The use of balanced scorecard for a sustainable deployment of renewable energy sources in the Czech Republic

Ticiano Costa Jordão, Michaela Stříteská, Karel Šatera

Abstract— This contribution provides a group of strategic objectives and a strategy map that can be adopted in the Czech Republic through a generic model based on balanced scorecard (BSC) aimed at setting up all necessary objectives, initiatives, performance measures and targets for a sustainable deployment of renewable energy technologies in the local and regional level in order to reduce carbon emissions, increase energy security and create business opportunities, among other benefits to the society at large.

Keywords— Balanced Scorecard, Renewable Energy, Sustainable development, Sustainability, Key Performance Indicators, European Union, Czech Republic.

I. Introduction

THE significant worldwide growth in renewable energy capacity is recent and has been observed mainly since the end of 2004 when it grew at rates of 10 % to 60 % annually for many technologies. Grid-connected solar photovoltaic (PV) increased the fastest of all renewables technologies, with a 60 % annual average growth rate for the five-year period from 2004 to 2009 (REN21, 2010).

The most important issues that have been contributing to an unprecedented growth in the use of renewable energy sources (RES) for electricity and heating purposes in the past ten years are the global warming and the fossil fuel depletion. The first issue is related with the concerns about the environmental consequences of greenhouse gas emissions. The second issue is related to the currently known reserves and rate of consumption of non-renewable energy sources such as oil and natural gas. The world sources of oil and natural gas are expected to be exhausted by around 2047 and 2068, respectively (Europe´s Energy Portal, 2007).

The foreseen exhaustion of fossil fuels is visible in the rapid increase in world energy prices observed in the past few years, mainly during the period from 2003 to mid-July 2008, when prices collapsed as a result of concerns about the deepening recession. In 2009, oil prices showed again an upward trend throughout the year, varying from about $ 42 per barrel in January to $74 per barrel in December (U.S. Energy Information Administration, 2010).

The International Energy Agency (IEA) estimates that by 2030 the world primary energy demand will be still mostly supplied by oil, followed by coal taking in acount a similar reference scenario. However, oil is expected to show the lowest average annual growth rate among the primary energy sources, a modest 0.9% rate. On the other hand, although with still a small contribution, RES such as solar and wind power will have the highest average annual growth rate observed during the period 2007-2030, a noteworthy 7.3%. In fact, solar and wind power together tend to contribute with almost the same share of hydro power in the electricity generation by 2030 among OECD countries (IEA, 2009).

Renewable energy feed-in tariffs (FiT) has demonstrated to be the world's most successful policy mechanisms for stimulating the growth of RES. In fact, European Union has taken a leading position on the global transition to a low-carbon economy in various sectors. In Europe, feed-in tariff programs have resulted to an unprecedented growth in the solar and wind power industries. The most significant growth has been seen in Germany, Spain and more recently, in Italy. More than a dozen U.S. and Canadian states have also introduced feed-in tariff legislation, and other states have initiated or announced plans for feed-in tariff regulatory proceedings (AltaTerra Research, 2010).

Nowadays, the highest installed wind power capacity is in US, Germany and China, in this order. Yet, China has more than doubled its wind power generation capacity between 2008 and 2009 (WWEA, 2010). In the context of solar power sector, the largest concentrating solar thermal power stations are located in Spain and in USA, while the world´s largest photovoltaic are concentrated in Germany and Spain (Greenpeace, 2008). In fact, Spain became the world´s biggest

Manuscript received October 31, 2010. This work was supported by the scientific research project of Ministry of Environment, Czech Republic under Grant No: SP/4i2/60/07 with the title Indicators for valuation and modelling of interactions among environment, economics and social relations.

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power generator of solar energy in July 2010 after the installation of a new plant, equaling its solar power production to the output of a nuclear power station (Burgen, 2010).

The major progress in research and development of renewable energy technologies accompanied by more effective policy framework have motivated several recent research on strategic territorial analysis and planning of potential RES. Geographic information system (GIS) tools have been widely applied since the last decade in the field of RES, mainly for locating areas with the highest potential for their development; for identifying the areas with restrictions that might affect their exploitation (e.g., environmentally or culturally sensitive lands); and, for estimating the energy output of RES in those areas that are suitable from a technical consideration and available for exploitation. Based on this information gathered, suitable strategies for the deployment of RES can be planned and implemented.

