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INNOVATIVE METHOD OF REGIONAL SUSTAINABLE ENERGY STRATEGIES

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Abstract

Sustainable energy management stands at the top of the most important challenges of our future because of its complexity and wide connectivity with the sustainability of the society and economy. Rational answer to this challenge could be found just based on locally differentiated ways because there is not any general optimum of so called energy mix. That is why locally (regionally) elaborated and implemented sustainable energy strategies are needed and it is not just a simple technical and/or economical task of experts. There must be involved every stake-holders in the regional business and non-business (public and civil) sectors into the process of elaboration and also the implementing of this strategy. And the whole strategy must be based on the local natural environmental conditions and innovative capacity including the social innovation too. We have elaborated a possible method for the solution of this very complicated task and it has been defined in the frame of an EU-project (RESGEN) and was tested in the practice too. Our experiences are summarized in this article.

Keywords: *sustainable energy management, innovative method, regional strategy*

Jel Code*: Q5; R5*

Introduction

We have finished an EU-financed pilot-project (called RESGEN) successfully in 2012 in cooperation of 4 countries (EU-regions, including the Northern-Hungarian region) and 9 participants (including the Károly Róbert University College as responsible for the methodology) aiming the elaboration of regional sustainable energy strategies. We wanted to increase knowledge and find best practice on how sustainable energy (SE) strategy can be boosted and implemented at a regional level. The main approach for this has been through the development of comprehensive regional strategies, which integrate all the main stakeholders (authorities, industry, R&D bodies) into regional programs so that the development is rooted in the regions. This paper presents the main results from the RESGen (RES Generation – From Research Infrastructure to Sustainable Energy and Reduction of CO_2 Emissions; EU Regions of Knowledge; 2010-2012) project within which a documented procedure was prepared and used. Now we deal with just the methodological results in this article.

SE directly descends from the idea of sustainable development, with its different interpretations and more than three hundred definitions within environmental management (e.g. IUCN, 1980; WCED, 1987; Johnston et al., 2007). SE interlinks with all the other

aspects of sustainability, which, in turn, depend on secure operation of energy supply (Smalley, 2005; Dinya, 2009 and 2012). Comprehensive understanding and expertise are necessary in developing SE management (Fig 1).

There are a number of technologies for renewable energy sources (RES) that can be implemented separately or in combination. Their integration is the key in creating complete alternative solutions with different degrees of regional energy self-sufficiency. SE management is necessary to avoid adverse impacts and careless use of RES. In developing the SE strategy procedure this approach has been applied regionally.

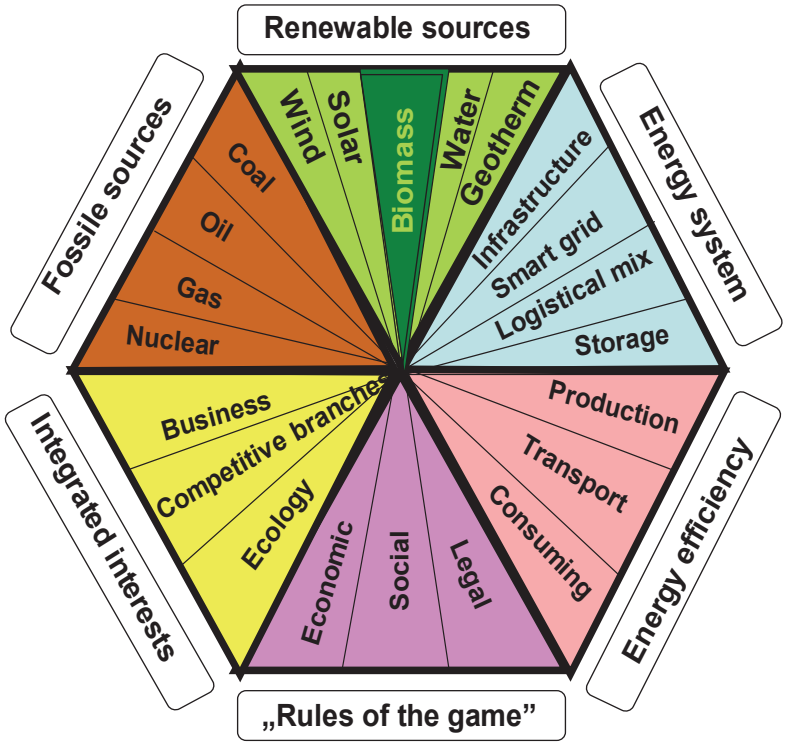

Figure 1 The concept of sustainable energy management
Source: Dinya, 2009.

