Energy Efficiency Networks: Overview of the implementation over the world and lessons learned

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ABSTRACT

An Energy Efficiency Network (EEN) is a group of companies or public institutions whose energy managers meet regularly to share experiences on energy savings and to implement solutions. In addition to a "simple" energy audit, the EEN concept includes the setting of energy saving goals on company level as well as on network level. Companies participating in an EEN are embedded in an approach toward Energy Management Systems. To strengthen the collective dynamic for implementing energy efficiency (EE) measures, site visits and monitoring are regularly organized. The concept of EEN was developed in Switzerland in the 1990s and transferred to Germany in 2002, delivering very good results in terms of energy efficiency improvement in companies. EENs have been implemented on a large scale in both countries as well as in China and Sweden. Furthermore, over the last 20 years, EEN pilot projects have been launched in 20 countries of almost all continents. This paper will focus on EENs of companies and present a global overview of the implementation of the EENs. Subsequently, the different framework conditions and key factors for a large and successful promotion of the EENs will be presented and analyzed. Finally, the added value of EENs will also be discussed, specifically based on the evaluations carried out in Germany.

Introduction

Most of the energy efficiency policies that target companies rely on four pillars: regulatory measures, information measures, financing measures and capacity building measures (IEA 2015), which are designed and implemented according to the national objectives. However, in the last 30 years, a new type of instrument to foster energy efficiency has been developed in Switzerland, then improved in Germany and is now rolling out in many countries. This new instrument is an Energy Efficiency Network (EEN), a group of companies or public institutions whose energy managers meet regularly to share experiences on energy saving measures and to implement solutions. In addition to the “well-known” energy audit, the EEN concept includes the setting of energy saving goals on company level as well as on network level. To strengthen the collective dynamic for implementing EE measures, site visits and monitoring are regularly organized. Even organizations that already have an Energy Management System (EMS) or the willingness to implement one can still profit from the benefits of network participation, however the focus of this paper is only on the EENs of companies and their implementation across the world.

To start, the history of the EEN concept will be presented, followed by a short overview on the typical actors and phases of an EEN. Then, the experience with EENs in Germany will be summarized, followed by an overview of EEN implementation over the world. Next, the added value of the EEN approach will be presented, followed by a short discussion on the framework

conditions for a large and successful promotion of the EENs. To close, the key results will be summarized, and the main issues will be addressed.

Origin and history of the concept

An EEN is a pool of companies[1] whose energy managers meet regularly to share experiences on energy savings and to implement solutions. As shown in Figure 1, the EEN concept was first developed and then successfully experimented in Switzerland in the 1980s and 1990s with the aim to foster profitable energy savings in the industry and the commercial sector (EnAW 2017).