A convenient strategic management tool originally conceived for the private sector (Kaplan & Norton, 1992) that can be well adapted into the regional planning and development of renewable energy systems is the Balanced Scorecard (BSC). A recent work has provided a general BSC framework for this purpose that can be well adapted into several regions of different territorial extensions, population sizes, social and culture values, economic levels of development, and potential for renewable energy use (Jordão, Sampedro, & González, 2010). This contribution intends to set strategic objectives and a strategy map for a sustainable deployment of renewable energy sources in the Czech Republic based on the general BSC framework.

II. The use of renewable energy in the Czech republic

The Czech Republic has one of the lowest energy import dependencies of the European Union, mainly due to its vast reserves of coal, particularly lignite, and of uranium. In fact, coal is the main domestic energy source, representing 46.20% of total primary energy supply (TPES) in 2007. The second highest share in domestic energy production is provided by two nuclear power plants. Currently, there are four nuclear power reactors in Dukovany and two in Temelín, which in 2007 jointly contributed with 14.6% of TPES and almost one third of the total domestic electricity production. On the other hand, Czech Republic is highly dependent on the import of crude oil and natural gas, mainly from Russia. The share of energy import on the total energy consumption was roughly 40 % in 2007 (Enviros, 2009).

As part of the EU common energy policy adopted in 2007 to reduce the effects of climate change, the Czech Republic also intends to increase its production and use of renewable energy in electricity, heating, cooling and transport. Such a common energy policy for the EU also contributes to growth, job creation and increase of energy security. The country has established a commitment with the EU to achieve an 8% share of electricity generated from RES in domestic electricity generation by 2010 and achieve a share of 13% of energy made from RES per final consumption before 2020. For the EU-15 Member States these targets are 21% and 20%, respectively. In 2006, the share of renewable consumption to gross final energy consumption in the Czech Republic represented 6.5%, well below the EU average, 9.2%. In 2007, the share of renewable energies in gross electrical consumption was 4.6%, far below the EU average, 15% (Europe's Energy Portal [EEP], 2008).

A further target set by the Czech Government in allignment with the European Commission proposes a 15%-16% share of renewable energy in total primary energy consumption (Europe´s Energy Portal, 2007).

Toward the proposed goals, the Czech Government introduced in 2005 by act of law no. 180/2005 a feed-in tariff for a range of renewable sources including small hydropower, biomass, biogas, wind and photovoltaic (PV). The tariffs were to be guaranteed for between 15–30 years depending on the type of power. The feed-in tariff proposed for solar PV as of January 2010 is one of the highest among the EU Member States. The cost of PV power to the power company is expensive. In 2010 the highest tariff is 12.25 Czech Crowns (€ 0.50) per kWh for small photovoltaic power (Energy Regulatory Office [ERU], 2009). For comparison, the average rate that a Czech household paid in November 2009 for power was in the range € 0.087 to 0.116 per kWh, depending on the annual level of consumption (Europe's Energy Portal, 2010).

Energy generation from RES has been increasing by approximately 10% in the Czech Republic every year (Czech Environmental Information Agency [CENIA], 2008) Data provided by the Czech Ministry of Industry and Trade shows that hydro power plants are responsible for more than 60% of the share of RES achieved in 2007. The energy from biomass is expected to play an increasing role in the energy system in the country, mainly from the use of energy crops with crop rotation and good agronomic practice. The role of wind power plants, refuse incineration plants and photovoltaic systems are still rather negligible in comparison with other forms of RES (CENIA). However, motivated by the high feed-in tariff and the decreasing cost of PV panels, the solar PV capacity installed in the Czech Republic has grown significantly since 2007 and in 2008 was the fourth highest among EU Member States, just behind Spain, Germany and Italy, in this order (Europe's Energy Portal, 2008).

The business with solar PV has become extremely profitable since due to the current market conditions investments are repaid within 8-10 years and the feed-in tariff is guaranteed for 20 years (EurActiv Network, 2010). This has led to an unprecedented boom in photovoltaic power, which increased from 70 MW in 2008 to 470 MW in 2009, and is predicted to hit at least 1,000 MW by the end of 2010 (EurActiv Network). Although not in the same proportion, the wind power installed capacity has also increased significantly in the Czech Republic also motivated by favorable feed-in tariffs. However, energy distributors and operators in the country have warned for the fact that the installed capacity of wind and solar energy

ISBN: 978-960-474-253-0

projects is nearly four times what can be safely fed into the country's electricity grid. The Association of Czech Regulated Electro-Energy Companies (CSRES) said the installed capacity of all projects approved by the end of January was 8,063 MW (EurActiv Network).

