LEEN* CONCEPT:

DRIVING FORCE OF SUSTAINABLE COUNTRY DEVELOPMENT

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ABSTRACT:

Energy Efficiency has been described as the EU's biggest energy resource and one of the most cost effective ways to enhance the security of its energy supply and decrease the emissions of greenhouse gases and other pollutants. Regarding future benefits of it, based on the data that for every 1% improvement in energy efficiency - EU gas imports fall by 2.6%, European Governments treats energy efficiency as a main driving force of strategic development. This impressive fuel of the future will create different business opportunities for European companies such as construction firms and manufacturers of energy-using equipment, and create new jobs in construction, manufacturing, research, and other industries investing in energy efficiency. But actually reality shows, that the activities in energy efficiency are still quite low, compared to what is going on in the renewables sector. Learning Energy Efficiency Networks (LEEN) could be a way to increase energy efficiency, which we need on the local level for the municipalities, small and medium companies, and public utilities. Results from networks in Switzerland, Germany and Austria show that companies and cities using LEEN concept doubled their yearly progress in energy efficiency compared to the industry average. Hence, it can be assumed that high-quality energy-audits compared with a guided mutual exchange of experience by energy managers of medium sized companies or municipalities can be considered as a new and effective policy instrument. LEEN concept can be defined as alchemy of the sustainable, strategic development of the Western Balkans region. This article is devoted to the new understanding how to realize most effectively energy efficiency or renewable energy potentials intensifying the activities of regional actors in the Western Balkans countries.

KEY WORDS:

Energy efficiency, Learning Energy Efficiency Networks strategic positioning, Western Balkans region

*LEEN: Learning Energy Efficiency Networks

Potentials of energy efficiency in Serbia and Germany in industry, trade, and services

The German industry uses around 2,600 PJ final energy each year. Final energy intensity, the relation between final energy demand and gross value added, had been quite successfully reduced in the 1990s, however very little improvement was achieved between 2000 and 2013. In order to achieve the energy efficiency target, specified by the German Federal Government – doubling the energy efficiency between 1990 and 2020 – energy intensity of the German industry has to be improved by 2.3 % annually between 2014 and 2020. This is a tremendous challenge, but not impossible.

Many national and international studies outline the existence of large energy efficiency potentials in the industrial sector (Eichhammer et al. 2009; Fleiter et al. 2013). Own empirical analyses from 366 energy audit reports came to the conclusion that more than 3,000 profitable energy efficiency investments with an average internal rate of return of 31% would reduce the companies' final energy demand by around 10% within four years. The internal rate of return varied from 12 % (minimum rate) to more than 100% in many cases. Obviously, the situation observed by Romm (1999) 20 years ago did not change: "Consulting engineers usually return from on-site visits in companies with substantial energy efficiency potentials that are easy to realize and usually have high rates of internal return".

The present knowledge about the profitable energy efficiency potential of the German industry, trade and service sector that could be realized between 2015 and 2020 is some 400 PJ. It would reduce energy cost of the two sectors by 9 Billion € in 2020 (-10%) reduce the CO_2 emissions by about 35 Mill. tones and would generate additional 40,000 jobs (net) mostly in the investment goods industry and the installers sector for installing and maintenance.

On the other side, Republic of Serbia is preparing a new strategy of energy policy for 2015-2025/2030. Regarding the EU Progress Report 2014 and its Energy Community obligations, Serbia has taken on the target of achieving 27 % of its energy demand from renewable sources in 2020. In the area of energy efficiency, the second action plan for energy efficiency, for 2013-2015, was adopted in October 2013. The Energy Efficiency Fund established by the Law on energy efficiency became operational in January 2014. Administrative capacity in this area needs to be strengthened.