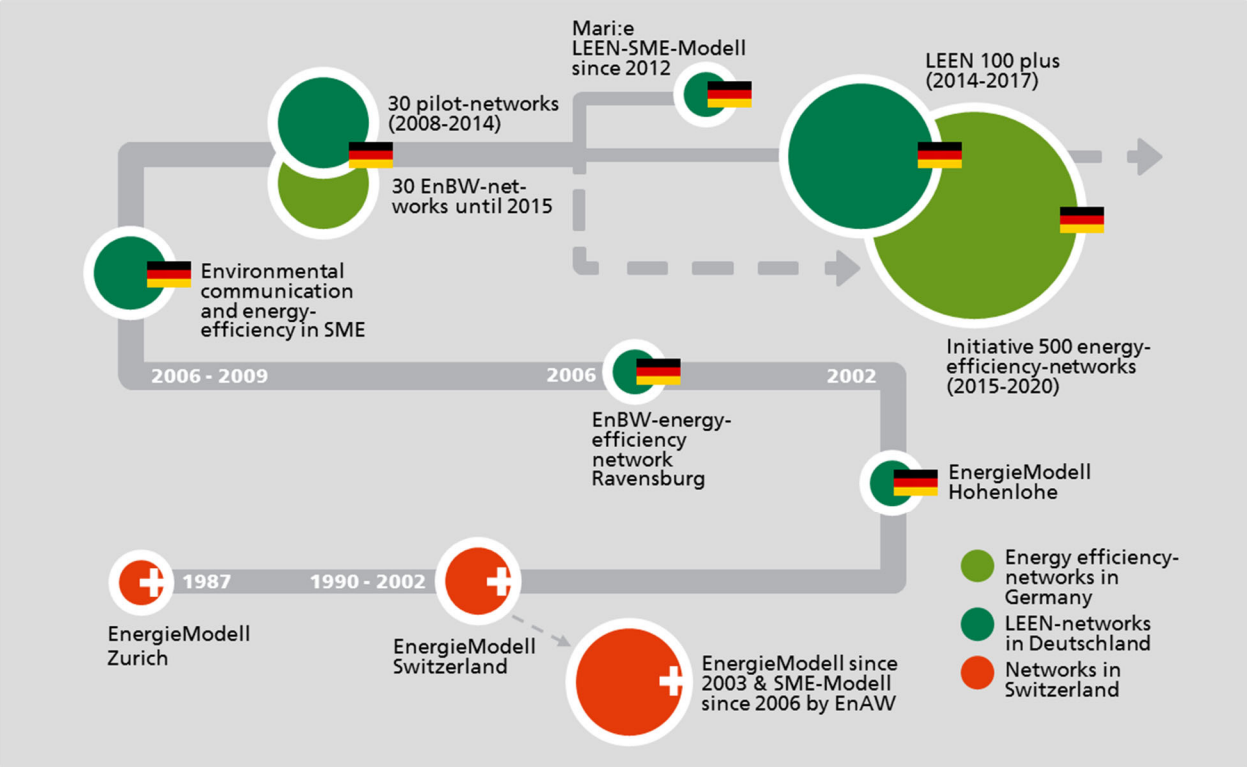

Figure 1. History of the EENs. *Source*: Fraunhofer ISI 2016.

In 2002, Fraunhofer ISI and the regional association "Modell Hohenlohe e.V." transferred the innovative concept from Switzerland to Germany and adapted it to the local context. Successive pilot projects – among them the 30 Pilot Networks project - led to the so-called Learning Energy Efficiency Networks (LEEN) (Jochem and Gruber 2007, Jochem et al. 2016). LEEN are groups of 10 to 15 participants, usually companies, but sometimes public institutions, which meet around four times a year over the course of three to four years, as agreed upon in a first contract. The approach was successfully demonstrated and documented in Germany for large participants (yearly energy costs > 1.1 Mio. $) as well as for smaller companies (yearly energy costs between 56,000 $ and 1.1 Mio. $). Network participants

[1] public institutions are basically also possible but not part of this paper

improved their energy efficiency faster than similar companies not involved in an EEN (e.g. Dütschke et al. 2016).

Based on these positive results, the Energy-Efficiency-Networks Initiative (IEEN) was launched in 2014 as a voluntary agreement between the German Government and 22 industrial associations and organizations. The aim of this initiative was to create 500 additional EENs by 2020 and to save 75 petajoules (PJ) of primary energy. This instrument became one of the pillars in the "National Action Plan on Energy Efficiency" (NAPE, see BMWi 2014a). The EEN concept has also gained a growing interest in Europe during the last 15 years as well as in other countries in the world such as China (Jochem et al. 2016 and IPEEC 2017).

How does an EEN typically work?

A so-called initiator starts the process of establishing an EEN. It can be a chamber of commerce, an energy agency, a utility, an industry association or even a company, which finds enough companies – typically between 8 and 15 – ready to participate in an EEN. After the participating companies have committed to being part of an EEN, the network officially starts. An EEN – following the LEEN standard – is operated according to the following steps (see also Figure 2):

- first, an initial energy review for each site (a confidential report and a list of measures) is carried out,
- based on these reviews, for each participant as well as for the group, a target on energy savings and CO_2 emission reduction is agreed upon,
- mutual exchange of experiences in regular meetings including site visits of the participating 8 to 15 companies of a region, forming the network, are organized (usually four times a year). In addition, workshops with focus on specific issues can be organized,
- the implementation of a successful energy management process leads to the increased implementation of energy audit recommendations by the participating companies,
- a monitoring (for each site confidential and for the network publicly communicated) is carried out every year.

