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SWOT Analysis of Renewable Energy in Rural Development

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Abstract

We found a few cases of renewable energy being well integrated into rural development. Renewable power generation, particularly wind and solar energy, has rapidly expanded in recent years, driven by the requirements of the European Union's Renewable Energy Directive and national targets with the use of the SWOT model.
SWOT analysis is a process that identifies the strengths, weaknesses, opportunities, and threats of an organization. Specifically, SWOT is a basic, analytical framework that assesses what an organization can and cannot do, as well as its potential opportunities and threats. The SWOT analysis takes information from an environmental analysis and divides it into internal strengths and weaknesses and external opportunities and threats.

Key Words: SWOT, Renewable Energy, Rural Development.

Introduction

In Europe, renewable power generation, particularly wind and solar energy, has rapidly expanded in recent years, driven by the requirements of the European Union's Renewable Energy Directive and national targets. However, low rates of power demand growth and a difficult economic situation have raised doubts about the timelines of future investments so that policymakers in several countries have started to express concerns about the affordability of high shares of certain types of renewable power generation. These concerns relate, particularly, to higher than anticipated rates of deployment of solar photovoltaic (PV) systems, driven, in some countries, by generous and unlimited subsidy schemes and rapidly falling PV system cost. For example, Spain acted in 2010 to adjust over-generous CRE (French Energy Regulatory Commission, 2012). Renewables subsidies and, more recently, a moratorium have been put on further subsidies to renewables. Difficulties about integrating high levels of variable renewables into an electricity system are also emerging in some European Countries. Renewables are steadily becoming a greater part of the global energy mix, in particular in the power sector and in regions that have put in place measures to promote their deployment. Double-digit growth rates have been observed in the last decade for some renewable energy technologies and renewables are projected to continue to grow strongly over the outlook period to 2035, provided that the necessary support measures are kept in place. However, the situation is nuanced across the three main energy uses: electricity, heat, and transport. Electricity generation from renewable sources is growing rapidly for most technologies, while renewable energy use for heat is growing more slowly and remains

under-exploited (Eisentraut et al., 2013). After a period of rapid expansion, the rate of growth of biofuels use has recently slowed due largely to adverse weather conditions that reduced harvests and increased feedstock prices, as well as sustainability concerns. Investment in renewable power generation has also been rising steadily but it fell, for the first time, in 2012. In part, this reflects falling unit costs, but it is perhaps also a sign that the prospects for renewable are becoming more complex. In the United States, the market for renewables has been growing strongly, in large part due to the continuation of stimulus policies directed at renewable energy, such as the provision of cash grants (instead of a tax credit) of up to 30% of investment costs for eligible renewable energy projects (US Treasury 1603 Program). This programmer expired at the end of 2012, but many projects were able to pre-qualify and would receive this support if completed by the end of 2016. An investment tax credit and production tax credits also provided support for renewables in the United States, despite uncertainty over the future of the programmers (Dena, German Energy Agency, 2012).

Methodology

After setting the objective(s), a common methodology is composed of the following four phases for a consistent SWOT analysis:

1. Organization (internal) and environmental (external) screening: this includes an assessment of the present situation/portfolio of products/services/technologies and their life cycle analyses
2. Analysis of existing strategies: this step addresses internal/external appraisal and gap analysis of environmental factors and defines strategic issues– key factors in the plan development
3. Prioritization of key factors and correlations: this main step develops new/revised strategies through the analysis of strategic issues and establishes critical success factors, the achievement of objectives, and strategy implementation
4. Strategy implementation and monitoring: the final phase prepares operational, resource, and projects plans to be implemented and monitors the results for the required corrective actions.

What are renewable energy rural areas?

The global deployment of RE has been expanding rapidly. For instance, the RE electricity sector grew by 26% between 2005 and 2010 globally and currently provides about 20% of the world's total power (including hydropower). Rural areas attract a large part of investment related to renewable energy deployment, tending to be sparsely populated but with abundant sources of RE. The case studies have found that RE deployment can provide hosting communities with some benefits, including:

- *New revenue sources*. RE increases the tax base for improving service provision in rural communities. It can also generate extra income for landowners and land-based activities. For example, farmers and forest owners who integrate renewable energy production into their activities have diversified, increased, and stabilized their income sources.
- *New job and business opportunities, especially when a large number of actors is involved and when the RE activity is embedded in the local*

economy. Although RE tends to have a limited impact on local labor markets, it can create some valuable job opportunities for people in regions where there are otherwise limited employment opportunities. RE can create direct jobs, such as in operating and maintaining equipment. However, most long-term jobs are indirect, arising along the renewable energy supply-chain (manufacturing, specialized services), and by adapting existing expertise to the needs of renewable energy (Hurth, 2013).