Regarding the actual situation and energy efficiency indicators in Serbia, the country has an primary energy intensity of 5,257 kWh/€ (2005), the ratio between primary energy and GNP, related to GNP at purchase power parity of 2.593 kWh/€ (2005). The primary energy consumption per capita in Serbia is 36.5 MWh/capita, and in Germany 45.7 MWh in 2014. The experience of the EU member countries, especially Germany, shows that if one aims to realise significant increases in energy efficiency strong governmental support but also initiative by companies is essential. In the mentioned new strategy for energy, the Serbian government said that it will take the public sector as a main example of accelerating energy efficiency by means of policy measures.

Two prority activities in the strategy are (1) energy modernization of construction sector in buildings, and (2) the introduction of an energy management system in the public sector. Because, in Serbia and Western Balkan region, energy efficiency is oriented to energy consumption, and, it is not easily achievable because there are various stakeholders, i.e., participants at the energy efficiency market are different. They should be encouraged to accept energy efficiency as a way of doing business and finally, as a way of living. This requires a change in a way people think. For both priority activities and mentioned challenges, the LEEN methodology provides enough elements which makes it to a powerful driver to accelarate energy efficiency in industry and the service sector in any country.

Obstacles and unused supporting factors

The limited realization of profitable energy efficiency potentials in industry and the service sector has been the subject of discussions about obstacles and market imperfections for more than two decades now (IPCC 2002), and the heterogeneity of these obstacles and potentials has been tackled by sets of several policy measures and instruments (Levine et al. 1995, DeCanio 1998).

Surveys and interviews show that often the attention given to energy efficiency investments in companies is very low and heavily influenced by the priorities of those responsible for the company or the production site (Rahmesohl 2000, DeGroot 2002, Schmid 2004). The reasons for this low attention to energy efficient solution are many depending on factors such as the size of the company, its energy intensity, the ownership, and the consciousness and leadership of the management. Classical obstacles are (see also Jochem et al 2014):

- lack of knowledge and sufficient market survey of energy managers, particularly in SMCs, but also of consulting engineers, architects, installers, or bankers;
- in order to overcome these lacking knowledge, high transaction costs of the energy manager (for searching solutions, tendering, decision making, installation; (Ostertag 2002)) and high cost for professional training for the other groups of actors are perceived;
- lack of own capital, fear of lending more capital for investments of off-sites or relying on the competence of a contracting company; energy efficiency investments are generally not considered as being a strategic investment (Coremans 2011)
- technology producers or whole sale often pursue their own interests opposing the possible innovation steps of efficient solutions;
- 80% of companies using only risk measures (payback periods), but not profitability indicators (e.g. internal interest rate, present net value) for their decisions.

Beside economic reasons for this priority setting of companies there are also psychosocial, motivational, and behavioral aspects, which have scarcely been analyzed except by some sociologists and psychologists in the 1990s (e. g. Stern 1992, Jochem et al. 2000, Flury-Kleubler et al. 2001). The authors call them “scarcely used supporting factors”:

- Traditional investment priorities steer the motivation and behavior of the staff and determine the career of the young engineers and their efforts; energy engineers often have difficulties to "make a convincing case" to the management (Schmid 2004).
- The co-benefits of energy-efficient new technologies are rarely identified and not included in the profitability calculations by the energy or process engineers due to the lack of a systemic view of the whole production site and possible changes related to the efficiency investments (Madlener/Jochem 2004).
- Management is often not aware that the workforce may suffer from criticisms made by friends or relatives that they are working in a "polluting" or wasteful industrial site.

Social relations such as competitive behavior, mutual estimation and acceptance not only play a role between enterprises, but also internally within a company. Efforts to improve energy efficiency are influenced by the intrinsic motivation of companies' actors and decision makers, the interaction between those responsible for energy and the management, the internal stimuli of key actors and their prestige and persuasive power (InterSEE 1998, Schmid 2004).

The complexity of obstacles to and the scarcely used supporting factors of energy efficient solutions in companies demand for a bundle of policy instruments which is rarely known and considered by policy makers in administration or the management in industrial associations or companies. However, a Swiss consulting engineer, Thomas Bürki, "invented" an activity with eight companies in Zürich: the EnergyModel of Zürich in 1987 (Bürki 1999, Graf 1996): After an energy audit for each participant, the energy managers of the companies met four times a year exchanging their experience on their energy efficiency investments and organizational measures in a structured manner – one topic, well prepared, eventually with one presentation of an external expert, moderated by an professional moderator. The performance of each company is monitored at least once a year.