There is a vast literature about the humankind's population dynamics, environmental impacts and limits of existence, natural resources and "peak oil" (e.g. Peura, 2012). Our world will undoubtedly face comprehensive changes, and the transition of energy sector towards SE can be an integral part of them. Today, there are a number of positive drivers for SE. However, the diffusion of SE has been slow, and there are also many barriers. To make the dynamics understandable, the main drivers and barriers have been shortly reviewed.

Drivers and Barriers to Sustainable Energy

It is easy to find economical motivation for energy saving and efficiency. Over the last two decades there has also been increasing awareness and aspirations to see more widespread use of RES. The main reasons for this have included the following:

- The RES potential: many authors demonstrate that there is realistic and easily mobilised potential for RES to enable energy self-sufficiency. (e.g. Peura and

Hyttinen, 2011; Resch et al., 2008) Even 100% RES systems have already been planned in practice (e.g. Lund, 2007; Connolly et al., 2011).

- The economy of RES technologies: the business case for RES solutions is often already feasible (Peura and Hyttinen, 2011), and investments in RES technologies have performed well (Masini and Menichetti, 2012). The benefits beyond business profitability can be significant. This regional added value (monetary aspects, reduced costs, increased purchasing power, new employment, tax income, social, ecological and ethical aspects), including improved vitality, would be remarkable. RES also generates more jobs than conventional energy (Hillebrand et al., 2006).
- General perception and policies: development of a positive perception has prepared the ground for social acceptance of RES. (Wüstenhagen et al., 2007). It has enabled policies and other support frameworks to emerge and grow. RES has moved to the top of the international political agenda (REN21, 2011), which means that the institutionalisation of SE is occurring globally (Peura, 2012). SE has become the key concept in reforming the energy sector.
- Technical evolution: technical evolution is still in its early development phase, but new solutions are developed on a constant basis. A recent analysis of the diffusion of coal, oil, gas and nuclear technologies showed that under favourable conditions a massive penetration of a few energy technologies has led to market dominance (Lund P.D., 2010). But their strong spatial diffusion worldwide indicates a high overall potential. Using the average observed growth rates of the prevailing energy sources, the share of RES would grow to 60% in 2050 (Lund P.D., 2010).

Despite the strong signs of progress, the expansion of SE has been far less than, for instance, the increase of world coal production (Jefferson, 2008). There are a number of reasons for this:

- Institutional opposition: the prevailing large actors tend to prevent any development that does not support their own business (Lund H., 2010). This also means that RES based solutions are fighting against existing energy structures.
- Diffusion of RES based technologies: the diffusion of SE and the establishment of larger RES based energy management systems, means in many cases a total change from fossil fuels to the use of new raw materials. This innovation requires not only new technologies but also innovative institutional frames (e.g. Jacobsson and Johnsson, 2000; Bergek, 2010). The shift towards these structures, which are different from the prevailing centralised system, will be a long-term process. As is the case for the diffusion of any innovation, institutional lock-ins preventing acceptance of new innovations by key actors, have to be ‘unlocked’. RES solutions are in the early phases of diffusion. This means that they are competing against technologies with many years of operation and technical evolution, where investments have been repaid; supportive social structures are in place and where all the benefits of mass production and established value chains exist.
- The process: change itself towards SE will be a long evolutionary process. The process will need to involve the majority of people and there will be a huge number of

decision-makers, from individual citizens, families, farmers and businesses, to the public sector. The success of this process depends primarily on how the different levels engage, what crucial stakeholders approve (Wüstenhagen et al., 2007).

The conclusion drawn is that physical prerequisites for SE exist. A shift towards SE and away from fossil fuels will presumably be on the global agenda in the near future. The majority of stakeholders wish to see this agenda move forwards, but there are barriers slowing the process. Also the role of economics is problematic: Market penetration and competition against powerful prevailing structures is difficult in the short term, but along with the diffusion the prerequisites and feasibility of SE are expected to improve. Conscious strategies and programs can boost this development, which has been in focus in constructing our procedure.