With the purpose to address this threat, the Czech government has given its approval for a renewable energy framework plan which aims to reduce generous subsidies driving the country towards a solar boom. The plan calls for a cap on feed-in tariffs for solar energy, up to approximately 50% of the current level, as well as making the recycling of old solar panels mandatory. Nevertheless, the reduction of feed-in tariff (FiT) is expected to be applied only for all solar PV new installations from 2011. All existing installations will still receive the same FiT rate they got when they originally installed, as this rate is fixed for 20 years (Hughes, 2010).

III. LITERATURE REVIEW

There is a large amount of research works related to strategic planning of RES that deserve to be mentioned. Some are particularly focused on one or two RES while other works attempt to be more comprehensive by comparing various alternatives. Here are listed only those research works that somehow have influenced the development of the BSC model proposed in this study.

In 2001, a BSC model was developed to capture and visualize other than financial benefits resulting from the installation of privately owned grid-connected photovoltaic systems in the Perth metropolitan region in the south-west of Western Australia consumer (Bach, Calais, & Calais, 2001).

Another interesting research consisted in a method for evaluating and ranking energy alternatives based on impact upon the natural environment and cultural heritage as part of the first phase of an Icelandic framework plan for the use of hydropower and geothermal energy (Thórhallsdóttir, 2007).

A fundamental contribution to the definition of strategically planned renewable energy policies can be provided by the spatial evaluation of the renewable energy potential. In this sense, researchers from Argentina adopted GIS tools to identify the potential of RES in Lerma Valley, Salta, Argentina (Belmonte, Núñez, Viramonte, & Franco, 2009).

A strategic analysis methodology for adaptive energy systems engineering with the purpose of optimizing level of service in the context of a community´s social, economic, and environmental position was recently proposed by two researchers from New Zealand and applied to a case study on Rotuma, an isolated Pacific island (Krumdieck & Hamm, 2009).

Another noteworthy contribution in this field consisted of a renewable energy technology portfolio planning that was proposed with the use of scenario analysis to renewable energy developments in Taiwan (Chen, Yu, Hsu, Hsu, & Sung, 2009).

Sustainability of energy systems is addressed by Ghomshei and Villecco (2009) in their fuzzy logic model used to scale energy systems based on their valued attributes such as storability, transformability, quality, transportability, availability, environmental value and resource sustainability.

One of the most recent innovations in terms of evaluating the potential of RES in various geospatial areas or regions has been provided by Honeywell International with their patented renewable energy calculator (Dillon, Blagus, Parr, Iyer, & Houghton, 2009).

IV. THE EVOLUTION OF BALANCED SCORECARD AS AN EFFECTIVE STRATEGIC MANAGEMENT TOOL FOR THE PRIVATE AND PUBLIC SECTOR

The Balanced Scorecard (Kaplan & Norton, 1992) is a strategic management approach that has gained popularity among corporations worldwide in the last two decades by providing a performance measurement framework that adds strategic non-financial performance measures to traditional financial metrics to give managers and executives a more "balanced" view of organizational performance. It was conceived to align business activities to the mission, vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. BSC evolved from its early use as a simple performance measurement framework to a full strategic planning and management system. It is based on four strategic perspectives which are linked with cause and effect chains. These are: learning and growth, internal business process, customer and financial perspectives. In each perspective of the strategy map there is a group of strategic objectives aligned to the mission and vision of the organization. The financial perspective is placed at the top (effect) while the learning and growth perspective is placed at the bottom (cause). The internal business process is directly linked to the learning and growth and the customer perspective provides the necessary requirements for the achievement of the strategic objectives specified in the financial perspective.

Initially conceived as a modern management control system for the private sector (Kaplan & Norton, 1992), the BSC was adapted to the specificity of the public sector. Some applications included the health care sector (Baker & Pink, 1995; Aidemark, 2001), education institutions (Di Gregorio & Shane, 2003), government and non-profit organizations (Bremser, 2001; Kaplan, 2001; Niven, 2003), and medium sized public sector enterprises (Barney, Radnor, Johnston, & Mahon, 2004) .