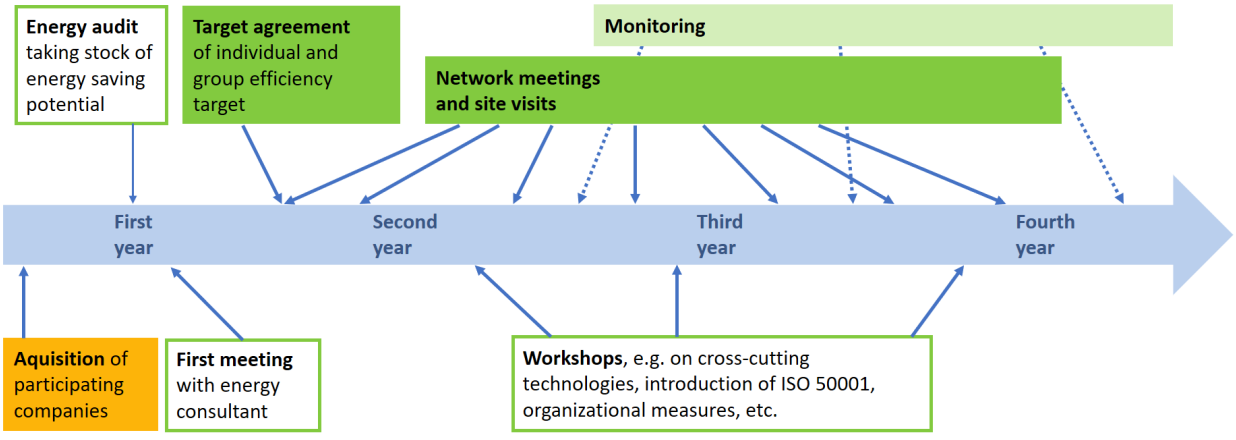

Figure 2. Typical implementation steps of an EEN. *Source*: Based on IPEEC 2017.

In addition to the initiator and participants of the network, three types of actors are required to run an EEN:

- The moderator, who organizes and moderates the meetings of the EEN. He makes sure the regular meetings are well prepared and organized.
- The energy consultant, who conducts the energy audits, provides technical support for the implementation of the energy efficiency measures and advises on the energy saving target.
- The network operator, who formally operates the network, makes sure each actor is doing his job and deals with the contractual issues with all actors, since the moderator and the energy consultants need to be paid.

Ideally, both the moderator and the energy consultant have been specifically trained to deal with EENs, as working with a group is different from that with individual companies.

The LEEN standard is only one EEN-model available on the market and is among several other EEN-approaches that have been implemented in Germany, most commonly:

- LEEN is the standard described above, which has been developed in the 30 Pilot Networks project.
- Mari:e has been developed from the LEEN standard to fit the needs of SME.
- Ökoprofit is a more holistic approach including other environmental impacts, but less formalized than the LEEN standard.
- The Reginee approach is comparable to the LEEN approach with a strong regional focus.
- The IEEN standard is defined by the minimum criteria of the Energy-Efficiency-Networks Initiative.

Table 1 provides an overview of the main differences among the EEN models as well as the requirements set by the AGEEN for the voluntary endorsement label for EENs (AGEEN 2016).

Table 1. Most common types of EENs

	LEEN	Mari:e	Ökoprofit-clubs	Reginee	IEEN	AGEEN Label
Minimum members required for an EEN	10	8	around 10	8	8 (at least 5 to start)	8 (max 16)
Initial contractual EEN lifetime in years	3	3	2	3-4	2-3	3
Energy savings / CO_2 targets	both	both	energy savings	both	energy savings	both
... for members or EEN	both	both	EEN	member	EEN	both
Obligatory monitoring	yearly	yearly	no	no	yes (at the end)	yearly
Type of the participants	larger companies	SMEs	SMEs	all	all	all

Source: Based on AGEEN 2016, AGEEN 2018 and GSIEEN 2018.

In Germany, any EEN (e.g. LEEN, Mari:e, REGINEE...) can be registered at the IEEN and contribute to it, as long as it fulfils the following minimum criteria (BMWi 2014b):

- founded after December 3rd, 2014,
- agrees to at least 2 years running time,
- has at least 5 participating companies or company sites in Germany,
- is supported by qualified moderators and internal or external energy consultants,
- defines a common energy saving target (at the latest one year after foundation), and
- participates in the monitoring process of the IEEN.

Further formats of networks have been developed, like the Resource and Energy Efficiency Network (REEF) (IPEEC 2017), which is not limited to energy efficiency topics but covers almost all environmental aspects including waste, resource etc. Independently of the EEN format, three main types of EEN can be distinguished according to the participating companies:

- regional EEN: the companies are geographically close to each other. This has a logistical advantage, since the companies have to meet regularly
- sector-internal EEN: the companies belong to the same economic sector
- company internal EEN: applicable to large companies, which have many sites

Throughout Europe, the experiences show, that most of the EENs are regional ones, since sector-internal EENs may raise some issues regarding the antitrust legislation or at least inhibit information exchange between participants, who are somehow direct market competitors.

