germany, whereby young apprentices in companies are trained to ‘scout’ energy saving potential by using different measurement tools. This also fosters technological innovation through the active reconsideration of production processes as well as products, such as changes in construction, design, materials and changes to new, highly energy-efficient components.

Creating new market dynamics in energy services: through the demand for quality energy audits, technical expertise, and annual monitoring, EENs have stimulated growth in the market for energy service companies (ESCOs) – both large and small. EENs offer new market opportunities for ESCOs or consultancy firms to provide effective facilitation and advice services to EENs. Indeed, in Austria, China, Germany and Switzerland (see Box below), EENs have emerged as a business model for service providers. For network operators too, new market opportunities have developed, including consulting, contracting, commissioning, training and the provision of other services.

Increasing transparency about energy use and data: Rigorously implemented benchmarking and monitoring and reporting (M&R) measures within some EENs greatly enhance availability and transparency of data on energy use, energy efficiency potential and their profitability. Some networks decide to disclose data either throughout the project via a web-based database or at the end of the network or project period, allowing for comparison and competition between companies towards higher energy savings.

Ensuring compliance with legal requirements: EENs provide a cost-effective channel for companies to comply with legal requirements. In Europe, for example, the EU Energy Efficiency Directive (2012/27/EU referred to as EED) Article 8 requires mandatory and regular audits for large companies. Pooling together financial resources to pay an energy consultant to advise companies on their compliance obligations, for example, can lead to more effective use of financial resources for companies.

Contributing to national and global climate policy: By helping companies realise cost-effective energy efficiency potential and compliance with legal requirements, EENs provide an effective contribution to limiting the adaptation and mitigation costs of climate change. In some countries such as Switzerland, where individual target setting within EENs are coupled with an exemption from the CO2 surcharge (currently CHF 84 per tonne), EENs can also help identify the least costly option for emission abatement (see Case Study 1).

Catalysing international knowledge transfer: Even though networks need to be highly contextualised in their implementation, the model itself can be exported internationally. Networks themselves have therefore become a strong vehicle for knowledge transfer, whether through multi-national corporations (MNCs) or bilateral collaboration. One such example is a large Mexican bakery company with global operations, which is now implementing the solutions it learned through an EEN in Mexico in its facilities around the world, including in other Latin American countries, Europe and China (see Case Study 4 and 5).

Case study | Realising the multiple benefits of EENs

Germany

There are many benefits to participating in EENs. For example, anumber of studies have analysed the results of Germany's '30 Pilot Networks' Programme, providing a rich set of quantitative evidence on the multiple benefits of energy efficiency networks.

Overall the '30 Pilot Networks' initiative – which brought together a total of 210 participating companies - has realised almost two thousand different energy efficiency measures, resulting in total energy savings of 870 GWh. This resulted in an average energy cost saving per company per year of EUR 200,000 (10% of energy costs) and 1,000 tonnes of CO2 reduction per year. A closer look at ten companies has shown that their total investment of EUR 2.4 million has resulted in total annual energy cost savings of EUR 1.4 million, leading to an average payback period of 1.7 years. EENs are also shown as highly cost-effective compared to other energy efficiency programmes: each euro of funds invested for an energy efficiency network results in 878kWh saved compared to 0.51 kWh per euro invested in the lowest end of programmes studied.

The study also showed that EENs, in a comparative analysis with other energy efficiency promotional measures, catalysed significant further investment – leading to an investment ratio of EUR 34.2 invested per euro of funding provided (Alexeew 2015).

Overall, participation in EENs has helped increase the competitiveness of companies, doubling efficiency progress on average 2% per annum compared to average of industry and achieving averaged EUR 10 to 20/tonnes of CO2 profits (Jochem et al. 2016).

Further to these benefits, EENs also catalysed new thinking within companies, raising awareness about energy efficiency and driving innovation. In several cases, companies participating in regional networks were so enthusiastic about the results from their EEN that management decided to generate a group-internal energy efficiency network within the company (examples: Procter & Gamble, Miele, BSH, ThyssenKrupp, Bosch).

China

In China, evaluations of EENs implemented in Changzhou, Chengdu and Kunshan reveal that the annual energy savings of the approximately 30 participating companies amounted to about 170,000 MWh. This resulted in annual energy costs savings of about EUR 16 million and corresponding CO2 emissions reductions of roughly 120,000 tonnes. The average payback period for more than 60% of the realised technical and organisational measures was calculated below three years, as observed in other countries (Arqum, 2016).

Additionally, the Chengdu network reported that network activities encouraged companies to make energy efficiency a more strategic issue at management level and further develop the market through increased demand for energy services. The site visits were highly effective and the contact they stimulated was much appreciated by the participants, leading to positive network effects of improved business-to-business relationships and cooperation between enterprises, increased information sharing, and innovation (Cheng, 2016) (see case study 4).

Barriers towards EENs – findings from the workshop

Even though there are multiple and very tangible benefits of energy efficiency and EENs from a macro all the way down to the micro-level, barriers exist to the significant scale-up of EEN activities (across different life cycle stages along the maturity of EEN initiatives).

Political support, incentives, regulation and/or other catalysing support measures are needed to overcome these barriers towards realising the potential of EENs and that of energy efficiency in general (Eberle, 2016).

Overall, the discussions at the workshop found that, on a topic that is inherently technical and an energy service that is new and complex, the human factors of trust, relationship and knowledge play an integral role in the success of creating EENs - trust between companies and service providers, banks and companies, but most importantly also within companies between decision makers and operators. As Eberhard Jochem (2016) said, "Energy efficiency networks are about [often unknown] opportunities, trust and knowledge". Once the participants of an EEN have met once or twice, almost all of them become convinced of the benefits of the network's activities. Below, some of the barriers to scaling up EENs are outlined. The toolkit presented in the next section of this report seeks to address these barriers.

Table 1 • Barriers towards Energy Efficiency Networks

Issue area	Barriers
Policy environment, incentives and support	• Lack of incentives and/or strong political message; • Lack of awareness about EENs amongst policy makers and the media due to the large variety of energy-efficient solutions available. The factors for EENs' successes are seen as being too complicated to portray for policy making and the media, where simplicity is preferred; • Lack of or difficulty in accessing information on how to effectively generate EENs for potential network operators.
Strategy and acquisition of network participants	• Lack of understanding for the novel service and the benefits that EENs offer; • Lack of awareness about energy costs and their profitable savings potential (except energy-intensive basic goods industries) due to low share of energy cost in total production cost (1-5%) (Koewener et al., 2011); • Lack of time of management board to consider network participation; • Lack of an overall energy use strategy in many companies; • Difficulty for network operators to identify the right contact point/decision makers within a new company; • Low effectiveness of sales pitches to management, as they are built on rational arguments and cannot be verified by the company – trust is an important factor; • Lack of awareness of existing opportunities, as companies believe that their strategists and energy managers have already exhausted all possible and profitable cost-saving measures; • Fear that a competing company would gather insights into knowhow of the production process; • Lack of trust in energy efficiency service companies and potential network operators.

Financial incentives	• Investment evaluation methods that center on short-term thinking with a focus on payback (i.e. measure of risk) and cheapest investments rather than internal rate of return or net present value (i.e. measures of profitability and profits); • Perceived high transaction costs; • Perceived inability to invest due to lack of staff, financial means or management support within companies; • Potentially high opportunity costs for the energy manager (e.g. environmental safety, occupational safety); • Difficulty financing energy saving projects, as banks decide upon a firm's general credit rating and not on the profitability and risk of individual small investments; • Need for financial support for energy audits and monitoring, especially of SMEs with low energy costs and related low potential of energy cost reduction.
Other factors	• Heterogeneity between companies in different sectors of regional EENs, which limits the focus on cross cutting technologies.

The barriers mentioned above can be alleviated, but must be addressed holistically in order to successfully generate an EEN.