The results of this first energy efficiency network were so convincing that the Federal Office of Energy of the Swiss Government funded this new idea in several pilot networks as EnergyModel Switzerland for industry and the service sector. The average annual energy cost savings were 165,000 CHF per company. The very positive results of speeding up the progress of energy efficiency in companies participating in those networks were confirmed (Kristof et al. 1999, Konersmann 2002).

A few years later, companies which reduce energy-related CO_2 emissions by a negotiated target and accept a yearly evaluation can be exempted from a surcharge on fossil fuels. This was first introduced at a level of 12.- CHF per ton of CO_2 in 2008, it will be 72.- CFH in 2016 approved by the Swiss Parliament in line with the Swiss CO_2 law. The Swiss Energy Agency for Industry, EnAW, is acting as an intermediary to negotiate target agreements on CO_2 reduction between companies and the Federal Government. The target agreements are mostly based on energy efficiency improvements over a given period of time, e. g. four years, or substitution options for fossil fuels such as indus-

trial organic wastes, renewables, or electricity (which is almost CO_2 free due to 60 % hydro power and 35 % nuclear power generation in Switzerland).

The Concept of the Learning Energy Efficiency Networks, LEEN

The generation and operation of energy efficiency networks is usually considered in three major phases of activity you can see in the Figure 1.

1. *Acquisition of the network*: the initiator, who may be represented by the president of the regional Chamber of Commerce or industrial association, the major of a larger city, or the CEO of an utility, motivates regional companies to join the planned network. The network operator supports this activity and considers the question who should take up the role of the consulting engineer and the moderator in the planned network. This phase is the crucial challenge. If a network is started, experience and evaluations show that all participants remain quite satisfied with the gains they take from the exchange of experiences and the network's service.
2. *Energy audit and targets*: In Phase 1, every participant receives an energy audit by an experienced engineer who also suggests and mid-term efficiency target for each participant (confidential) and a joint target as a commitment publically communicated. The energy audit has to be performed according to a detailed scheme of identifying energy efficiency potentials and their economic evaluation in all areas of cross cutting technologies and organizational measures. The entire process including the report is in compliance with ISO 50,001.