Impacts of an EEN: The experience in Germany

In Germany, the 30 Pilot Networks project demonstrated very promising results and involved 330 companies in 28 Learning EENs (LEEN) (Fraunhofer ISI and LEEN GmbH 2014). On average, the energy audits identified 19 energy efficiency measures in each company (Rohde et al. 2015). Assuming an internal rate of return of 12% as a criterion for cost-efficiency, 10 of the 19 measures were considered as cost-efficient. Because some of the measures such as air leakage were highly cost-efficient, the above-mentioned 10 measures had an overall internal rate of return of 31%. Regarding the implementation: over the 4 years of operation time, companies achieved on average 2.3% per year in terms of energy savings and a reduction of 2.4% per year of their greenhouse gas (GHG) emissions (Durand et al. 2018). Large companies achieved a final energy saving of 2.67 gigawatt-hours per year (GWh/a) and a 940 tCO_{2eq} reduction.

Looking at experiences for the IEEN, a first monitoring has been carried out in March 2018, covering 253 companies from 21 EENs[2] (Barckhausen et al. 2018). For the monitored companies and EENs, the report showed on average that:

- 4.1 measures / participating company were implemented in order to increase the energy efficiency.
- 82% of the implemented measures were quantifiable, the remaining measures were mainly organizational ones.
- a typical EEN achieved savings accounting 11.9 GWh/a of final energy and 17.0 GWh/a of primary energy, corresponding to a reduction of 5.0 $ktCO_{2eq}$/a of emissions. The achieved results were on average 5% higher than the target set by the IEEN.[3]
- on the company level, the savings are 984 megawatt-hours per year (MWh/a) final energy, 1.41 GWh/a primary energy, avoiding 418 tCO_{2eq}/a.
- an EEN operates 27 months and has 12 companies. 78 % of the EENs are regional networks, only 22% are sectoral EENs.

Regarding the implementation, Figure 3 provides an overview of the implemented measures in final energy savings and number of measures according to the types of the measures. While lighting measures are the most frequent (27% of 859 measures), they only account for 6% of the energy savings achieved. In fact, 52% of the savings (99 GWh/a of 191 GWh/a) were achieved through four different measure types: cogeneration of heat and power (14%), process heat (13%), space heat & hot water (13%) followed by process engineering (12%). Although the operation time of EENs (27 months) was relatively short, the companies participating in an EEN did not limit their efforts to low hanging fruits but rather implemented more complex measures.

[2] from a total of 98 EENs at that time

[3] if the 500 targeted EENs are initiated, it is expected that the IEEN will slightly overreach the target set in the NAPE (75 PJ primary energy savings and 5 Mt CO_2)

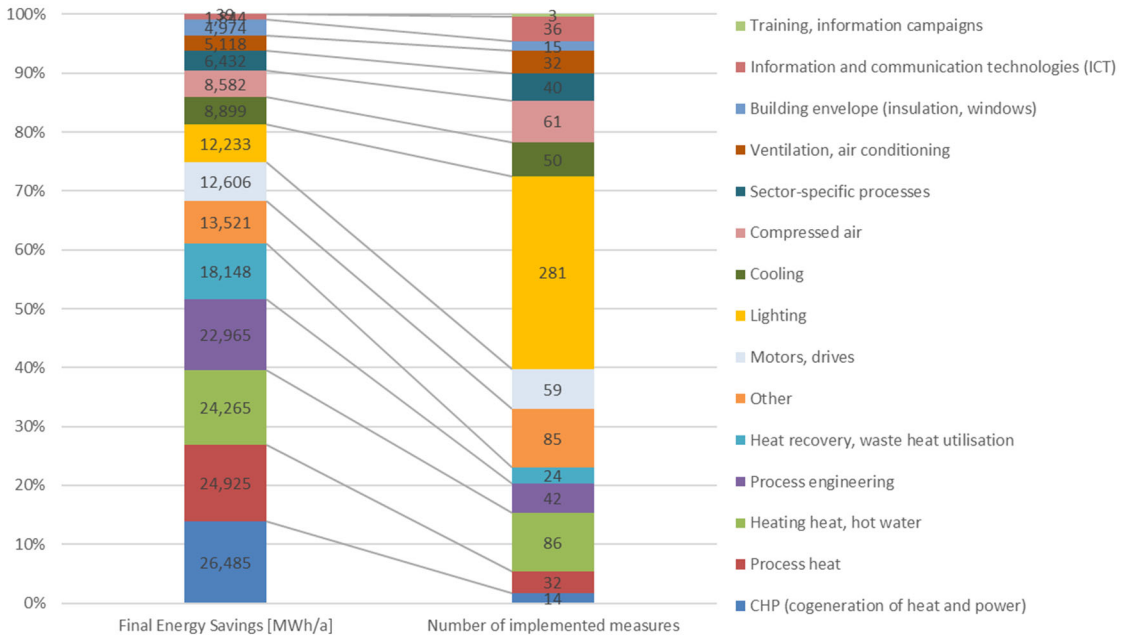

Figure 3. Implemented measures (n=859, n(not answered) = 6). *Source*: based on Barckhausen et al. 2018.