An extension of the conventional Balanced Scorecard has been proposed under a new label named *Sustainability Balanced Scorecard* (SBCS). While the conventional model includes four management perspectives, the SBCS also addresses a fifth non-market perspective (Figge, Hahn, Schaltegger, & Wagner, 2002; Schaltegger & Dyllick, 2002) that includes strategically relevant issues that are not covered in market arrangements with the company. The nonmarket perspective is usually drawn as a frame for the other perspectives because societal issues constitute the framework

ISBN: 978-960-474-253-0

of market operations with the financial community, customers, suppliers, and employees. These are external or sustainability issues that influence the business and are addressed by stakeholders.

No matter the case in which BSC is applied, its correct introduction and use starts with the definition of the organization's "mission", "vision" and "values" as determined by the managers. These three elements provide the framework within which the strategic objectives are set by the organization.

V. THE USE OF BALANCED SCORECARD AS A TOOL FOR REGIONAL RENEWABLE ENERGY PLANNING AND DEVELOPMENT

Within the sphere of applicability of BSC in governmental organizations, the present study adopts a previously conceived general BSC framework (Jordão, Sampedro, & González, 2010) for a sustainable deployment of RES in the Czech Republic with its strategic objectives and strategy map.

Table 1 suggests the mission, values and vision that could be pursued by the Czech Energy Regulatory Office (ERU) concerning the planning and development of RES in the country.

Just like the general BSC framework for RES, the present BSC model is based on four perspectives upon which the strategic objectives and their related initiatives (critical success factors), measures (key performance indicators) and targets will be set. These perspectives are: *Learning and Development*, *Energy Supply Systems*, *Energy Services Consumers*, and *Welfare*.

TABLE 1
SUGGESTED MISSION, VALUES AND VISION FOR THE CZECH ENERGY REGULATORY OFFICE (ERU)

Mission	To put forth policies that will result in a sustainable energy future for the region and increase the awareness of the benefits of renewable energy and energy efficiency.
Values	*Social value*: healthier home environments that result in healthier people which lead to healthier communities. *Economic value*: lower operating costs, greater home value, longer economic value lifecycle. *Environmental value*: less pollution, energy efficient and better use of natural resources.
Vision	The energy will derive primarily from sustainable, renewable energy resources.

Table 2 presents these perspectives and their related strategic objectives that can be considered in the Czech Republic.

Fig. 1 illustrates the Strategy Map with the strategic objectives defined in each perspective. These objectives are linked in a cause-effect relationship. Each objective can be broken down into a number of CSF (initiatives) which are necessary for achieving that goal. In the scorecard the weight of each strategic objective within each perspective has to be defined by ERU according to the level of importance assigned. The performance level for each strategic objective has to be oriented towards a previously defined target.

TABLE 2
THE PERSPECTIVES AND RELATED STRATEGIC OBJECTIVES FOR RES DEPLOYMENT IN THE CZECH REPUBLIC

Perspectives	Strategic Objectives
Learning and Development	Enhancing the information capital Enhance the organizational capital Enhance the human capital
Energy Supply Systems	Enhance the operations Management Process Enhance the customer management process Enhance the Innovation Processes Enhance the Social and Regulatory Processes
Energy Services Consumers	Reduce energy supply cost Improve the energy service level (reliability and extent of energy supply) Provide additional alternatives of energy sources Increase trustworthiness of energy consumers and community engagement
Welfare	Improve regional environmental quality Increase the socio-economic value generated

The *Welfare perspective* is placed at the top of the Strategy Map since for the Czech Energy Regulatory Office the prosperity of local community is the most important strategic outcome which will be represented by a maximized long-term stakeholder value.

In the *Learning and Development Perspective*, three strategic objectives can be aimed in a sequential order, starting with the enhancement of organizational capital, then improving the information capital and finally, enhancing the human capital.

In the *Energy Supply System Perspective*, four main strategic objectives can be focused. The enhancement of operations management process will partly contribute for the reduction of energy supply cost and for the improvement of energy service level, which are two strategic objectives within the overlying perspective *Energy Services Consumers*. The enhancement customer management process will partly contribute to the increase of trustworthiness of energy consumers and in the improvement of energy service level. The improvement in the innovation processes will play an important role in the reduction of energy supply costs by reducing the need for importing components for these technologies or the complete technology itself. It will also provide additional alternatives of RES.