Methodology

The underlying idea was to promote SE by developing a replicable common approach and methodology. In the project it resulted in four regional roadmaps for future implementing of SE. The roadmaps are clearly defined practical project programs based on regional strategies, for which stakeholder commitment is crucial. *Fig 2* illustrates an overview of the procedure, which comprises the following phases:

- Development of regional strategies based on the regional characteristics (regional SE, capacities and capabilities) and today's priorities
- Development Vision and Roadmaps to 2020

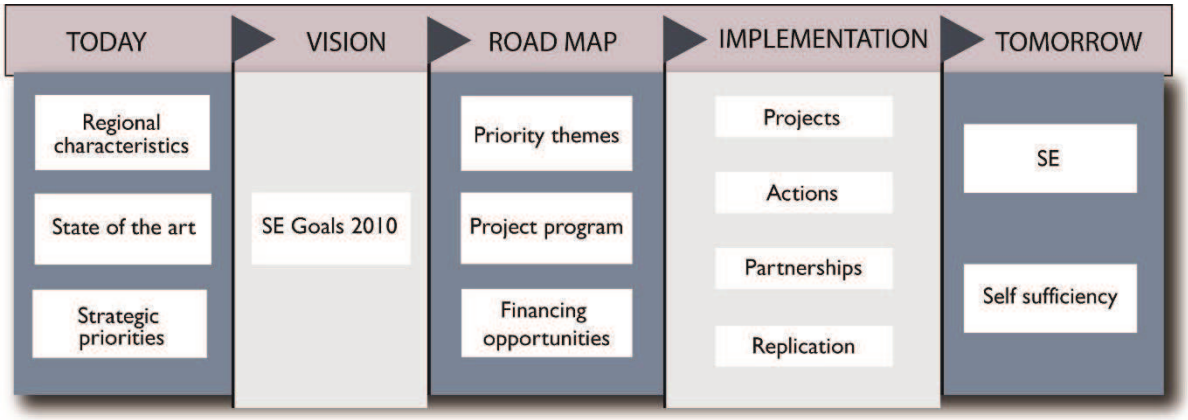

Figure 2 Overview of the procedure.
Source: Peura – Dinya, 2013.

Regional characteristics formed the starting point i.e. current energy mix, and future perspectives of SE. The analysis aimed to identify alignment and complementarity between the regional SE innovation supply, demand, and supporting policies. Each region collected information as follows:

- SE – state of play
  - current energy overview: national and regional statistics
  - situation and perspectives: workshops, interviews, analyses.
- SE policies: national and regional.

- Directories of SE innovation demand and supply, basic regional information (2008)
  - company base, R&D: employees, turnover, R&D expenditures, international presence, main fields of activities, funding sources, SE fields.

The data was further elaborated in regional SWOT analyses (Porter, 1990; Dinya, 2011), which was considered easy to understand and quantify for defining the regional priorities. Information attained through questionnaires and workshops was organised into a matrix (Fig 3), which enabled the definition of strategic steps:

- "SO": exploiting opportunities, based on strengths
- "WO": eliminating weaknesses, exploiting opportunities
- "ST": avoiding threats, based on strengths
- "WT": avoiding threats, eliminating weaknesses

The matrix was used in the following way: each S, W, O and T was collectively defined and given numbers (S1, S2, ... T1, T2 etc.). These numbers were placed into the matrix where every cell was a combination of S-O, S-T, W-O or W-T. The participants in the SWOT panel gave scores to each cell according to how important they considered each combination (e.g. S1-O1, S1-O2 ... W1-T1, W1-T2 etc.; scale 0-5; 0= no relevance; 1= very little relevance .... 5= very important). The collective opinion was the sum of all scores and those combinations that received the biggest scores were considered the most important ones.