Implementation of the EENs in the world

Due to the success in Switzerland and Germany, the EEN approach underwent an expansion both within Europe and outside of Europe. In this section, a rough overview of the worldwide implementation of the EENs is provided. While in Germany the website of the IEEN (GSIEEN 2019a) provides a clear overview on the EENs implemented and registered at the IEEN, it is much more difficult to get precise information on the EENs rollout in the world. This is due to following factors:

- EENs are a soft instrument, for which there exists neither a clear definition nor an international standard, not even in Germany, where a draft for a guideline describing the operation of a learning EENs has been initiated.
- EENs can be categorized as capacity building instrument or as information instrument, making the tracking of EENs even more difficult.
- There is no website or database reporting EEN activities in the world or in specific regions of the world.[4]
- Due to the relative novelty of the EEN approach, many countries are in an early implementation phase. The rather "project based" approach of the EEN implementation leads to scattered data, which might be inaccessible shortly after the end of the project.

As an example, to illustrate the difficulty to gather precise figures: in the US and Canada, utilities have deployed Strategic Energy Management (SEM) Programs, which aim to support the

[4] like https://clasp.ngo/policies or https://www.worldenergy.org/data/energy-efficiency-policies-and-measures/ in the field of Standards and Labelling

implementation of ISO 50001 and of EE measures in companies. The first SEM was launched in 2009 (Burgess 2015) and in 2014, the Consortium for Energy Efficiency defined a standard for SEM (CEE 2014). However, only SEM with a cohort approach can be assimilated to the EEN concept even if there is usually only a saving goal on participant level and not for the whole cohort. After a first pilot project with North Western Energy in 2011, around 2/3 of the SEM program administrators in the US now use a cohort approach. In Canada, the concept has been experimented since 2015.

Fortunately, few actors actively promote the EEN concept and have produced very valuable reports, papers and presentations whose review made this rough assessment possible. These actors are namely of 3 types:

- Institutions in the field of international cooperation for sustainable development, like the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), EuropeAid or UNDP (United Nations Development Programme) or some ministries, which were involved in many initiating pilot projects.
- Companies with a strong experience in training moderators and technical experts for the work within an EEN. Such companies are very important to export and adapt the EEN concept to new countries and are accordingly best informed on worldwide activities.
- The International Partnership for Energy Efficiency Cooperation (IPEEC), which promotes collaboration on energy efficiency within the G20. IPEEC recognized the great potential of EENs and published a working paper (IPEEC 2017) dedicated to EENs and pushed the EENs on the agenda of the G20 (IPEEC 2015).

Table 2 presents an overview of the EENs in the world. The results are aggregated since EENs are usually launched within a program, varying from a pilot project to a national program. In the overview, EENs are ranked by continent and then by country. The type of EEN is specified: LEEN, Ökoprofit, REEF or other, when not clear or mixed. Also, the progress status of the network or program has been considered. There are three possible statuses:

- "in the pipeline" for programs that are currently in the concrete planning phase (e.g. first participants have already been identified). Programs, which were only in discussion phase, were not presented in this paper.
- "implementation" means that EENs have been initiated and are currently in operation.
- "completed" for programs or EENs which have obviously completed all activities.

When either the number of participating companies or the number of EENs in a program was reported, a ratio of 10 companies per EEN was considered. In Germany, double counting may have occurred, since any EEN can be registered at the IEEN if it fulfills the IEEN criteria and applies to the IEEN.