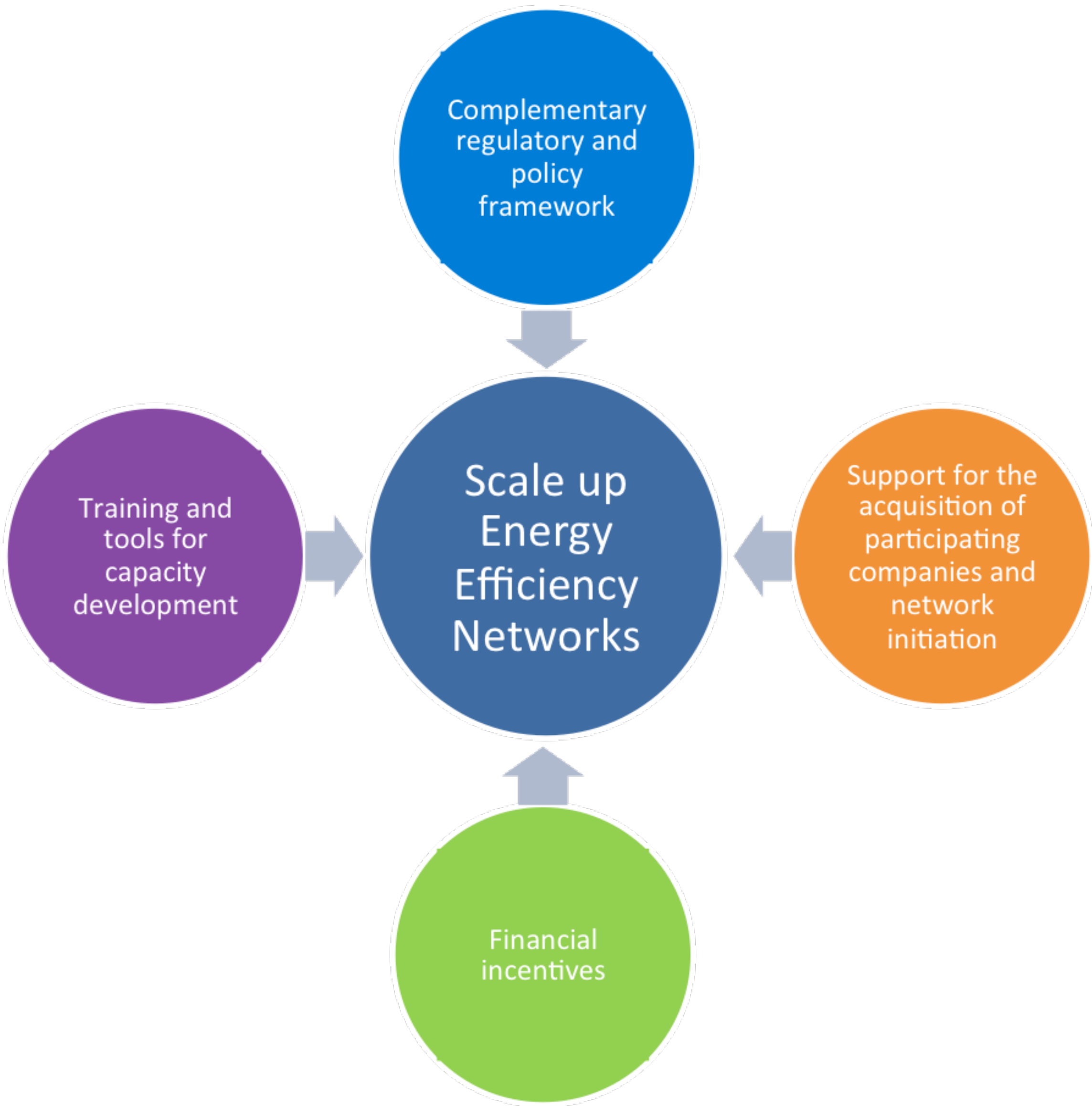
Toolkit for policy makers

Addressing the barriers in setting up EENs can significantly help scale up energy efficiency networks. This section looks at four key contextual factors that frame activities of EENs (see Figure 1):

1. A complementary regulatory and policy framework.
2. Support for the acquisition of participating companies and network initiation.
3. Financial incentives.
4. Provision of training and tools for network operators, consulting engineers and moderators.

Each contextual factor is introduced through guiding questions, which are followed by an explanation of available tools as well as international good practice case studies.

Figure 1 • Portfolio of measures suited to support the successful generation and operation of energy efficiency networks



A complementary regulatory and policy framework

Which tools and incentives can governments put in place in order to most effectively stimulate network generation and excellent performance? What complementarities exist in policy frameworks, such as exemption from energy and CO2 taxes or surcharges from GHG certificates of participants in EENs?

Governments can stimulate network generation and activities through regulatory incentives and an enabling policy framework. Depending on the country context, these could be 'stick'-type regulatory approaches all the way to a policy framework that signals strong political leadership on energy efficiency.

The **CO_2 law** in Switzerland, introduced in 1999 and revised in 2011, is one such example. The government sets a target on CO2 emissions reductions through the CO2 law and uses a CO2 tax to incentivise companies to reduce their emissions. In return for agreeing to a single binding CO2-target within the network and to annual monitoring, companies in an EEN and are exempt from the high CO2 tax - presently set at CHF 84 per tonne (see Case Study 1). This CO2 tax provides a favourable policy environment for EENs and has been the primary driver incentivising companies to join one of 90 EENs that have so far been initiated in Switzerland (Eberle, 2016). Switzerland has introduced a very stringent framework for the creation of EENs with particularly strong financial incentives. Other governments have also demonstrated the use of other policy mechanisms to stimulate network activity.

Germany has opted for a **voluntary agreement** within a framework of **strong political leadership and cooperation with industry** (IEEN, 2014). Upon the positive results of the '30 Pilot Networks' project, the German government decided to cooperate with 21 industry and business associations (covering nearly all sectors of German industry) to scale up EENs through the 'Energy Efficiency Networks Initiative (IEEN)'. The initiative is one of the key measures for industry in the National Action Plan on Energy Efficiency (NAPE) announced in December 2014 and has set the ambitious goal to initiate 500 networks by the end of 2020. There are no additional incentives or sanctions under this voluntary agreement. Rather it is based on minimum performance criteria for networks. IEEN present an opportunity for German industry associations and companies to demonstrate leadership in the field of energy efficiency. The high-profile political leadership and cooperation with industry associations has created national and regional awareness of the network process and been effective in initiating **100 networks** during the first two years of the agreement.

Furthermore, political leadership can create behavioural and organisational incentives by shaping social norms. While not as tangible as monetary drivers in the form of CO2 or energy taxes, energy efficiency laws or subsidies (also for energy audits), social norms can be considered non-monetary drivers in the corporate decision making processes of companies. This is particularly relevant in country contexts, where there is a strong environmental awareness and companies can capitalise on non-monetary drivers to improve their external brand reputation.

Through its **energy efficiency law** adopted in 2014, the Austrian government demands utilities and other energy suppliers with minimum sales of 25 GWh to prove energy efficiency measures that show average annual energy savings of 0.6% of their energy sales in the previous year to final customers in Austria. Alternatively energy suppliers can make a compensation payment, which goes directly to an investment fund that is used to subsidise energy efficiency measures (AEA, 2015). In anticipation of this law and building on the Swiss and German experience, the public utility Vorarlberger Kraftwerke AG (VKW) initiated the first EEN in Austria (VOL.AT, 2013). The results exceeded the initial target agreements, with actual energy efficiency improvements of 8.7% (agreed at 6%) and CO2 emission reductions of 8.3% (agreed at 6%), showing that EENs can be an effective mechanism to help utilities and energy suppliers meet their requirements (Energieeffizienznetzwerk Vorarlberg, 2016; Jochem et al., 2016).

Broader power sector reform can also be a driver of EENs. In China, its single utility - the State Grid Corporation of China (SGCC) – recognised EENs as a possible instrument to implement effective demand side management (DSM), which is part of an extensive power sector reform programme (State Grid, 2011). EENs can contribute to reducing energy demand and load pressure on the power system. Hence, the State Grid together with the GiZ launched an ambitious project to initiate 500 networks across the country (Yin, 2016).