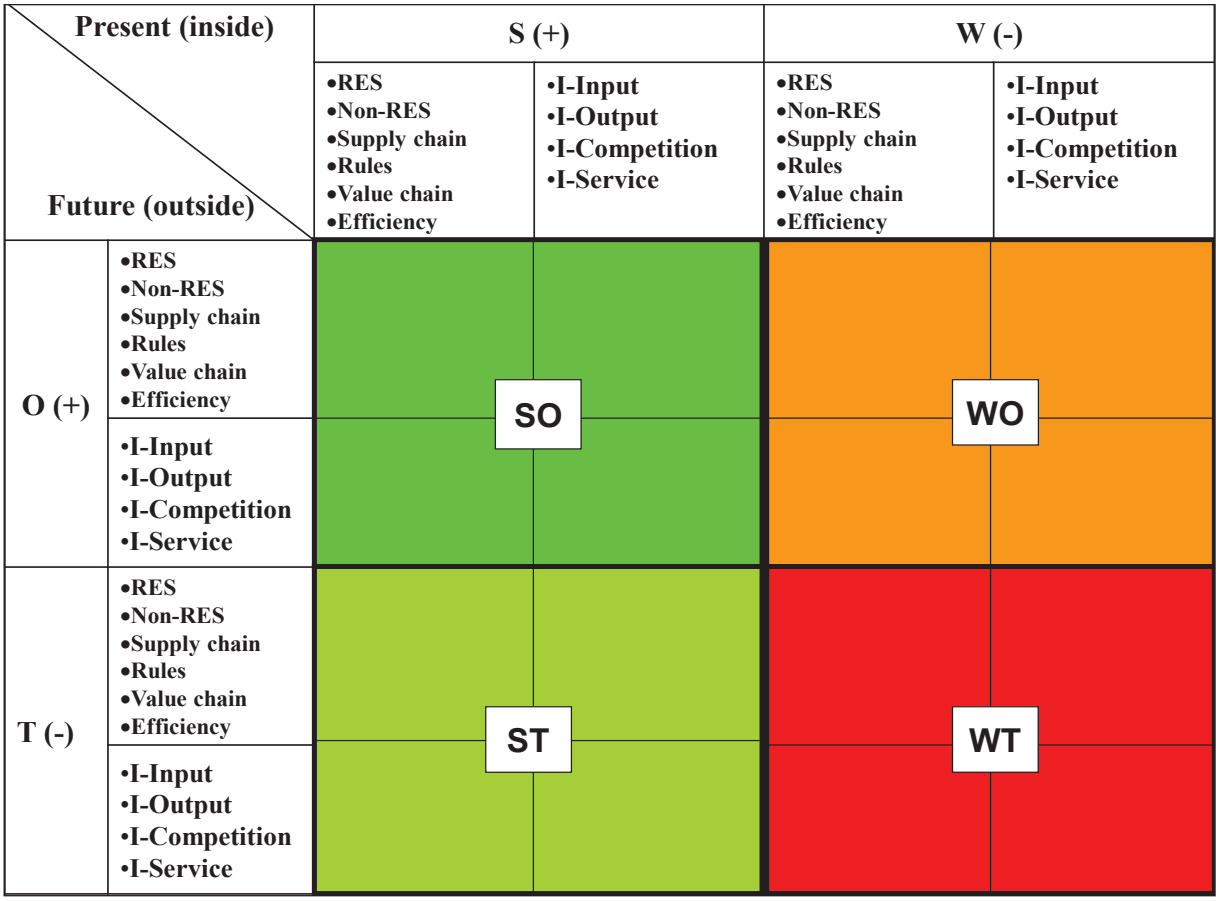

Figure 3 The SWOT matrix
Source: Dinya, 2011.

Then, the regions defined their vision 2020 and roadmap. Regional panels outlined the most likely future scenarios for the vision and defined the priority themes and project ideas; these were further developed by emails and discussions and within the roadmaps. A series of regional workshops were organised to guide the regions. The Delphi-method (Linstone and Turoff, 2002) was recommended but the regions were free to use any relevant method to attain a collectively defined roadmap. The project partners produced short descriptions of all project ideas. All materials were delivered to the panels. In the final workshop the results were discussed and, according to the Delphi-method, the participants could comment on the earlier results.

Each panel participant received an email including the proposed themes and project ideas for scoring, instructions and Excel-templates ready to be filled in. The overall scores were considered as the regional collective opinion and the regional priorities and projects were defined according to these results. This organisation resulted in the "fishbone" structure representing the roadmap for each region. In the fishbone (Annex 1) the themes are the four blocks, the priority areas the fish-bones, and the separate projects the actions.