Table 2. Aggregated overview of EENs in the world

Continent	Country	LEEN	Ökoprofit	REEF	Other EEN	Phase	Start	Diffusion	No. of EENs (estimated)	No. of companies (estimated)
Africa	Nigeria	X				Implementation	2017	Pilot Project	1	10
Africa	Nigeria	X				In the pipeline	2017	Pilot Project	4	40
Africa	South Africa	X				Completed	2011	Pilot Project	1	10
Africa	South Africa	X				Completed	2014	Pilot Project	1	10
Asia	China		X			Completed	2004	Pilot Project	1	10
Asia	China		X			Completed	2004	Pilot Project	1	10
Asia	China		X			Completed	2011	National Program	500	5,000
Asia	India		X			Completed	2002	Pilot Project	1	10
Asia	India		X			Completed	2003	Pilot Project	1	10
Asia	India			X		Completed	2008	Pilot Project	1	10
Asia	India			X		Completed	2008	Pilot Project	1	10
Asia	Jordan	X				In the pipeline	2019	Pilot Project	2	20
Asia	Vietnam	X				Implementation	2017	Pilot Project	1	8
Europe	Austria	X				Implementation	1991	Pilot Project	6	60
Europe	Belgium	X				Implementation	2014	Pilot Project	1	10
Europe	Germany		X			Implementation	1998	Large Program	100	1,000
Europe	Germany		X			Completed	2002	Pilot Project	5	50
Europe	Germany	X				Completed	2008	Pilot Project	30	300
Europe	Germany	X				Implementation	2014	Large Program	40	400
Europe	Germany				X	Implementation	2014	National Program	228	2,280
Europe	Romania				X	In the pipeline	2019	Pilot Project	1	10
Europe	Sweden				X	Completed	2005	Pilot Project	6	52
Europe	Sweden				X	Implementation	2005	National Program	10	100
Europe	Sweden				X	Completed	2010	Pilot Project	4	33
Europe	Sweden				X	Completed	2011	Pilot Project	6	57
Europe	Sweden				X	Implementation	2015	National Program	38	320
Europe	Switzerland				X	Completed	1987	Pilot Project	1	10
Europe	Switzerland				X	Completed	2000	National Program	80	800
Europe	Switzerland				X	Implementation	2016	National Program	102	3,800
Europe	Ukraine	X				In the pipeline	2018	Pilot Project	3	30
North America	Canada				X	Implementation	2015	Pilot Project	8	80
North America	Mexico				X	Implementation	2015	National Program	15	120
North America	United States				X	Implementation	2011	Large Program	88	880
South America	Argentina	X				Implementation	2018	Pilot Project	1	10
South America	Brazil		X			Completed	1996	Pilot Project	2	20

Continent	Country	LEEN	Ökoprofit	REEF	Other EEN	Phase	Start	Diffusion	No. of EENs (estimated)	No. of companies (estimated)
South America	Brazil		X	X		Completed	2010	Pilot Project	1	10
South America	Brazil		X	X		Completed	2012	Pilot Project	1	10
South America	El Salvador				X	Implementation	2018	Pilot Project	1	10
South America	Nicaragua				X	Implementation	2018	Pilot Project	1	10
Total (worldwide)									1,295	15,620

Source: Based on Arqum 2011, Arqum 2016, Backman 2018, GIZ 2017, GSIEEN 2019a, IPEEC 2017, Ivner et al. 2014, LEEN 2019, Strömvall, 2018, Yu 2015 and interview with J. Burgess for US and Canada.

According to Table 2, an overall number of approximately 1,295 EENs or 15,620 participating companies have been estimated. With the exception of Australia, all continents have experienced the EEN concept in one way or another. Figure 4 presents the global coverage of the EENs.

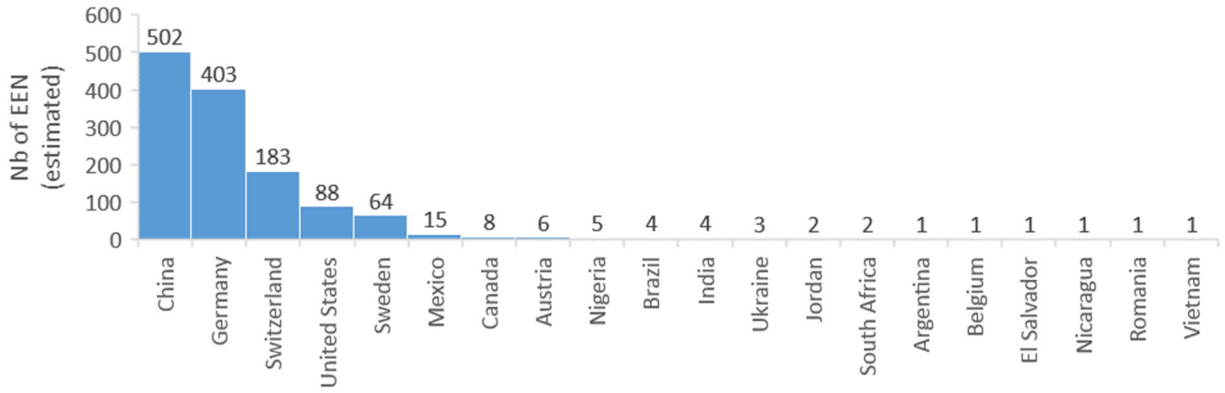

Figure 4. Estimated number of EENs in each country.
Source: Based on Arqum 2011, Arqum 2016, Backman 2018, GIZ 2017, GSIEENs 2019a, IPEEC 2017, Ivner et al. 2014, LEEN 2019, Strömvall, 2018, Yu 2015 and interview with J. Burgess for US and Canada.