Subsidised audits are yet another incentive to get companies involved in network activities. These have led to demonstrated successes within the Canadian Industry Program for Energy Conservation (CIPEC) and the Swedish National Energy Audit Programme for small and medium-sized industries (see Case Studies 3 and 7)

A subsidised network process can also be used to demonstrate the benefits of EENs to gain buy-in from companies and obtain their trust, especially in places where the EEN concept is new. In Mexico, for instance, a national programme for EENs was launched in 2014 in the absence of any tax or other regulatory incentives. The programme was led by the government in collaboration with six international partner agencies (GiZ, Danish Energy Agency, UNIDO, NRCan, PTB, and the Commission for Environmental Cooperation). The programme was fully funded by the partner agencies and companies could participate in the EENs for free. Given the positive results from the network activities, companies have subsequently voiced their willingness to pay for energy management and their participation in EENs. New networks will be financed by member fees (Villegas, 2016).

Case study | Mexico

The Mexican Commission for Energy Efficiency (CONUEE), a subsidiary of the Ministry of Energy (SENER), developed the National Program for Energy Management Systems (PRONASGEn) which aims to support organisations across all sectors to develop their capacities to implement Energy Management Systems (EnMS) and thereby increase their competitiveness through more efficient use of energy. One of the key pillars of PRONASGEn is the establishment of learning networks, with the wider objective being to support the implementation of EnMS in accordance with the requirements of the ISO 50001 standard within a group of companies and to prepare them for certification to ISO 50001.

In collaboration with six international partner agencies, CONUEE initiated five networks with 50 participating companies, each targeting different sectors. Some network activities are still taking place, but projected savings include: 25% of electricity and 37% in natural gas. While this initial pilot programme was funded by CONUEE and its partners, companies have been motivated by the results to continue the new networks as self-funded projects. On an even larger scale, Grupo Bimbo and Dow Chemical plan to replicate the project across their facilities through a group-internal network, as well as across their value chain throughout Latin America. Furthermore, the positive results have motivated participating companies like Clariant, Vitro, Bio Pappel and Herdez to implement EnMS at a corporate group level, demonstrating the critical role of EENs in raising awareness about the benefits of EnMS and the catalysing impact of subsidised network process to gain companies' trust in the network concept (see Case Study 5).

Section summary: Regulatory and policy frameworks as drivers of EENs

Regulatory and policy frameworks are strong drivers of EENs by providing incentives for participation. The above examples show that a wide range of instruments are available for use by policy makers.

There is no 'one-size-fits-all' approach. Rather, the choice of regulatory and policy instruments should be calibrated to countries' specific contexts, including political feasibility and dynamics of cooperation between government and industry. In Switzerland, Germany and Canada, the governments have a strong direct link with industry through associations. In other countries this cooperative context is much weaker. In such countries, the role of financial incentives for participating companies and/or network operators are of greater importance.

Support for the acquisition of participating companies and network initiation

What measures can be used to facilitate acquisition of participants?

Member acquisition presents the most important challenge for network operators and teams. Experience has shown that convincing companies of the benefits of joining EEN is no easy task. In the early stages of launching EENs in German SMEs, network operators estimated that it would take half a day to acquire one company to a network, which turned out to be five days.

Workshop participants identified trust as the key driver for successful member acquisition and network initiation. Relatively new and complex to grasp, the concept of EENs is initially often met with skepticism from companies. To turn this skepticism into productive engagement and participation in a network requires effective communication and relies on relationships of trust between stakeholders, including government actors as patrons, industry associations or regional Chambers of Commerce, service providers and staff within companies.

The variety of stakeholders involved shows that EENs cannot be solely driven by government, but require strong support and buy-in from industry to be successful and launched more widely. In all countries that are implementing EENs, government and industry have worked closely to establish a culture for energy efficiency in industry and to demonstrate the benefits of EENs.

The process of acquisition is a fluid one and may follow different processes. Workshop participants nonetheless identified seven building blocks to the process, outlined in Figure 3 and illustrated in case studies below.

Figure 2 • Building blocks of member acquisition and network initiation

Building Block	Case Study
Enable availability of and access to information: As a first step for companies to join EENs, they need to be aware of the benefits of energy efficiency and networks. To enable this, availability of and easy access to information on EEN is critical. This can be enabled through various online and in-person communication channels, such as informative websites, newsletters, special informational meetings, workshops, and annual meetings with accountants in charge of a utility or bank, etc.	The German Networks Initiative (IEEN) has established an extensive communication campaign to improve awareness regarding the instrument. The IEEN hosts a Secretariat that provides regular newsletters, press releases, tools, an annual conference, and even an information hotline to make information more easily accessible to companies.
Leverage channels of trust: Information flows quickly and effectively through channels of trust. In this sense, channels of trust such as industry associations, chambers of commerce, local or regional governments and utilities can play an important role in spreading trust, thereby supporting the acquisition of EEN members and initiating a new project.	CIPEC works through so-called Task Forces (sectoral focus), which have Leaders that are representatives of industry and champions from their respective sectors. These leaders are effective ambassadors in promoting the benefits of network activities, as they themselves are the trusted ear and voice of industry (typically high profile companies that are very knowledgeable and respected among peers).
Identify the right contact point(s): For a company to consider joining an EEN, the right contact point(s) need to be identified. Often it requires at least a decision maker (e.g. board member) and a chief engineer or technician (e.g. energy manager) to join a network. Commitment and support form top management is important as participating in an EEN encompasses investment decisions for energy efficiency measures, as well as allocation of internal staff resources to see through the implementation of the projects (EEN meetings, data collection, communication etc.).	In Germany, informational events are organised to make companies aware of EENs and also draw the corresponding contact points from companies. Invitations for these events have shown the importance of involving right contact points: either a management/board representative or the chief energy manager. Once the initial contact is established, peer-to-peer influence and pressure help further advance the acquisition process.
Deliver the right pitch: To convince a company to join requires the right pitch, one that is tailored to the target audience. For decision makers and purchasing managers, the financial benefits are more critical, while for energy managers or staff working on maintenance and equipment, other benefits may be more important. The discourse around energy efficiency may also differ from country to country, which all have to be taken into account. It is therefore important to reflect the interest of the participating companies and their representatives in the initial pitch, choice and presentation of the project content.	Mexico has launched a programme of EENs based on the experience of German EENs. However, in Mexico EENs are not pitched to companies by selling the benefits of energy efficiency measures. Rather Energy Management Systems (EnMS) are framed as means for increased energy productivity which leads for greater competitiveness of companies – a discourse that resonates better with Mexican companies. In Western Europe, companies in the end-user and retail trade branches have also shown greater interest in EENs in so far as its network activities are framed as contributing to 'greening' their company.

Building Block	Case Study
Perform a convincing first meeting: The first informative meetings for 'pre-selected interested companies' is critical and is best conducted in person. Ideally, the invitation should come from a person of trust, e.g. president of chamber of commerce, trade association or of a mayor or head of the district government, who helps in advocating for and setting up meeting.	The LEEN-management system provides clear recommendations on how to perform a first informative meeting: opening speech from a person of trust, followed by general information on how EENs work, a presentation from a company with experience participating in an EEN, and a presentation from a network operator and discussion on the planned EEN; and sufficient time for individual conversation and questions.
Perform a convincing acquisition visit: To complete the signed contract by a new member to an EEN, in most cases the network operator has to visit the production site and discuss the individual needs of the company and the potential benefits of participating in the EEN.	In Austria and Germany, the final acquisition visit is planned and led by the network operator –often accompanied by the consulting engineer. Both need to be figures of recognisable competence and reliability. The meeting includes a short on-site visit in order to provide initial recommendations on potential energy efficiency solutions.
Disseminate impact: After implementation, disseminating success stories is yet another powerful tool to support the initiation new network activities. This can be done effectively through industrial associations, chambers of commerce, coordinated communication campaigns or award schemes.	Since 2007, the Swiss Federal Office of Energy has run the 'Watt d'Or awards', and award scheme to highlight leading EENs. On the one hand this kind of government-led award scheme incentivises networks to perform well, and on the other it also serves as an excellent way to highlight the benefits of EENs to companies that are not yet part of a network. The award scheme also includes multiple categories, which speaks to different sectors.