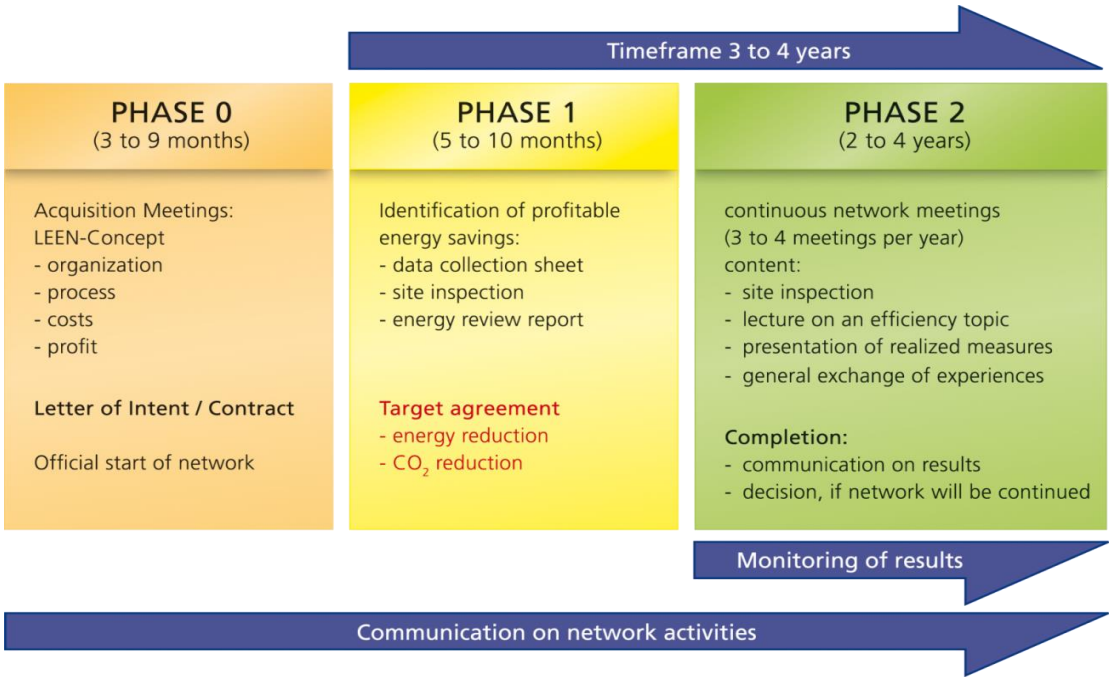

Figure 1: Three phases of generating and operating an energy efficiency network

3. *Regular meetings and yearly monitoring*: In Phase 2, the essential cornerstone of a network's success is built upon the regular meetings during at least three to four years inducing the exchange of experiences not only during the four meetings per day, but also bi-laterally when an energy manager is consulting his colleague in specific cases of investments and planning. The meeting well prepared by the modera-

tor generally covers one topic of an energy efficient solution which may also be covered by a presentation of an invited external expert, fooled by a deep discussion. Each meeting also includes an onsite visit of the inviting participant. Continuous monitoring of the measures that have been implemented permits the tracking of reduced energy cost and its contribution to higher profits. At the level of the network, the consulting engineer can also report on the network's progress of energy efficiency or CO_2 mitigation keeping track of the mid-term target the network had decided upon in the phase 1.

The concept of the Learning Energy Efficiency Network was based upon the Swiss Energy Model. However, from the beginning in the first German network, two differences were added to the Swiss concept.

- A professional moderator prepares and moderates the regular meetings and writes the minutes; so he is not technically biased as the consulting engineer could be, but he is specialized to calm down to extroverted participants and to invite the introverted participants to report on their experiences. The moderator may also moderate the yearly meeting when the report of the monitoring is discussed with the board or management of the company.

- The medium term network target for efficiency progress and CO_2 mitigation was introduced to use it internally for generating a team spirit and an atmosphere of sportive competition among the energy managers and to use it externally for public relations of the participating companies and the network being engaged in climate protection and resource efficiency.

The major components of the underlying theoretical concepts for the local learning networks can be summarized as follows:

- The heuristic approach of *innovation systems* is used to demonstrate the network of actors who are involved in bringing about an innovation (Kuhlmann 2001). An investment in new energy-efficient technologies does not come about due to a decision of the management of a company, but is the result of an complex interplay between many actors who may have different weights in influencing a decision in a particular case: consultants, equipment suppliers, installers, architects, outside maintenance staff, key accountant of energy suppliers or the cooperating bank, investment decisions of competitors or of management colleagues in the region.
- One element of the concept follows the *dynamics of a product or investment cycle,* applying them in two dimensions: (1) new and reliable efficiency technologies just being introduced to the market are presented on the initiative of the senior engineer and (2) changes to the production and product quality at the production site caused by the efficiency investment are analyzed in order to identify risks and co-benefits which are often neglected in energy efficiency investment considerations.
- The concept also considers aspects of innovation research, i. e. the concept of first movers, followers, and late applicants with the competences and motivations of those types of companies and their management, as well as the size of the company and its potential to engage specialists in the field of efficient energy use as internal staff or external consultants.

- Finally, the concept also integrates approaches of social and individual psychology: social dynamics such as mutual affirmation and acknowledgement within a company and among energy managers of several companies or administrations, social cohesion, responsibility and sanctions once a common target has been agreed upon, low competitive behavior in acquainted groups as well as individual behavior such as the motivation of professional careers, the motivation of experts to share their knowledge with colleagues often working in small and medium-sized companies, or the motivation of management with regard to achieving a good acceptance of the company at its production location (Schmid 2004, Flury-Kleubler et al. 2001).