Other important strategic objective within this perspective is the enhancement of social and regulatory processes by providing incentives for the exploitation of all RES identified in the region with moderate to high potential, developing clear

ISBN: 978-960-474-253-0

procedures and criteria for acceptance of new project based on RES use.

In the *Energy Services Consumers Perspectives*, the reduction in the energy price supplied by RES and the improvement of energy service level together with the provision of additional alternatives of energy sources will contribute for the increase of regional socio-economic value. On the other hand, the increase of the awareness of citizens and business entrepreneurs about the benefits and level of feasibility of investing on renewable energy sources through distributed generation (DG), will contribute for the improvement of regional environmental quality.

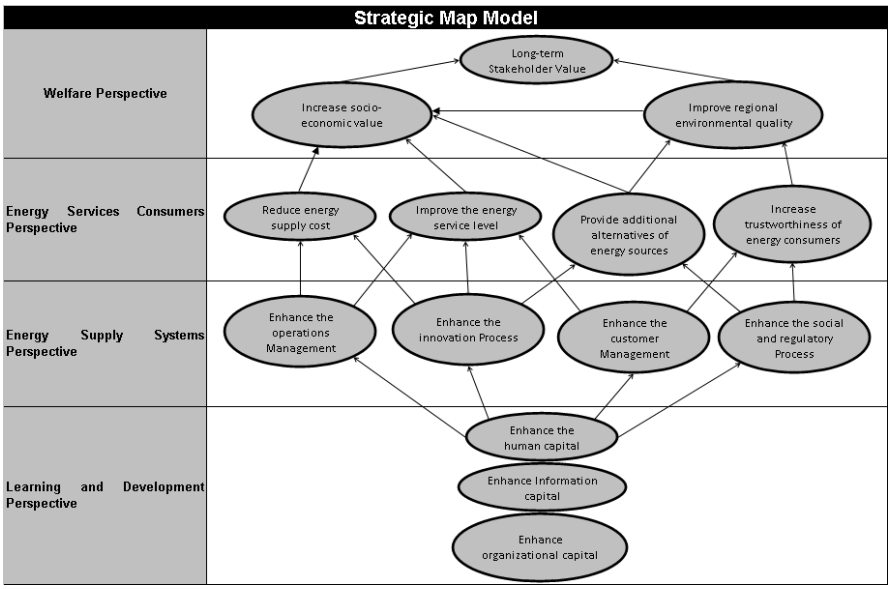

Fig. 1: BSC strategy map for a sustainable strategic planning of renewable energy use
Source: Adapted from Kaplan & Norton, figure 1-3, page 11 (2004)

The *Welfare Perspective* can be consisted of two main strategic objectives, which in turn can be translated into several detailed initiatives that will take in account the current environmental and socio-economic conditions. Among the initiatives oriented towards the improvement of environmental quality by using RES, the most remarkable ones are those related to minimization or avoidance of air pollution and greenhouse gas emissions.

Other important initiatives in the environmental sphere include the minimization or avoidance of noise, water resource use, aesthetic impact on landscape and impacts on terrestrial and aquatic biota.

The increase of socio-economic value generated can mainly be addressed by incoming foreign and local investment, generation of local employment, increase of real state value, and reduction of impacts to human health, all related to the introduction of RES technologies in the region. Finally, the decrease of energy import dependency also contributes for the increase of regional socio-economic value.

Some important key performance indicators (KPI) that can be considered in the Welfare perspective by the Czech Energy Regulatory Office can be identified grouped according the strategic objective:

Improve environmental quality: Ambient concentrations of air pollutants in urban areas, Air pollutant emissions from energy systems, Greenhouse gas emissions and projections in tonnes of carbon dioxide equivalent (CO2 eq.), greenhouse gas intensity as the ratio between energy related greenhouse gas emissions (carbon dioxide, methane and nitrous oxide) and gross inland energy consumption, noise level of wind farms measured in dB (A), share of PV and solar thermal placed in compatible landscapes, share of wind power turbines placed in compatible landscapes (e.g. agricultural zones), share of biomass power plants placed in compatible landscapes, and amount of land flooded by hydropower plants and amount of land eroded along the riverbed upstream and downstream.