Section summary: Building on trust and effective communication for successful member acquisition and network initiation

Trust and effective communication are key drivers of successful member acquisition and initiation of EEN activities.

There are a number of mechanisms/step-by-step building blocks that provide solutions to improve companies' understanding of EENs and overcome their skepticism towards this novel and complex concept: 1) Enabling availability of and access to information; 2) Leveraging channels of trust; 3) Identifying the right contact point(s); 4) Delivering the right pitch; 5) Performing a convincing first meeting; 6) Performing a convincing acquisition visit; and 7) Disseminating impact. Case studies show tried-and-tested examples of how these mechanisms have been successfully implemented across different countries. These provide ideas for network operators and policy makers alike on measures that can be undertaken to scale up EENs through more effective member acquisition and network initiation.

Financial incentives

What can be done to resolve challenges that face financing of EENs?

There are a number of financial incentives that can be leveraged to stimulate companies' participation in EENs. The first important consideration for companies is direct incentives, i.e. the benefits versus costs of network participation (including subsidised energy audits and membership fees in some cases). A second category of financial incentives is more indirect and could be derived from the availability of specific promotional schemes for efficient technologies, as well as networks impact on changing risk perception, assessment of payback period vs. internal rate of return (IRR).

1) Cost and benefits for network participation

In a study on the impact and performance of various promotional energy efficiency schemes in Germany, energy efficiency networks emerged as the most cost-effective[4]. The range of cost-effectiveness varies from as low as 0.51 kWh per euro fund invested for a programme to 878 kWh per euro fund invested for an energy efficiency network (Aleexew, 2015)[5].

Direct financial incentives are significant, as already demonstrated in earlier case studies (see above).

In Switzerland, the cost of participation for networks is EUR 3,000 (SMEs) to EUR 8,000 (large companies) per year, depending on the size or annual energy costs of each company. The average annual energy cost savings after four to five years of operation are EUR 120,000 per company, significantly outweighing the initial cost of participation in the network (Koewener et al., 2011).

In Germany, the '30 Pilot Networks' initiative realised average annual energy cost saving per company of EUR 200,000 (10% of energy costs) and 1,000 tonnes of CO2 reduction per year. A closer look at ten companies has shown that their total investment of EUR 2.4 million has resulted in total annual energy cost savings of EUR 1.4 million, leading to an average payback period of 1.7 years. Compared to the annual cost for network participation ranges between EUR 1,500 to 2,000 for SMEs to EUR 4,500 to 7,000 for large companies (LEEN, 2016).

Benefits significantly outweigh cost of network participation in emerging economies too. In Brazil, for instance, two REEF projects between 2010 and 2014 (total of 16 companies) achieved annual energy savings of more than 26,000 MWh resulting in a reduction of CO2 emission of about 2,800 tonnes per year. This generated annual cost savings of about EUR 4.3 million, and a payback period of less than 3 years for the initial investment of more than EUR 9.5 million. On average, each of the 16 participating companies saved approximately EUR 270,000 per year. Hence, with an initial financial expense of approximately EUR 590,000, an internal rate of return of 45% was achieved.

Evaluations of the EEN implemented in Changzhou, Chengdu and Kunshan (see above) reveal that the annual energy saving potentials of the approximately 30 participating companies amounted-up to about 170,000 MWh. This resulted in yearly energy costs savings of about EUR 16 million and CO2 emissions reductions of roughly 120,000 tonnes per annum. The average pay-back period for more than 60% of the realised technical and organisational measures was calculated below three years, as observed in the other countries (Arqum, 2016).

4 Cost-effectiveness is calculated as the ratio of primary energy savings per annum achieved by the programme against annual budget costs.

5 To estimate the cost-effectiveness of the programme, values were taken from one of the 30 networks that were being evaluated. It led to annual savings of 29,000 MWh for the ten participating companies. Assuming that the funds of EUR 10 million for all networks were distributed equally, around 878 kWh were saved per Euro of fund provided.

2) Viability of and financing for efficiency projects

Improving access to and availability of resources

Access to and availability of financial resources present a challenge primarily faced by SMEs, which have limited capital available to invest, especially in emerging economies. An even greater challenge can be the limit of staff resources in terms of time, knowledge and competence.

To address these issues, the Carbon Trust Fund in the UK, for example, operates a Green Business Fund, which provides dedicated support to SMEs in the implementation of energy efficiency measures. The Green Business Fund "provides direct funded support through energy assessments, training workshops, equipment procurement support and up to GBP 10,000 capital contribution towards energy saving equipment purchases" (Carbon Trust, 2016). In Germany, SMEs can get up to EUR 8,000 for the energy audit (the first activity in an EEN) and for consulting services during implementation.

Large companies often do not need financing support, but face the challenges of human resources and opportunity costs. Participating in EENs, including workshops, site visits and audits, usually requires a commitment of five to ten working days per year by a member of staff. While cost-benefit calculations usually include payback and IRR on technology investments made, a case for the payback in human resources and related transaction costs need to be made too. This is a particular challenge for SMEs with energy cost and savings potentials at least one order of magnitude smaller.

Strengthening trust and improving risk perception

Finally, the perception of risk of investment (technology) and corporate risk by banks present barriers to financing efficiency investments for companies participating in EENs. In addition, companies at times lack trust in the technological solutions recommended, i.e. perceived risk of both the supplier of technology and the technological solution itself.

In both cases, EENs can serve both as "risk analysis" by colleagues and peers as well as a quality assurance mechanism – so long as there is a rigorous quality standard for the operation of EENs. For companies, network participants could also recommend contractors and technology suppliers with relevant experience and corresponding references.

To improve the risk perception by banks of companies participating in EENs, it would help for banks to understand the rigorous network process that companies go through, including their collaboration with specifically trained consulting engineers and experienced network operators. The expected additional profits of highly energy-efficient solutions would increase the credit rating and the trust from banks, and decrease their risk perception.

Section summary: Creating financial incentives – direct and indirect

There are different ways in which companies can be incentivised financially to participate in networks. Direct financial incentives are present in the cost-benefit ratio of network participation, where benefits significantly outweigh costs – as has been demonstrated in case studies from Switzerland and Germany. Subsidised energy audit programmes or membership fees can also help greatly to engage companies in EENs – as seen in Sweden and emerging economies.

Indirect incentives can also play an important role. Notably, improving the access and availability of resources, and leveraging EENs to increase trust and risk perception, can incentivise companies' participation in EENs.

To improve access to and availability of resources, policy makers can consider examples where direct financial support is provided to companies, especially SMEs, such as through subsidised energy audits or financing the implementation of specific technological solutions. Such financial incentives have proven effective in stimulating EEN activities, especially for SMEs.

Training and tools for capacity development

What are training needs & tools to improve the network process and create a market environment that delivers services for EENs? Are there existing toolkits for EENs in some countries? Which aspects should be covered in such a toolkit (e.g. useful hints and tools for the network operator, the consulting engineer or the moderator, for acquisition of participants, energy audits, monitoring, and business models)?

Developing the capacity of EEN operators and relevant experts through dedicated training and the provision of tools is another key ingredient for the success and scale up of EENs. Relevant individuals need to possess both highly developed interpersonal and facilitation skills (e.g. for workshop moderation) as well as energy project management and efficiency related technical expertise.

Highlight: The CEM Energy Management Campaign has designed a comprehensive programme that comprises a set of actions that are designed to create an ecosystem for energy management systems, including efforts to increase the number of qualified ISO 50001 professionals. To this end, the EMWG runs an ISO 50001 Lead Auditor Certification Program that help countries build workforce programmes to qualify skilled ISO 50001 Lead Auditors (CEM, 2016). Having qualified auditors is often noted as a challenge by network operators or countries interested in initiating network activities, which rely heavily on high quality energy audits (see Case Study 6).

Training

Workshop participants identified a significant gap in the market of service suppliers to EENs. This presents a particular challenge in countries where the market for energy services is less developed. In Morocco for instance, there no auditors to date, which are certified, leading to highly variable quality of energy auditors. Thus according to a survey, 70% of company owners do not trust the auditors. Other countries too struggle with highly variable quality of energy audits.