Experiences of application in Northern Hungary

In Northern Hungary the starting point was the complex system of global sustainability challenges, which was applied at the regional level *(Fig 4)*. This model of a sustainable region was tested by the selected actors (forming the RESGen Regional Strategic Committee; RSC) in the regional economy of Northern Hungary. The RSC had an open structure of geographical, sector-wise and functional representation of the regional stakeholders. The RSC was in continuous contact with the stakeholders.

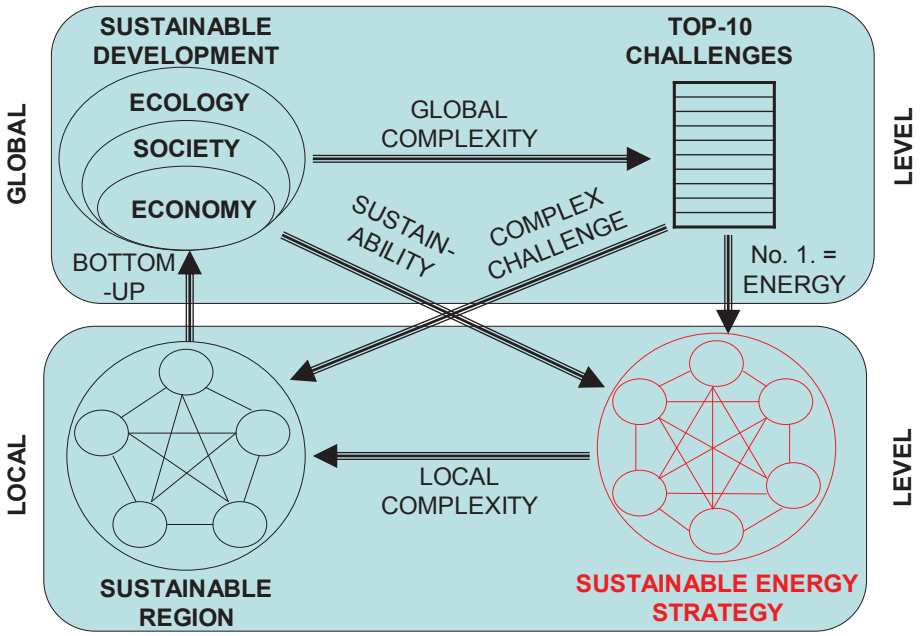

Figure 4 The SE region model applied in Northern Hungary
Source: Dinya, 2011.

The RSC elaborated the regional SWOT matrix and provided the regional energy *(Fig 5)* and