The particular form of the energy efficiency network, called the Learning Energy Efficiency Network (LEEN) was developed in Germany between 2002 and 2014. The LEEN management system has now more than 100 useful elements to support the network operator, the consulting engineer, and the moderator, but also initiators or multiplicators such as trade associations, chambers of commerce, or business developers. These elements may be recommendations how to approach and acquire potential participants, or on the agenda of an first informational event, the description and division of tasks for the network operator, the consulting engineer, or the moderator, master contracts for all actors, including the participating companies, recommended reporting for energy audits and yearly monitoring, training material for consulting engineers and moderators, and many other assisting material including 20 calculation tools for the technical and economic evaluation of energy efficiency options of cross cutting technologies such as boilers, compressors, electrical motors, or pumps.

The achievements of LEEN-Networks in Germany from the perspective of participating companies

The 366 companies participating in 30 pilot energy efficiency networks between 2009 and 2014 have been evaluated by several analyses including the results of their energy audits, the yearly monitoring as well as questionnaires at the beginning and the end of the four years' first operating phase you can see in the Figure 2.

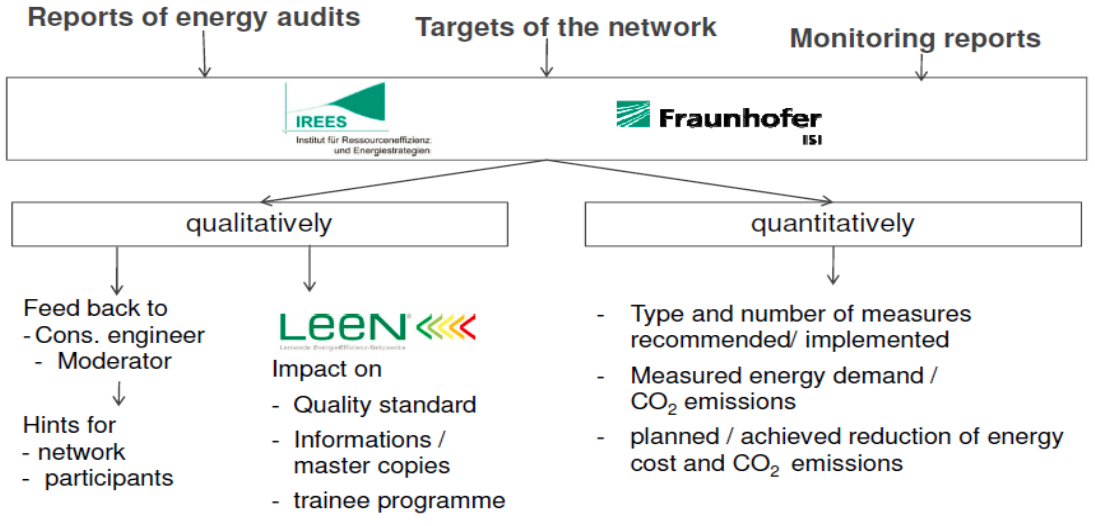

Figure 2: Evaluations of the performance of 30 pilot energy efficiency networks with 366 companies

The participating companies were asked about their past involvement in energy efficiency and their expectations at the beginning of the network and their judgment about the performance of the network and their gains from it at the end of the four years period. The systemic nature of the energy efficiency networks contributes to the fact, that many obstacles of energy efficiency mentioned in section 2 get reduced, and that often unused supporting factors (such as motivation, acknowledgement, or self-responsibility) are applied during the meetings and site visits or in the meetings the board or management discussing the results of the yearly monitoring.