Targeted training for experts (energy auditors, network operators, consulting engineers etc.) is thus critical to ensure the delivery of high quality services for and the scale up of EENs, and must be put in place rapidly.

In addition, workshop participants suggested creating networks for experts, through which experts can exchange experiences with each other and receive training. In Switzerland and Germany, regular meetings for exchanging experience among the network teams (network operator, consulting engineer, and moderator) are a standard practice. There are also training courses for consulting engineers (in both countries) and moderators (in Germany) with exams and certificates that have to be renewed every four years to ensure that certified professionals have the latest knowledge and competencies on EENs.

Tools for generating and operating EENs

A range of tools already exist, including guidelines, templates for contracts or meeting agendas, behavioural rules during the meeting, training manuals and software[6]. For tools to be useful, they should at the first instance be general, easy to use and cover basic information. The first threshold cannot be too high, as the tools would otherwise be difficult for new users to access and challenging for operators to update and maintain.

6 Sweden is working on developing energy audit software, which can reduce the internal cost of energy audits by 50% and help standardise part of the network process.

In sum, a toolkit (or a network management system) should have the following characteristics:

- Be general, easy to use and cover important information how to generate and to operate EENs;
- Be designed to cater to environments with different contractual, legal and regulatory requirements;
- Offer analytical tools and software-based solutions to evaluate energy efficiency potential, in particular of cross-cutting technologies (including calculation of profitability and co-benefits) and to monitor energy savings achieved (at least on an annual basis);

Example: Over the past ten years, LEEN GmbH has developed a network management system of around 100 tools and documents, including guidelines on each working step of the network process, contract checklist, and flyer and presentation templates, among other material. However, 20 to 30 tools out of 100 are the most pragmatic and commonly used. Arqum GmbH, with extensive experience in implementing EENs in emerging economies, has developed a suit of training programmes and tools for EEN in this context.

- Provide guidelines for network operators on how to initiate, implement, operate, monitor and evaluate EENs (acquisition of participants, master contracts for participants, the consulting engineer and the moderator);
- Provide guidance and example material for marketing and promotion of EENs, e.g. customisable text and graphic templates;
- Set-out minimum qualification standards (recruitment advice) for key EEN agents, such as operators, engineers, and moderators;
- Provide guidelines for consulting engineers (organisational efficiency measures, target setting for each participant and the network, monitoring, reporting to board members or management);
- Provide guidelines for the moderators (preparation and operation of the meetings, identification of speakers according to the topic of each meeting, related site visit, yearly meeting with a board member or management); and
- Provide best practice guidance on qualitative elements of training and communication:
  - Roles, skills and characteristics required of consulting engineers and moderators;
  - How to best structure remote engagements through webinars; and
  - How network operators and moderators can maintain active links with technology suppliers and engineering companies as well as banks, utilities and other relevant stakeholders.

Section summary: Provision of training tools

To scale up EENs not only requires increasing the interest of companies to join, but also to expand the network of service providers that are essential to implementing EEN activities. At present, many countries struggle with highly variable quality of energy auditors or lack of them altogether. Targeted training and provision of network platforms for experts (energy auditors, network operators, consulting engineers etc.) could help increase the number of high-quality service providers available and needed to scale up EENs.

Tools, including guidelines, training manuals and [energy audit] software can help streamline the network process, thereby increasing efficiency and lowering the cost, including the entry threshold. Tools should be simple and few in number, and focus on covering essential information related to the network process.

Conclusion: Summary of recommendations

Energy efficiency delivers significant multiple benefits – especially in industry. Yet, much of this potential remains untapped. Realising energy efficient solutions in industry is often hindered by decision routines, prioritisation of core business areas, lack of specific knowledge and market overview, and high transaction cost. There is also a lack of communication, exchange of experiences and knowledge.

EENs, as peer-to-peer business-to-business networks, have been designed to overcome these barriers and tap into the energy efficiency potential in the industrial sector. As such, they offer an effective platform that brings companies together and are also a mechanism to exchange experiences and facilitate the planning and implementation of energy efficiency measures across the participating companies within a network.

EENs work on a voluntary basis and require buy-in and collaboration from industry. Thus EENs can exist with or without government intervention – although governments often provide incentivising mechanisms and policy frameworks- and achieve energy efficiency improvements in companies in the most cost-effective manner. Networks create a positive dynamic of peer-to-peer learning and pressure, whereby the moderated meetings allow for exchange of good practices and monitoring of progress towards agreed targets.

Networks also provide many other benefits, such as improving competitiveness, fostering innovation and creating new market dynamics for energy services, among others.

There are nevertheless a number of barriers towards the creation and implementation of EENs, which can be overcome by four measures outlined in the report toolkit. These include:

- A complementary regulatory and policy framework;
- Support for the acquisition of participating companies and network initiation;
- Financial incentives; and
- Provision of training and tools for network operators, consulting engineers and moderators.

The effectiveness of each of the four contextual drivers has been demonstrated in-practice across a number of developed and emerging countries, and has successfully led to the initiation and scale-up of EENs (see Case Studies and Annex).

Scaling up EENs internationally, through leveraging the contextual drivers expanded on in this report, could help realise the untapped energy efficiency potential in the industrial sector, creating tangible benefits for both industry and policymakers. This toolkit and the accompanying case studies can be used as a guiding reference for practical tools and inspiration for the scale up of EENs, both in developed and emerging countries alike.

Case Studies

Case study 1 | Switzerland

Context

In Switzerland, companies have established and collaborated through networks since 1987. The first Swiss network was the 'Energy Model Zurich', which was initiated by eight of the largest electricity consumers in Zurich that decided to work together in order to save energy. A few years later, upon recognising significant energy saving potential, the Swiss Energy Agency for the Private Sector (EnAW) was founded by leading economic associations in 1999 with the goal to help the private sector to reduce energy consumption and CO_2 emissions. Network activities primarily took place between large companies in early years, but have since spread to SMEs, for instance in the industrial laundry and hotel sectors. In all sectors, the primary challenges toward energy efficiency improvement remain the similar: high costs of capital investments and maintenance for machinery and technical equipment; lack of resource awareness at the management and staff level; no systematic resource data collection and interpretation; lack of technical and context know how; planning errors and problems in technical systems; outdated technical equipment; and insufficient know how in operating the technical systems, which all point towards high potential for optimising resources and cost savings (Lorenz, 2016).

In the Swiss case, EENs operate in a favourable policy framework that incentivises action by public-private partnerships. This framework involves the government setting a target on CO_2 emissions reductions through the CO_2 law (introduced in 1999 and revised in 2011) and using a CO_2 tax, presently set at CHF 84 per tonne to incentivise companies to reduce their emissions. The incentive to participate in an EEN lies in the exemption from this CO_2 tax, should companies enter into a target agreement with the EnAW and achieve the corresponding energy saving targets (Eberle, 2016)[1 2].

Formation and network process

The EnAW supports interested companies to join other companies in setting up an EEN. Then a target agreement is developed first through initial data collection and visits, whereby data on the energy consumption is collected as well as other complementary basic data, such as building surface, production data and data on past energy saving activities. As a second step, the consultant helps identify potential energy savings (and CO_2 emissions reductions), measures and the payback period of these measures. Targets are then set based on the calculations of energy saving potential of economic measures. Energy consumption and the implementation of these measures are monitored and reported annually.

The network sets energy saving targets for both itself and its individual member companies. In this process the EnAW acts as the intermediary in the negotiation of target agreements in CO_2 reduction between companies and the federal government.

To illustrate with a concrete example, the first EEN was established in industrial laundries in autumn 2005, with the required minimum of eight companies participating. As a first step, the resource consumption (for water, energy, heat, and chemicals etc.) by kilogramme of textiles treated were compared, which showed a wide range between the most and least efficient laundries. The operations and equipment of the laundries were then analysed in depth, to identify explanations for the broad range in resource consumption.