Increase the socio-economic value: Increase in residential housing prices (in %) due to reduction of particular kind of air pollution (in %), amount of RES (in kWh) locally generated and locally sold and exported; number of RES users, Net energy import in oil equivalents, Number of firms manufacturing RES components; total payment to RES investors; taxes paid by RES suppliers; total payments of salaries and benefits to employees involved in RES; average level of operational costs of RES suppliers, share of local employment provided by renewable energy industry measured in terms of electricity generating capacity installed, the number of local jobs provided by RES industry per kWh of electricity generated.

I. Conclusion

As previously shown the BSC can also be used for a sustainable strategic planning of renewable energy use in the territory. In the case of the Czech Republic, the strategic

ISBN: 978-960-474-253-0

objectives have to be aligned with the proposed commitments to the EU in terms of share of electricity generation and energy generation from RES. However, it is important to consider the level of incentives provided for the investors (e.g., feed-in tariffs) and estimate it carefully in order to avoid a major increase of energy prices for households and for the industrial users. Therefore, the BSC model does not aim to maximize the use of RES but mainly to work towards its optimization. The accomplishment of this task depend on the collaboration of various stakeholders, such as technology experts, business executives, government officials, major educators, prominent artists and community leaders.

Due to the current economic recession in which the country is currently found, the following objectives may gain a higher relative weight by ERU in comparison with the others: the reduction of energy prices, the improvement of energy service level, the increase in the security of energy supply, and the generation of local employment provided by RES investments. These weights assigned to strategic objectives may change in the future as the country will overcome the recession and the environmental objectives may receive a higher relative weight.

REFERENCES

[1] Aidemark, L. (2001). The meaning of balanced scorecards in the health care organization. *Financial Accountability & Management , 17*, pp. 23-40.

[2] AltaTerra Research. (2010, August 5). *Renewable energy feed-in tariffs: global outlook and North American report card*. Retrieved August 15, 2010, from Renewable Energy World.com: http://www.renewableenergyworld.com/rea/events/renewable-energy-feed-in-tariffs-global-outlook-and-north-american-report-card

[3] Bach, N., Calais, P., & Calais, M. (2001, April). Marketing residential grid-connected PV systems using a Balanced Scorecard as a marketing tool. (A. Sayigh, Ed.) *Renewable Energy , 22*, pp. 211-216.

[4] Baker, G. R., & Pink, G. H. (1995). A Balanced Scorecard for Canadian hospitals. *Healthcare Management Forum , 8*, pp. 7-21.

[5] Barney, W., Radnor, Z., Johnston, R., & Mahon, W. (2004). The design of a strategic management system in a public sector organisation. *Proceedings of the Fourth International Conference on Performance Measurement and Management.* Edinburgh.

[6] Belmonte, S., Núñez, V., Viramonte, J., & Franco, J. (2009, August-September). Potential renewable energy resources of the Lerma valley, Salta, Argentina for its strategic territorial planning. *Renewable and Sustainable Energy Reviews , 13*, pp. 1475-1484.

[7] Bremser, W. G. (2001). Accountants for the public interest: strategy implementation and performance measurement for a nonprofit organization. *Journal of Accounting Education , 19*, pp. 75-86.

[8] Burgen, S. (2010, July 13). *Spain overtakes US with world's biggest solar power station*. Retrieved July 20, 2010, from The Guardian: http://www.guardian.co.uk/environment/2010/jul/13/spain-solar-power

[9] Chen, T. Y., Yu, S. O., Hsu, G. J., Hsu, F. M., & Sung, W. N. (2009, August). Renewable energy technology portfolio planning with scenario analysis: A case study for Taiwan. *Energy Policy , 37*, pp. 2900-2906.

[10] Czech Environmental Information Agency [CENIA]. (2008). *The Environment of the Czech Republic*. Retrieved March 15, 2010, from CENIA: http://www.cenia.cz/web/www/web-pub2.nsf/$pid/CENMSFVZ8VR3/$FILE/ebergy_sector.pdf

[11] Di Gregorio, D., & Shane, S. (2003, February). Why do some universities generate more start-ups than others? *Research Policy , 32*, pp. 209-227.

[12] Dillon, J., Blagus, R., Parr, S., Iyer, V., & Houghton, A. (2009). *Patent No. US20090313083A1*. Morristown, NJ (US).