On average, the efficiency progress doubled compared to the average the non-participants of the branch resulting in an efficiency increase of 2.1 % per year. The average savings per participant (with yearly energy cost of around 2 Mill €) were 180,000 €/a inducing investments of almost 600,000 € during the four years period. Of course, the average figures do not reflect specific situations of companies, of branches, and status of efficiency at the beginning of a network or the engagement of the participating company during the four year period of the network's operation. Two networks improved their efficiency by less than one percent per year, but two networks improved by more than four percent per year, 14 networks between 1 and 2 % and 10 between 2 an 3 % annually.

The investments in the additional energy efficiency achieved also substantially varied depending on the type of investment (e.g. economizer of a boiler, heat exchanger added to an air compressor, high efficiency motors instead of a normal motor, pumps or ventilators) and its size depending on energy services or energy demand in the production site or the building or factory (see Table 1). About 80 % of all net investments were below 50,000 €. However, one has to consider the basic re-investment which usually goes with the net efficiency investments such as a new boiler, a new air compressor, a new normal pump, ventilator or normal efficient electrical motor. The value of this basic re-investment is several times as high as the net energy efficiency investment, but not reported here. This is important from the aspect of financing those investments by third parties like contractors or banks.

Table 1: Distribution of net energy efficiency investments

Range of net investments in Euro	Number of net investments	Share of total net investments %
< 5,000	1,387	39.8
5,000 to 50,000	1,511	40.4
50,000 to 250,000	474	13.6
250,000 to 1 Mill.	96	2.8
> 1 Mill.	17	0.5

Given the impressive success of the LEEN networks in the industrial sector, the German Federal Government decided in 2014 to set up a funding scheme for energy efficiency

networks for cities and counties between 20,000 and 200,000 inhabitants (BAFA 2014). The concept for this target group was based on the LEEN management system for companies and was adapted to the situation of public bodies and more building-focused technical topics. The funding conditions requested the applicants to respect the rules of the communal energy efficiency networks.

The grant scheme was unexpectedly fast accepted: by the end of August 2015, more than 35 communal networks are being acquired to convince the necessary eight communes or cities forming an energy efficiency network. Five networks are already operating and further five networks started in September.

Transferring the LEEN-networks to Serbia, first steps, and the prospects

During the past five years of active communication with the different stakeholders in Serbia, a team of experts of the center Teslianum concluded that, if the Government wants to achieve defined goals and targets in the Strategy of Energy of Republic of Serbia 2015-2025/2030, the country needs an integral methodology securing enough interrelations and interconnections between governmental bodies, big companies, SMEs, faculties and local municipalities.

According to the analyses of the different concepts, methodologies and programmes for improving energy efficiency, the experts found that the LEEN managements system is an excellent and appropriate concept for the Serbian three main target groups:

- *Local municipalities:* during the next two years, the Serbian Government plans to establish energy managers in 100 cities with more than 20.000 habitants who will assist the local administration with energy balance sheet defining and data collection,
- *Big public and private companies:* which have to be modernized and restructured in Serbia according to the EU standards and directives,
- *SMEs:* they are recognized as a main engine of the country's sustainable development.

The main problem for the correct strategy realisation is the absence of a system structure in Serbia through which different stakeholders can *communicate, coordinate and cooperate*. This 3C rule is absolutely in accordance with the operational concept of LEEN.

The LEEN management system with its large experience and development of more than ten years in companies, communal administrations and training activities is the only one estimated from different stakeholders in Serbia as an integral tool well suited to help them to establish a so necessarily needed balance of motivation, education, and information between top management and employees, especially within technical teams. Formal education on the Serbian and West Balkan universities is not sufficient to prepare neither the engineers neither the managers for the adoption of the new modern

standards, technical, technological and know-how expertise, such as EUD2012/27/EU about energy efficiency or ISO 50,001.

The multiple benefits of energy efficiency approach defined by the International Energy Agency (IEA) reveals a broad range of potential positive impacts on the economy, society, and the environment of a country (see Figure 3).