RES-innovation profiles *(Fig 6).*

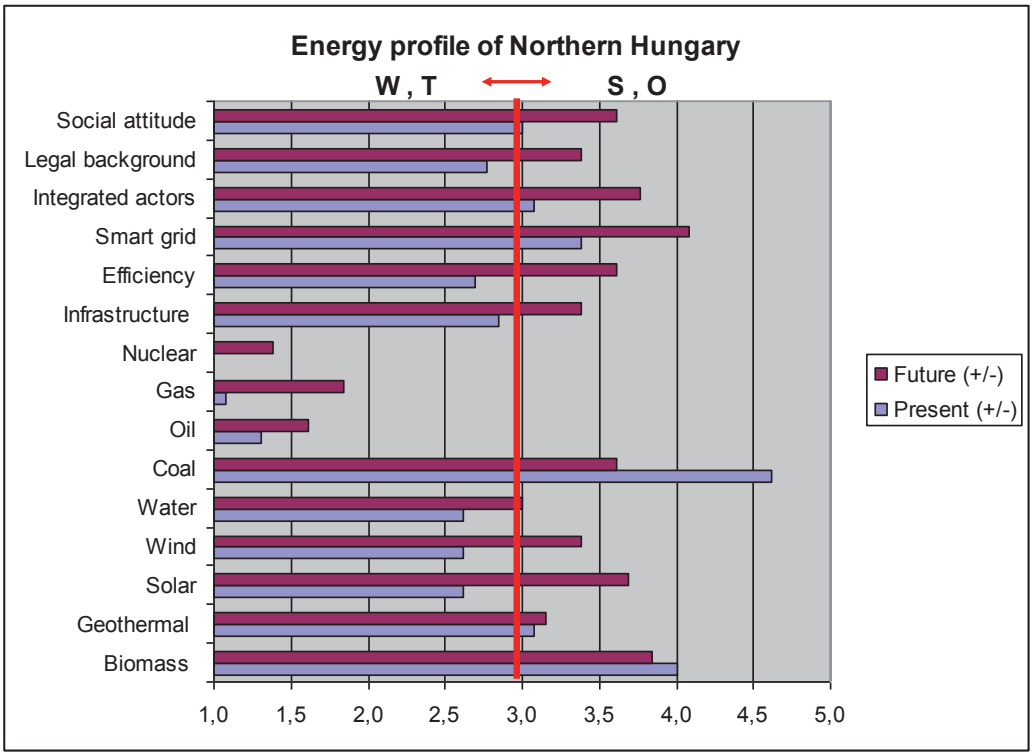

Figure 5 The regional energy profile of Northern Hungary.

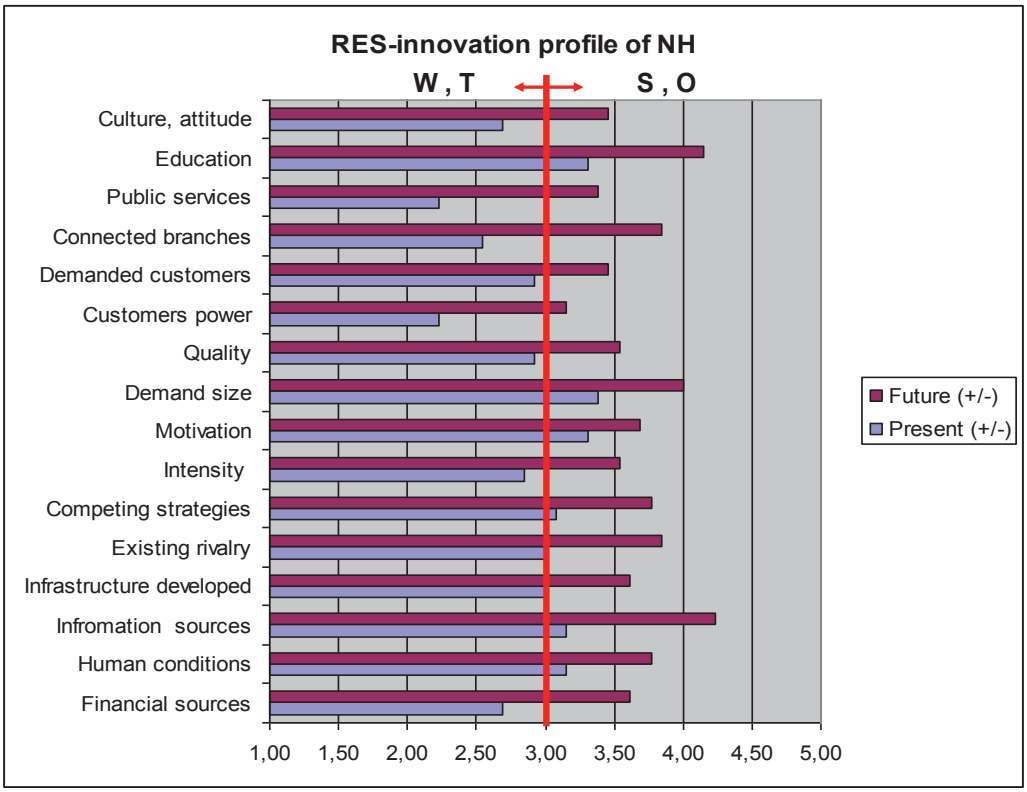

Figure 6 The regional RES-innovation profile of Northern Hungary.

Based on these results the present situation and the future potential of the energy sector and RES related innovation capacity in Northern Hungary were defined *(Figs 7 and 8).*

The RSC outlined the regional RES-strategy for Northern Hungary with the most important actions as follows:

1. Developing integrated local systems based on the bioenergy potential and pilot systems
2. Introducing zero-emission technologies into the exploitation of coal reserves and subsidising the co-firing of biomass with coal
3. Serving the increasing innovation and education needs through the regional bioenergy knowledge centre and involving solar energy
4. Intensive dissemination of successful RES-projects to drive innovation and RES-investment, and to exchange the culture and attitude of energy consuming and to establish the social basics of SE management
5. Providing knowledge services for RES-projects outside the region based on developing regional RES-innovation capacity especially in bioenergy and distributed energy systems
6. Establishing sustainable energy using programs using the knowledge services of regional innovation centres
7. Implementing consultation programs to involve the public sector (local governments, hospitals, schools, etc.) in SE management
8. Elaborating innovative solutions for the private, public and NGO-sectors to help them in starting successful RES-projects