Switzerland and Germany report a high number of EENs and account together for 45% of the EENs in the world. This is not a surprise, since both countries have a long EEN tradition and have national programs aiming at the nationwide implementation of EENs: Switzerland exempts EEN participants from a fossil tax (EnAW 2016) and the German Government has signed a voluntary agreement with 22 industry associations (BMWi 2014a). However, the highest number of EENs was recorded in China, where over 500 EENs (39% of the EENs in the world) were initiated in three economic regions: Changzhou, Chengdu and Kunshan. The initiator was the State Grid Corporation of China (SGCC), which considers the EENs as an effective instrument for Demand Side Management (IPEEC 2017).

The EEN concept has been implemented in more than 20 countries so far, however, 15 countries account together only for 5% of the total EENs and the reasons for the low implementation are diverse. In the early 2000s, India experimented the EEN concept in a few pilots supported by international donors, and Brazil followed a similar path, but the two countries did not go beyond the pilot project phase. Nevertheless, the more interesting observation is the recent launch of pilot projects in many new countries and often with the support of the German Technical Cooperation (GIZ) itself. It is still too early to know, how sustainable the approaches are, but – as in China – the key issue will be the adaptation of the EEN concept to the local context as well as the choice and motivation of the local partners, who are in charge to generate the EENs. In China, where GIZ supported the first EEN activities, the role of the SGCC was determinant to assure a wide and fast rollout of the concept.

Added value of the EEN approach

The main evaluations of the EENs have been carried out in Europe and more particularly in Germany with the 30 Pilot Networks project, the LEEN100 project and the IEEN. They provided interesting and similar results on the medium- and long-term impacts of EENs and highlighted the added value of working in a network. According to 87 companies, that participated in a survey on the LEEN100 project in 2018 (Chassein et al. 2018), 45% of the companies agreed, that "some of the implemented efficiency measures would not have been implemented without participation in the network", 77% stated that "suggestions from the EEN were implemented in measures", and 55% that "a common target of the network is an important incentive to implement energy efficiency measures". Based on these results, it is clear that the participation in an EEN generates numerous benefits such as innovation and motivation of the participants to implement measures. 96% of the companies declared they particularly appreciated the "exchange of experience among colleagues", 75% the "site inspection at the meeting". Both are factors, that increase the confidence and the interest of the energy managers and that are not covered by basic training and certification in the field of energy management system (like ISO 50001). Therefore, the EEN approach is not limited to the "simple" implementation of an Energy Management System in a company, it pushes the company further.

Furthermore, setting a target in terms of energy savings on EEN level is an important feature, which can in addition be used by the EEN for public communication. According to the final evaluation of the LEEN100 project (Fraunhofer ISI and Streks 2019):

- 75% of the companies supported fully or partly the statement, that "through the common goal, [our] company has set itself a more ambitious goal than would have been the case without the network".
- more than 55% declared that "a common goal of the network is an important incentive to implement energy efficiency measures."

The evaluations regularly conducted by the IEEN among its participants show similar results (GSIEEN 2019b): in 2018, 97% of the participating companies appreciated the exchange of experiences and 90% the site visits.

In terms of satisfaction, a large majority of the participating companies recommend the EEN concept. According to the 2016 survey (GSIEEN 2017), 73% of the participants were very satisfied or exceptionally satisfied with the EEN in addition to 21% of satisfied companies. 83%

of the companies rated the cost-benefit of their EEN participation as good or very good. This explains why 57% of the companies would most likely recommend other companies to participate in an EEN, 38% would probably recommend it in addition.

Framework conditions and key factors for a large and successful promotion of the EENs

The previous sections have shown the golden side of the EENs: the operation phase, that takes place after enough companies have decided to join a network and exchange knowledge and implement measures. Companies participating in an EEN are generally very satisfied with the EEN approach and decide to extend the network's operation time (Durand et al. 2018).