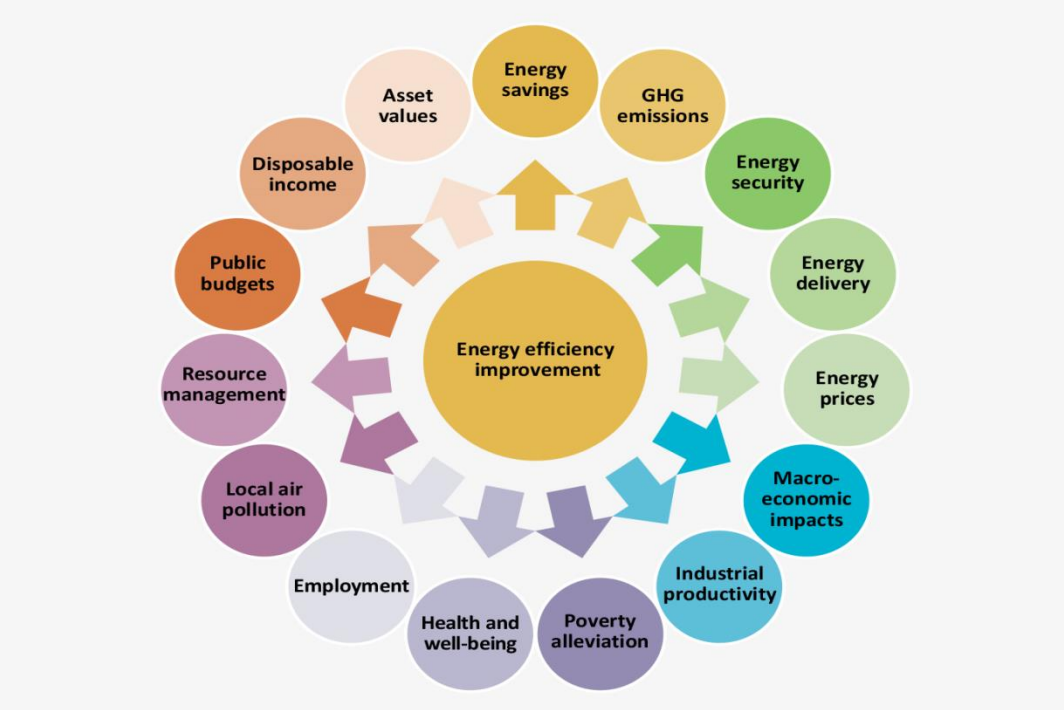

Figure 3: The multiple benefits of energy efficiency improvements-Source: IEA 2014

An IEA (2014) analysis concluded that energy efficiency has the potential to support economic growth while reducing energy demand, as large imports of energy is substituted by domestically produced investment goods and services. The induced economic growth enhances social development, speeds up environmental and climate protection, supports tendencies of sustainability, and ensures a secure energy system of a country.

The LEEN methodology concretises elements that support companies and cities to help the country to obtain remarkable economic development. Increasing the share of renewable energies as an additional element to energy efficiency is also regarded as a major technical element of the LEEN management system.

For a country such as Serbia and others in the Western Balkan region, after more than twenty years of continues weak development and with the strong dependency from energy policy of other countries, a methodology like LEEN can be the right choice to increase the employment of young people, to reduce rural and city migration, to strengthen and enrich the basic education system, and stabilise economic and energetic dependence from foreign countries.

Conclusions

The fact that almost all companies that started since the first established LEEN network in the region of Hohenlohe in Baden -Wurttemberg in Germany in 2002, are still active in their networks or similar newly founded (including internal efficiency networks of large companies), shows that company benefits obtained by LEEN network participation in Germany, Austria, and Switzerland are well recognized by them.

This also explains why utilities, consulting engineers, chambers of commerce, and regional governments, or energy agencies in Belgium, the Netherlands, Sweden, Denmark, Brazil, Mexico, and other countries are presently considering introducing the LEEN system in their industries and service sectors. They are checking whether the LEEN methodology gives sufficient added-value to a better strategic positioning of the companies (including competitiveness) or cities. This is needed to identify well operating drivers for sustainable development in a country or region.

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