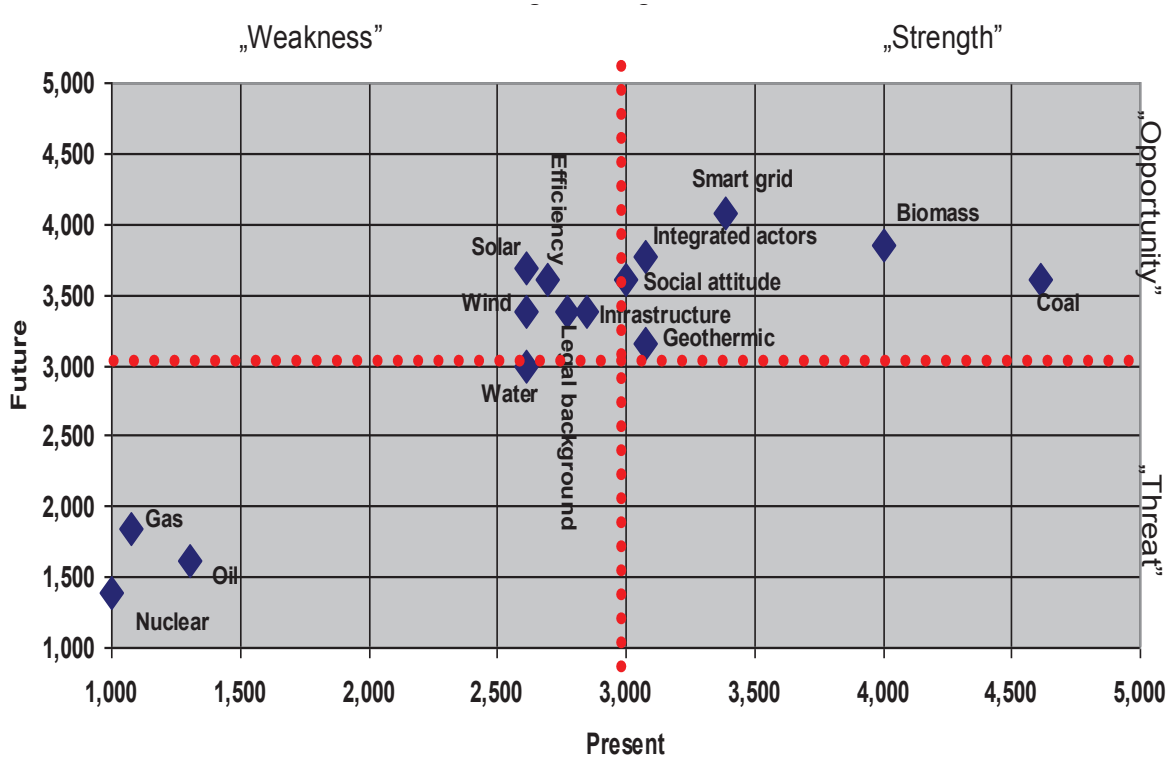

Figure 7 The present and future potential of the energy sector in Northern Hungary.