1 All information pertaining to this case study come from Eberle, 2016, unless stated otherwise.
2 The CO2 bill, updated in 2012 set the goal to reduce CO2 emissions by 20% from 2012 to 2020 compared to 1990 levels. Accompanying the goal, Switzerland imposed a CO2 steering tax of 77 EUR/tonne (CHF 84) (2cts/kWh) starting from 10 Euros, limited at 110 Euros per tonne CO2. Since 2008, companies may choose between paying CO2 taxes or agreeing to the binding (energy) target agreements as part of the energy bill.

Based on these analytical insights, action plans were devised with concrete goals, such as cost and benefit calculations for each laundry. In 2007, the target agreements with individual commitments for each participant were signed with the EnAW and the EEN was granted a reduction of CO_2 emissions of 15% for the period ending in 2012.

Results and impact

Following the success of the first Swiss EEN initiated by the private sector, a more systematic approach towards network building was adopted by the EnAW in collaboration with the Swiss Department of Energy. To date, more than 3,700 companies have participated in 90 networks from all sectors. Over 2,600 of these follow the original Energy Model for large companies and over 1,000 follow the SME model.

The energy efficiency networks are financed by the participating companies with average contributions of EUR 3,000 (SMEs) to EUR 8,000 (large companies) per year, depending on the size or annual energy costs of each company. The average annual energy cost savings after four to five years of operation are EUR 120,000 per company, significantly outweighing the initial cost of participation in the network (Koewener et al., 2011).

What is noteworthy in the Swiss case is that the CO_2 emission reductions achieved through participation in the networks has been higher than the target emission reductions set through the CO_2 law. Using 1990 as a baseline, companies with target agreements reduced CO_2 emissions by 25% compared to the business average of 15% (i.e. those companies that were only exposed to the tax). This implies that EENs as a 'voluntary tool' can offer a more cost effective alternative than policy instruments such as taxes towards reaching emission reductions targets set by mandatory policies.

Lessons learnt

The incentivising policy framework has been a critical driver to the rapid expansion of network activities in Switzerland, with key milestones in changes to the regulatory framework correlating with increases in network participants – first with the adoption of the CO_2 bill in 2001, then the adoption of the CO_2 tax in 2008 and finally the updated CO_2 bill adopted at the end of 2012.The incentives stemming from this framework elevate energy efficiency to a strategic topic considered at the board level and are accompanied by a systematic approach and tools. It has also provided policy stability, allowing large companies and SMEs to engage in long-term strategic planning – one of the key success factors in energy management.

Case study 2 | Germany

Context

In 2002, the concept of EENs, which originated in Switzerland in 1987, took root in Germany. Network activities started with a pilot project initiated in 2008 by a consortium of research institutes and companies called the '30 Pilot Networks' project, which involved 210 participating companies. The goal was to demonstrate the benefit of EENs and to establish a management system – the Learning Energy Efficiency Networks system (LEEN) - which comprises a set of tools for energy consultants to guide companies through the network approach (identification of efficiency potentials, auditing and energy management protocols, monitoring and verification, etc.). Upon the positive results of the pilot project, the German government launched the 'Energy Efficiency Networks Initiative' (IEEN), a collaboration programme with 20 industry and business associations to scale up EENs, through which industry associations motivate companies to participate in EENs. The initiative, which is one of the key measures of the National Action Plan on Efficiency (NAPE), was announced in December 2014 and has set the ambitious goal of initiating 500 networks by the end of 2020. The goal of the networks initiative is to reduce primary energy consumption by 75PJ and 5 million tonnes CO2 (BMWi, 2014). To date a total of 90 EENs operate in the country.

Energy Efficiency Networks in Germany.[3]

Almost in parallel, the Energie Baden-Württemberg AG (EnBW), a German public utility company, started pioneering network activities in 2006, having established more than 28 regional EENs to date (EnBW, 2014).

Formation and network process

LEEN and the utility based model of EnBW broadly follow the same network process, consisting of the following steps: the identification of efficiency potential, establishment of a common energy saving target, establishment of auditing and energy management protocols, monitoring and verification, regular meetings for exchange and identification of solutions, and annual monitoring.

Results and impact

The networks of both models have produced significant results. A comprehensive study of the '30 Pilot Networks' initiative shows that total investment of EUR 2.4 million across 10 companies resulted in annual energy cost savings of EUR 1.4 million with an average pay back period of 1.7 years. Overall, the initiative realised 1,980 different measures to save energy, resulting in total energy savings of 870 GWh. The 28 networks established through the EnBW have achieved energy savings of 300GWh per year, which translates into energy cost savings of EUR 20 million per year and CO2 emission reductions of 100 million kilogramme per year. Every participating company saves on average 6-8% of its energy consumption (Koewener, 2016).

Lessons learnt

The German example demonstrates that networks are increasing energy efficiency gains visibly in a cost-effective manner. A rigorous network approach has been useful in scaling up EENs in Germany after the initial '30 Pilot Networks' project. Furthermore, the German case shows that industry buy-in is critical to stimulate companies' interest in network participation. Close partnership and collaboration between industry and business associations and the government is thus another important dimension to aid the proliferation of EENs.

3 https://www.iea.org/media/workshops/2011/iip/12_Fraunhofer.pdf

Case study 3 | Sweden

Context

Sweden uses different policy instruments to improve energy efficiency in industry. These include the overarching Swedish Environmental Code (SFS 1998:808), which is a law, and a number of end-use policy instruments and programmes, such as the Swedish Energy Audit Program (SEAP), which provides subsidised energy audits to industrial companies with energy consumption above 300MWh annually. Complementary to these policies and programmes, the Swedish Energy Agency (SEA) has also initiated a national programme of energy efficiency networks, which now spans between 35 and 40 active networks (Ivner et al., 2014).

Formation and network process

In Sweden, networks have been used as early as the late 1990s to implement environmental management systems. Later in 2008, industrial areas piloted energy efficiency networks in the Linkoeping region. These networks have been built around a central coordinator (elsewhere called network carriers or operators) that moderate the steering committee comprised of representatives from the participating companies, similar to the energy efficiency networks in Germany and Switzerland. However, in comparison to EENs, these initial networks did not have clearly formulated targets, nor were there guidelines on the size, process and lifespan of a network (Paramova et al., 2014).

Following these experiences, ENERGIG was the first Swedish pilot energy efficiency network programme to adopt a network process based on LEEN and adapted based on insights from Sweden-specific research. There are different networks in Sweden, mostly sectoral networks, but network activities for SMEs have also expanded recently. SMEs receive support through subsidised energy audits, which are a defining factor of mobilising SMEs to participate in network activities. The cost for participating members is EUR 1000 per year for SMEs. As part of the network process, new software is being developed and applied, together with a new regional end-use and energy efficiency measures database (Bjoerkman and Thollander, 2016).

Results and impact

The pilot has not been concluded yet so there are no specific results on energy savings achieved. Previous studies were also unable to quantify the benefits of network participation due to lack of performance monitoring and evaluation by the respective networks in the absence of a standardised process. There are, however, a number of positive developments that can be observed. Participating companies did register a reduction in energy consumption and most companies have successfully implemented solutions that emerged through the network process (Paramova and Thollander, 2016). Tools that have been adopted in the Swedish regional industrial energy efficiency networks include the energy audit software, which can significantly cut the cost of energy audits compared to conventional energy audits. Furthermore, the database created has already compiled over 8000 real measures, which, if implemented, could lead to 3 TWh/years of savings – institutionalising and making available the valuable lessons learnt through network activities (Bjoerkman and Thollander, 2016).

Lessons learnt

Sweden has been continuously improving its network programmes and its connections with other public support programmes, such as subsidised energy audits. Especially for SMEs, the combination of subsidised energy audits and participation in energy efficiency networks is emerging as an effective combination to stimulate the uptake of energy efficiency measures in SMEs by overcoming typical energy efficiency barriers, such as lack of resources and insufficient information. The programmes have also shown that it would be beneficial to have a standardised monitoring and reporting mechanism in place to evaluate the progress of participating companies in networks, therefore building the evidence base for more network activity.