The other side and bottleneck of the EEN approach is the acquisition phase, especially in countries where there are no strong incentives for a company to participate in an EEN. In Germany, the large pilot project LEEN and the IEEN, which results from a voluntary agreement between the German government and industrial associations, report similar figures: on average, 4 working days are necessary to persuade a company to join an EEN. Apart from the fact that energy efficiency might generally not be the highest priority on the agenda of companies, the high effort might be due to following factors:

- The EEN concept is still relatively unknown. The newest survey of the IEEN (GSIEEN 2019b) showed that greater awareness and more publicity are needed and expected by EEN initiators.
- Companies or energy managers may underestimate the benefits of the concept, before they have experimented it. However, according to evaluations, the cost-benefit ratio was in fact estimated as good or very good for 83% of the participating companies (GSIEEN 2016).

So far, the performance[5] of EENs in the IEEN is higher than assumed at the time of the launch of the initiative, still, it is uncertain, whether the number of created EENs will be as high as expected to deliver the expected contribution of this instrument to the NAPE.

Since a company must generally – at least in Germany – commit to an EEN for 2 to 4 years before joining it, this minimum commitment period is probably an obstacle to the decision to join. In order to eliminate the essentially psychological barriers that prevent a company from joining an EEN, some ideas are currently being developed, such as a reduction of the minimum commitment period, or a commitment only after 1 year of having joined the EEN or even the possibility of trying an EEN before committing to one. Some actors are also experimenting an approach whereby an EEN can accept new participants over time and when the maximum number (around 16) is reached, it is then divided into two networks of 8 companies.

However, the experience shows, that the stronger the local framework is, the easier the acquisition of new companies becomes. In Switzerland, the exoneration of the CO_2 surcharge on fossil fuels for companies involved in a network was a very effective way to increase the number of EENs and to achieve large energy savings. In China, the companies in the three implementation regions had strong incentives to participate in an EEN. In the US, good customer relationships and incentives (e.g. for each saved kWh) enable utilities to attract participants to SEM programs.

[5] in terms of energy savings

Probably, the combination of both approaches would deliver the best results in terms of generating new EENs. Yet, the implementation and the operation phase can only be successful if the actors – moderators and energy auditors – are well trained in order to provide a required support to the companies.

Conclusion

Companies participating in an EEN learn from each other and share a kind of collective emulation for implementation of energy efficiency measures. Consequently, the EEN approach can be considered as a fantastic catalyst to motivate companies to implement energy efficiency measures as well as an energy management system. The EEN concept is still poorly known and understood, even in a country such as Germany, which has an extensive EEN experience. EEN – as an instrument – is still in development at two levels: at the operational level, it needs to be adapted to the local context, when new countries experiment it. At the macro level: programs fostering a wide implementation of EENs are rather rare in the world. Nevertheless, two main tendencies can be observed: a fully voluntary approach as seen in Germany whose strategy is a voluntary agreement with industrial associations, or a more engaged approach as seen in Switzerland or China, where the participation in an EEN brings clear additional benefits to the companies or at least exempts them from taxes or other disadvantages. The fact that these three countries have initiated almost 85% of the estimated 1,295 EENs worldwide and have obtained great energy savings for the EENs shows the success of these strategies. In North America, there is no national program, but utilities have rather similar SEM program design elements, which include different types of incentives (Ochsner et al. 2015).

The EEN approach has extended itself and is currently undergoing a phase of expansion and internationalization. Over the past two years, seven countries (Argentina, El Salvador, Jordan, Nigeria, Romania, Ukraine and Vietnam) have decided to start or have already started the EEN implementation, most of them with support of the German expertise. One of the main challenges in each country will be to transform a successful pilot project into a program that promotes a large deployment of EENs. The key issues will be the adaptation of the EEN concept to each local context, to find the right actors aiming to mobilize companies, and the way to promote EENs. In addition, the training of moderators and energy experts conducting the energy audits is important to ensure that an EEN will be operated for the benefits and satisfaction of its participants.

Since the EEN instrument is still being developed and has not yet reached its full potential, it would be interesting to increase the exchange of experiences over the world on how this instrument was implemented and to better monitor the number of EENs and participating companies and, of course, the impacts in terms of energy savings and costs. At national level, some initiatives exist, like the EEN Working Group in Germany (Arbeitsgemeinschaft der Energieeffizienz-Netzwerke Deutschland – AGEEN), but nothing comparable exists at the regional or international level, although IPEEC has done a great work to disseminate knowledge on the EENs within the G20 and to put the instrument on the agenda.

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