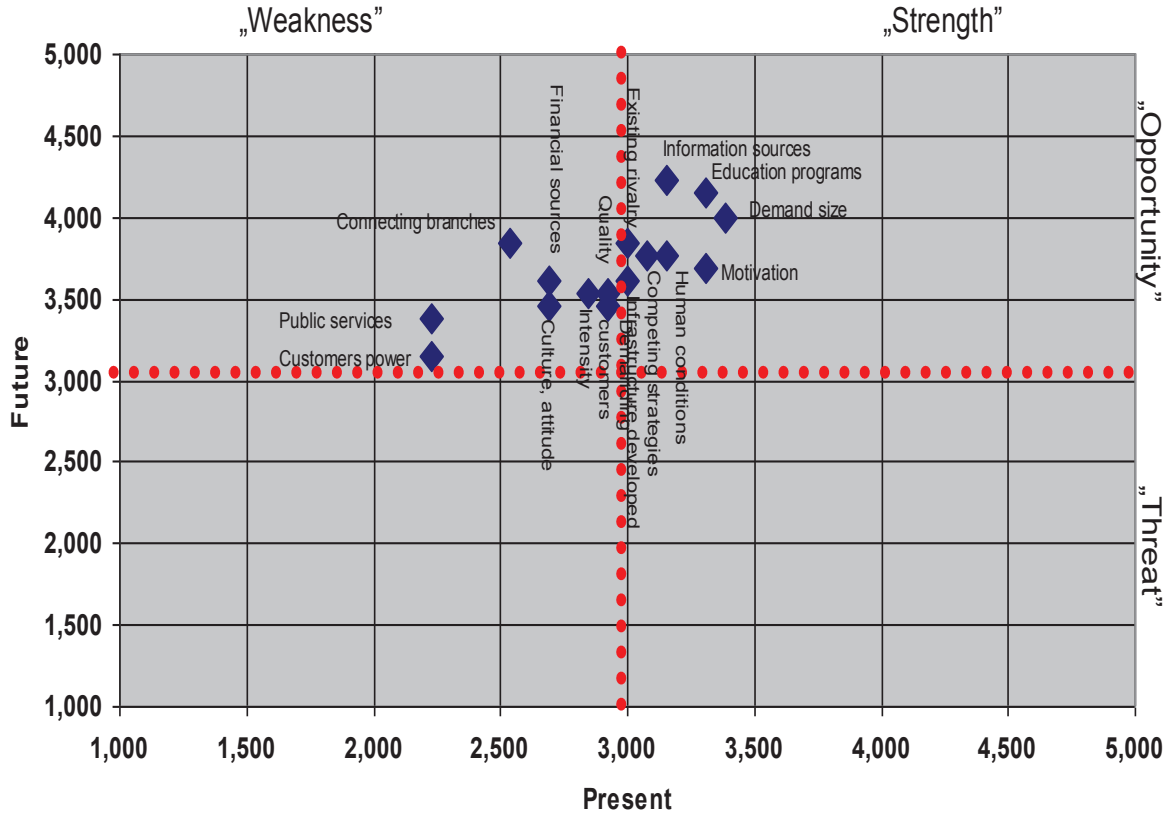

Figure 8 The present and future potential of innovation capacity in Northern Hungary.

The innovation of the applied procedure was two-fold: it integrated new approaches and methods with previously well-known tools (SWOT) into an easily applicable system, and it was applied in a novel branch for a bottom-up strategy and implementation of SE. Systematic management is essential, because the anticipated SE reform is a social process involving all stakeholders. The procedure provided regional stakeholders with a 'platform' for structured discussion and ensured commitment. For this reason the project was nominated among success stories in EU projects in 2012. It also contributed to the 'S3' (Smart Specialisation Strategies; EC, 2010) definition to include SE.

Conclusions

This article introduces an elaborated procedure for implementing SE strategy regionally, and it was tested in an EU-project called RESGEN. The main conclusions and lessons learnt are the following:

- The procedure worked well, with some requirements to improve user-friendliness. The method was applied differently in each region, demonstrating flexibility of the method.
- Public awareness, attitudes and trust, stakeholder commitment and functioning of the decision-making system are vital for successful implementation of SE strategy.
- Regional stakeholders were motivated to develop their own strategy, aiming at regional self-sufficiency and SE management.
- The procedure can reveal positive facts that usually are not known or expected. It may also reveal institutional opposition and negative attitudes against SE management, thus making the barriers and bottlenecks visible. These and the new strategic tool enable realistic development and control of the process.
- There is a call for "rules of the game", in order to reduce uncertainty of the business environment for SE management. Conscious development through comprehensive regional strategies and structured programmes will be important – the procedure is an attempt towards SE management development integrating local and regional implementation, national and international policies, smart specialisation and general progress.

The elaborated and tested procedure provided a systematic tool enabling unified development for all regions. The experiences suggest that the procedure could be fit for a more widespread use. The existence of this kind of tools may encourage regional programmes and thus promote the implementation of sustainable energy management.

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Annex 1 The regional roadmap is based on the fishbone structure, which presents the final priority projects and actions