Case study 4 | China

Context

The concept of energy efficiency networks first spread to China through a bilateral collaboration programme between Germany and China, through which the State Grid identified EENs as a possible instrument for effective demand side management (DSM)[4]. In 2011, the first training was delivered and the first network was created in Changzhou through the local State Grid Cooperation, consisting of 12 companies – both Chinese and international. The State Grid aimed for radical expansion of EENs in China and more training events followed, with over 500 networks being launched across the country (Yin, 2014).

Of these, one of the most successful networks is the EEN in the Chengdu Economic and Technological Development Industrial Zone (CDETDZ). The CDETDZ is located in the east of Chengdu and is an innovation park focused on the automotive industry with over 200 Chinese and national companies registered (Cheng, 2016)[5].

The National New Industrialization Demonstration Base of automobile industry in the Chengdu Economic and Technological Development Industrial Zone[6].

Formation and network process

The first network in the CDETDZ consisted of 11 participating companies, with the CDETDZ park management acting as the network carrier and moderator, Arqum GmbH providing technical support and Sichuan Electric Power ESCO providing consulting and auditing services. The network process broadly followed the LEEN model (energy audits, setting energy consumption standards, sharing of good practices and field visits), but in an accelerated fashion. Compared to the four-year duration of LEEN, the network process in the Chengdu network was reduced to one year and intensified interaction between network participants, with monthly instead of quarterly meetings and site visits. This was largely due to the fact that the network wanted to deliver visible results as quickly as possible, given the initial goal of the State Grid to expand to 500 networks in a very short amount of time and to mobilise more companies to participate in new networks.

Results and impact

In the first EEN at CDEDTZ, six technical recommendation reports were developed. These reports supported experience sharing on the topics of transformation of heat recovery in air compression systems, energy-saving upgrades of fans and pumps, and oxygen-combustion technology. Overall 108 recommendations were developed, from which 19 concrete projects were realised with cumulative energy savings of 3.56 GWh, as well as 887,000m3 of natural gas saved and 48,000 litres of water.

4 In 2011, the NDRC enacted the new version oft he „DSM directive“, requiring two power grid utilities to fulfil a set energy saving quota each year – initiated by the utility by helping their (industrial) customers to implement energy efficiency measures: min. reduction of 0.3% of sold electricity and min reduction of max grid load by 0.3% compared to the year before. Energy saving services could be counted as a way towards fulfilling this obligation.

5 All information pertaining to this case study comes from Cheng, 2016, unless stated otherwise.

6 http://www.gochengdu.cn/news/industrial-parks/chengdu-economic-technological-development-zone-a104.htm6

In addition, network activities encouraged companies to make energy efficiency a more strategic issue and helped develop the market further through increased demand for energy services. The intensive monthly site visits were highly effective and the contact they stimulated were much appreciated by the participants, leading to improved business-to-business relationships and cooperation between enterprises, increased information sharing, broader improvements in the industrial park environment and social environment as well as improved brand image for and competitiveness of the industrial park.

The positive results of this first networks stimulated other companies in the park to be interested in joining EENs, initiating the subsequent second and third EENs, which are currently in operation.

Lessons learnt

Seen in the context of China as an emerging economy, EENs can be an effective management tool and service instrument for local governments and utilities to fulfil the targets of energy saving and environmental protection. EENs can support the expansion and development of the local energy service market and use it to achieve the objective and targets.

Furthermore, the successful experience of the CDTEDZ shows that using industrial parks as a network carrier could be an effective model to expand EENs in countries like China, where much of industrial activity is clustered in dense industrial parks. The competitive dynamics between industrial parks could act as an incentive and be leveraged to increase EEN activities.

Furthermore, the experience in China shows that depending on context, the network process may have to be adapted, including for instance an accelerated networks process in line with the dynamic development and demands of local industry.

Case study 5 | Mexico

Context

The government of Mexico holds a strong awareness of the importance of energy efficiency. To this end, there is a specific National Commission for the Efficient Use of Energy (CONUEE) that is responsible for promoting and implementing energy efficiency measures across the country. In 2015, CONUEE launched a new strategy to promote the application of Energy Management Systems (EnMS) across all energy users. This National Program for Energy Management Systems (PRONASGEn) seeks to overcome and minimise the barriers and poor practices that prevent energy users from the systematic adoption of energy efficiency measures, while aiming to support the formal adoption of EnMS. Activities focus on the most energy intensive industrial sectors, but also SMEs, refineries and public buildings. As part of the activities package, specialised training and capacity building is provided to establish EnMS, as well as development of technical measures for national and international experts. PRONASGEn also uses the IET 50001 software to calculate uptake and monitor impacts of all its activities. EENs are also introduced as a way to raise awareness about and implement EnMS (Villegas, 2016)[7]. CONUEE is coordinating this project together with six international partners.

Formation and network process

As part of PRONASGEn, five ‘learning networks’ have been established with 50 participating companies, implementing different approaches. Two networks of which broadly follow the German LEEN approach; one network is based on Danish concepts, where strong technical knowledge is fundamental to support the implementation of EnMS, and another network follows the ISO 50001 standard as a means to obtain the Superior Energy Performance (SEP) certification.

All the above networks include forms, checklists, templates, examples, workshops and guidance from technical experts and, in some cases, moderators who provided technical assistance and helped with the practical implementation of the EnMS. Field visits were also conducted to encourage exchange of good practices and make recommendations. In addition, technical webinars were conducted to share experiences.

Results and impact

Some network activities are still taking place, but projected savings include: 25% of electricity and 37% in natural gas – all coming from the implementation of solutions to increase efficiency in refrigeration, water heating, steam distribution, compressed air, CIP and other processes with two-year payback periods. In addition, an extra 5% of energy savings could be achieved through improving maintenance and review of operating parameters. These activities will have a positive impact on the environment due to a direct reduction of GHGs associated to EnMS improvement.

On an even larger scale, Grupo Bimbo and Dow Chemical plan to replicate the project across their facilities through a group-internal network, as well as across their value chain throughout Latin America. Furthermore, the positive results have motivated participating companies like Clariant, Vitro, Bio Pappel and Herdez to implement EnMS at a corporate group level, demonstrating the critical role of EENs in raising awareness about the benefits of EnMS. Many employees were trained, six plants applied for ISO 50001 certification, and guidelines were developed for the implementation of learning networks on energy efficiency and EnMS in the Mexican context.

7 All information pertaining to this case study comes from Villegas, 2016, unless stated otherwise.

The ongoing networks will continue as self-funded projects during a second stage, with the main objective being to ensure that EnMS is used in a robust and continuous improvement process. Three new networks are being created in this context.

Lessons learnt

PRONASGEn, has shown industry that EnMS are an effective tool to drive significant energy savings and represent a competitive pathway to comply with energy policies aiming at broader energy efficiency and corporate goals. EENs have played a critical role in raising awareness amongst industrial companies about the benefits of EnMS and provided a process for them implement EnMS. In fact, for some companies the experience has been so positive that the approach of EENs has trickled down and spread to other parts of the corporate group or even to other regions. In particular, capacity-building has been very important in Mexico, given its emerging economy status.

Case study 6 | United States

Context

In the U.S., informal cohorts (similar to networks) started as early as 2005, with the cohort model formalising around 2008 through utility based programmes in north-western U.S., which promote strategic energy management aligned with ISO 50001 principles.

Formation and network process

On average, there are five to ten companies per cohort and by December 2015 over 750 companies have been engaged, with projects averaging 2.3-8% in energy savings. Companies are engaged in a 12-18 month programme through a series of workshops and consultations. Engagement is built on two pillars – organisational and technical, with the former focusing on establishing energy teams, engaging executives, empowering employees, and setting goals. The latter focuses on establishing reliable regression models and identifying opportunities in OMB (operations, maintenance and behaviour). An executive of the company has to sign a participation agreement that includes post-cohort expectations.

Cohorts and the CEM Energy Management campaign

Such cohorts have over time emerged as an effective delivery mechanism for the promotion and adoption of energy management systems (EnMS), including EnMS of the ISO 50001 standard (Siciliano, 2016)[8]. As such, cohorts can be an effective complementary mechanism to help reach the goal of 50,001 global certifications to ISO 50001 as set out by the Clean Energy Ministerial's (CEM) Energy Management Campaign, launched in June 2016.