[13] Energy Regulatory Office [ERU]. (2009, November 23). *Cenové rozhodnutí Energetického regulačního úřadu č. 5/2009 (Price Decision ERO No. 5 / 2009)*. Retrieved March 21, 2010, from Czech Energy Regulatory Office: http://www.eru.cz/user_data/files/cenova%20rozhodnuti/CR%20elektro/OZ/ER%20CR%205_2009_slunce.pdf

[14] EurActiv Network. (2010, March 11). *Czech renewable energy boom tests grid safety limits*. Retrieved June 10, 2010, from EurActiv Network: http://www.euractiv.com/en/energy/czech-renewable-energy-boom-tests-grid-safety-limits-news-329169

[15] Europe´s Energy Portal. (2007, January). *Czech Republic - Renewable Energy Fact Sheet.* Retrieved March 12, 2010, from Europe´s Energy Portal: http://ec.europa.eu/energy/energy_policy/doc/factsheets/renewables/renewables_cz_en.pdf

[16] Europe's Energy Portal. (2008). *Europe's Energy Portal: shedding a light on European energy developments*. Retrieved August 22, 2010, from EEP: http://www.energy.eu/#renewable

[17] Europe's Energy Portal. (2010, April). *Europe's Energy Portal: shedding a light on European energy developments*. Retrieved August 23, 2010, from EEP: http://www.energy.eu/#feedin

[18] Figge, F., Hahn, T., Schaltegger, S., & Wagner, M. (2002). The sustainability balanced scorecard linking sustainability management to business strategy. *Business Strategy and the Environment , 11*, pp. 269–284.

[19] Ghomshei, M., & Villecco, F. (2009). Energy Metrics and Sustainability. In O. Gervasi, D. Taniar, B. Murgante, A. Lagana, Y. Mun, & M. L. Gavrilova (Ed.), *ICCSA 2009, Part I, LNCS. 5592*, pp. 693-698. Springer-Verlag Berlin Heidelberg.

[20] Greenpeace. (2008). *World´s largest photovoltaic power plants*. Retrieved April 12, 2010, from Greenpeace Energy: http://www.pvresources.com/en/top50pv.php

[21] Hughes, E. (2010, August 26). *Czech government approves renewables energy framework plan*. Retrieved October 15, 2010, from PV-Tech.org: Daily News: http://www.pv-tech.org/news/_a/czech_government_approves_renewables_energy_framework_plan/

[22] IEA. (2009). *World Energy Outlook.* Paris: IEA Publications.

[23] Jordão, T. J., Sampedro, E. L.-V., & González, E. R. (2010). The use of balanced scorecard in the strategic planning of renewable energy supply in the regional level. *Proceedings of the 9th International Business Week on Renewable Energy Industries.* University of Minho, Braga.

[24] Kaplan, R. S. (2001). Strategic performance measurement and management in nonprofit organizations. *Nonprofit Management and Leadership , 11*, pp. 353-370.

[25] Kaplan, R. S., & Norton, D. P. (1992, January-February). The balanced scorecard - Measures that drive performance. *Harvard Business Review* , pp. 71-79.

[26] Krumdieck, S., & Hamm, A. (2009, September). Strategic analysis methodology for energy systems with remote island case study. (Elsevier, Ed.) *Energy Policy , 37*, pp. 3301-3313.

[27] Niven, P. R. (2003). *Balanced Scorecard step by step for government and nonprofit agencies.* Wiley.

[28] REN21. (2010). *Renewables 2010 Global Status Report.* Retrieved August 15, 2010, from REN21: http://www.ren21.net/globalstatusreport/REN21_GSR_2010_full.pdf

[29] Schaltegger, S., & Dyllick, T. (Eds.). (2002). *Nachhaltig managen mit der Balanced Scorecard. Konzepte und Fallstudien [Sustainability Management using the Balanced Scorecard. Concepts and Case Studies]*. Wiesbaden, Germany: Gabler.

[30] Thórhallsdóttir, T. E. (2007, August). Strategic planning at the national level: evaluating and ranking energy projects by environmental impact. *Environmental Impact Assessment Review , 27*, pp. 545-568.

[31] U.S. Energy Information Administration. (2010, 5 25). *International Energy Outlook 2010*. Retrieved July 22, 2010, from U.S. Energy Information Administration: http://www.eia.doe.gov/oiaf/ieo/highlights.html

[32] WWEA. (2010). *World Wind Energy Report 2009.* Bonn: WWEA head office.

ISBN: 978-960-474-253-0