Beyond cohorts, the comprehensive programme of the EM Campaign encompasses a comprehensive set of activities that seek to build an ecosystem for energy management, including auditor training, awareness raising for companies as well as technical tools. An important crucial aspect of the campaign is to increase the number of qualified ISO 50001 professionals. To this end, the EMWG runs an ISO 50001 Lead Auditor Certification Programme that help countries build workforce programs to qualify skilled ISO 50001 Lead Auditors (CEM, 2016). Having qualified auditors is often noted as a challenge by network operators or countries that are interested in initiating network activities, which rely heavily on high quality energy audits.

Results and impact

Participating companies have appreciated the cohort programs, highlighting the benefits of positive peer pressure and trust relationships established through the cohorts over time. Recognition events solidify accomplishments and outline a pathway forward. Therefore, cohorts are recognised as an effective delivery mechanism for the CEM EM Campaign.

Lessons learnt

It is important to nurture an ecosystem of service providers, evidence to promote and scale up energy efficiency network activities – not just about optimising the network process itself. Furthermore, the cohorts show that networks are an effective model to promote the adoption of ISO 50001.

8 All information pertaining to this case study comes from Siciliano, 2016, unless stated otherwise.

Case study 7 | Canada

Context

Industrial energy efficiency is a priority to realise climate change and clean growth objectives for Canadian industry. Canada works through networks and with partners to engage industry on energy efficiency. Many industries in Canada are energy-intensive: mining, oil and gas, pulp and paper, petroleum refining, chemicals, smelting and refining, steel, cement. In 2013, all industrial activities combined spent CAD 47.6 billion on energy.

In this context, the government's role through Natural Resources Canada's Office of Energy Efficiency is to provide national standards, foster collaboration with subnational governments and industry, and align actions with the US and internationally. The Energy Efficiency Act adopted in 1992 mandates NRCan to promote energy efficiency. The Canadian Industry Program for Energy Conservation (CIPEC) is Canada's industry-government partnership that promotes voluntary actions to reduce industrial energy intensity. CIPEC supports specific sector Task Forces that work like networks to systematically promote industrial energy efficiency. CIPEC encourages effective energy management and continual improvement in energy efficiency, as it improves the corporate financial bottom line while helping Canada meet its climate change objectives.

Today, CIPEC consists of about 2,400 members, representing 21 industrial sectors and over 50 trade associations, and is the focal point for industry action on energy efficiency in Canada. All CIPEC members have signed letters of commitment with NRCan reflecting industry's support for voluntary initiatives that lead to energy and cost savings.

Formation and network process

The CIPEC sector Task Forces facilitate networking and serve as a platform for the dissemination of information and the exchange of best practices within Canada's industrial sectors. To realise climate change and clean growth objectives for Canadian industry, Canada will continue to look to these sector Task Forces to help efforts to build successful partnerships and leverage common interests.

CIPEC works with its sector Task Forces to set goals and objectives, and develop action plans for improving energy efficiency across the different industrial sectors. The Task Forces coordinate closely with industry associations to deliver a range of services:

1. Awareness: through regular newsletters, case study videos and articles, outreach, communications and social media activities;
2. Knowledge: through workshops, technical guides, tools and support, biennial conference, internships for new professionals;
3. Action: financial support for projects, program delivery in collaboration with subnational governments, tax incentives, in-house expertise and guidance;
4. Reward: awards and recognition programs

CIPEC leverages these multiple channels to encourage industry participation and efforts to improve energy efficiency. The popular Dollars to Sense workshops for industry have served more than 30,000 participants since they started up in 1997. The webinar series has attracted more than 3,100 participants over 49 sessions, teaching companies about the skills and tools that can make them more energy-efficient[9].

Since 2003, CIPEC's biennial conferences have also made a significant and innovative contribution bringing together leading experts, and since 2007 have awarded those companies leading in industrial energy management.

9 CIPEC Annual Report 2015.

Results and impact

In 2013, the Canadian industrial sector produced about 26% of Canada's GDP. Between 1990 and 2013, industry reduced their combined energy intensity by 8.1 per cent[10]. Such improved energy efficiency measures resulted in CAD 3.0 billion in energy savings in 2013 alone.

Between 2011 and 2016, under the ecoENERGY Efficiency for Industry program, 53 CIPEC Leaders voluntarily implemented an energy management project. Over this same period, 19 CIPEC Leaders voluntarily became certified to the ISO 50001 Energy Management System standard which requires them to continuously improve their energy performance. Energy Management Systems can be quickly implemented with immediate results, and can readily identify energy savings opportunities that can achieve a payback period of less than two years. For example:

- Chrysler Group LLC's Brampton assembly plant was the first automotive plant in Canada to achieve ISO 50001 certification resulting in energy cost savings of more than CAD 2 million annually.
- IBM's Bromont manufacturing plant was the first IBM facility worldwide to become ISO 50001 certified in 2013 and saw a 9.2 percent reduction in energy consumption and CAD 550,000 in energy cost savings that year.
- Lincoln Electric's Toronto facility became ISO 50001 certified in 2013 and saw a 22 percent energy savings that year.
- 3M Canada's Brockville plant was able to save CAD 350,000 in energy costs between 2011 and 2013 just in the work performed to achieve ISO 50001 certification4.

Lessons learnt

After 40 successful years of collaboration with industry, CIPEC continues to be a living example of what Canada does very well: work together to create solutions that support the advancement of business while bringing great benefits to everyone.

10 Efficiency Trends in Canada 1990 to 2013

Case study 8 | Cross Country

Context

In many countries, the practice of EENs has spread throughout companies in the form of 'group-internal EENs'. These EENs are established along similar lines to EENs in Switzerland and Germany, but across different production sites within the same corporate group (Jochem et al., 2016). In Germany, companies such as Miele and Bosch Siemens Hausgeräte (BSH) have launched group internal EENs, building on a history of operating internal working groups on energy efficiency dating to the 1980s and 1990s, respectively. In these cases, it has been executive management that has set the goal of reaching a specific energy efficiency target that provided the impetus for action. At BSH for instance, executive management agreed on a goal to increase 25% energy efficiency improvements between 2010 to 2015 across its 10 production sites in Germany.

Looking at other countries, in Mexico Dow Chemical is planning to replicate the LEEN approach through their own network of production facilities throughout its value chain in Latin America, building on Mexico's first learning network on Energy Management Systems (see below) (Villegas, 2016).

Formation and network process

The group-internal network process broadly follows the approach of Learning Energy Efficiency Networks (LEEN). The decision to draw on the LEEN approach emerged from companies' positive experiences from participating in regional networks. Thus the concept of LEEN, including management approach and tools were adopted across most group-internal networks (such as in the case of Miele).

Results and impact

BSH managed to reduce energy demand per tonne of products by 25% between 2010 and 2015. Targets for the future are further reductions of 10% between 2015 -2020 and 20% in 2015 – 2025. Miele Group has reduced specific energy demand by a total of 33% (or 3% per year)[11] between 2000 and 2013. This is less compared to BSH in recent years as Miele has for a long time applied energy efficiency measures, therefore already having reaped the 'low-hanging fruits'. Another example is the bus manufacturer Evobus, a daughter company of the Daimler Group, which participated in LEEN since 2005 and reduced its final energy demand by 46% and annual CO_2 emissions by 32.500 tonnes from 2005 to 2015 at two large production sites in Germany.

Lessons learnt

The proliferation of group-internal EENs has developed organically from the positive experiences of company branches or production sites participating in regional or sectoral EENs through the initiative of corporate groups themselves. This development demonstrates that companies are deriving concrete benefits from EENs in terms of energy and associated cost savings as well as other multiple benefits, such as contribution to corporate sustainability and environment agendas.

It also demonstrates the versatility of the LEEN process and tools, which can be readily applied in an EEN within a corporate group in a similar manner to the way it is applied in regional or sectoral networks. Where policy incentives are absent, leadership from senior management is a driving factor to the formation of group-internal EENs.

11 Miele (2016): Sustainability – Energy consumption per tonne of product. https://www.miele.com/en/com/energy-consumption-per-tonne-of-product-4013.htm

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