- *Innovations in products, practices, and policies in rural areas*. In hosting RE, rural areas are the places where new technologies are tested, challenges first appear, and new policy approaches are trialed. Some form of innovation related to renewable energy has been observed in all the case studies. The presence of a large number of actors in the RE industry enriches the "learning fabric" of the region. Small and medium-sized enterprises are active in finding business niches as well as clients and valuable suppliers. Even when the basic technology is imported from outside the region, local actors often adapt it to local needs and potentials.
- *Capacity building and community empowerment*. As actors become more specialized and accumulate skills in the new industry, their capacity to learn and innovate is enhanced. Several rural regions have developed specific institutions, organisms, and authorities to deal with RE deployment in reaction to large investment and top-down national policies. This dynamic has been observed both in regions where local communities fully support RE and in regions where the population is against potentially harmful developments.
- *Affordable energy*. RE provides remote rural regions with the opportunity to produce their own energy (electricity and heat in particular), rather than importing conventional energy from outside. Being able to generate reliable and cheap energy can trigger economic development (Box et al., 2010).

What is a 'SWOT Analysis'?

Basic elements:
The acronym SWOT stands for *Strengths*, *Weaknesses*, *Opportunities* and *Threats*, categories that are evaluated during strategic planning or analysis method for a business, company, project, product, or person. A SWOT analysis identifies and specifies the internal and external attributes that are helpful or harmful to achieving the objective (Figure 4). Decision-makers may evaluate the degree to which there is a strategic fit between internal and external characteristics of the objective (IEA, 2015).
The analysis will focus on attributes that give an advantage over others (*strengths*) or disadvantage relative to others (*weaknesses*), on elements of the environment that could be exploited as advantage (*opportunities*) or that could cause trouble (*threats*) in reaching the objective. All these categories are related, and it is useful to analyze them both separately and in connection with each other. For example, when analyzing the opportunities, it is useful to analyze strengths as new opportunities may open up, as well as weaknesses as whether they could open up opportunities by eliminating them. When using SWOT analysis, only precise,

verifiable attributes are accepted, the lists for the most significant factors are prioritized and trimmed as necessary, and options generated are carried through the strategy formation process and applied at proper decision levels. In conjunction with other analysis models, the SWOT frameworks for strategic thinking become extremely useful in the decision-making process (European Commission, 2016).

Putting renewable energy to work in rural areas:

A well-designed framework for regional policy could offer a real opportunity to reconcile policy trade-offs and identify potential complementarities among the three objectives of energy security, climate change mitigation, and job creation. These findings underline the need for a shift in the approach to rural development policy in many OECD countries away from a model that emphasizes spectral policy and subsidies, to one that is place-based and grounded in local conditions and opportunities and that focuses on the competitiveness of rural areas. Specific factors to bear in mind include (OECD, 2011):

- Embed energy strategies in the local economic development strategy so that it reflects local potentials and needs. Environmental and energy security arguments tend to be the main impetus for promoting renewable energy, and the local economic benefits tend to get overlooked.
- Integrate RE within larger supply-chains within rural economies, such as agriculture, forestry, traditional manufacturing, and green tourism.
- Limit subsidies in both scope and duration, and only use them to induce RE projects that are close to being viable in the market. If subsidies are too high, they can attract "rent-seeking" investors, can lead to high-cost energy that is only viable as long as high levels of subsidy are sustained, can have a negative impact on land use, and displace other activities such as agriculture and tourism.
- Avoid imposing types of RE on areas that are not suited to them. For example, wind power is only appropriate in certain places – more care is needed to identify those places rather than adopting policies that somewhat arbitrarily spread RE projects across national landscapes.
- Focus on relatively mature technologies such as heat from biomass, small-scale hydro and wind. These proven technologies are not likely to experience big jumps in technology that can make recently completed plants instantly obsolete.
- Create an integrated energy system based on small grids able to support manufacturing activities. The policy should take into account backstop technologies for intermittent power sources. In several regions, the capacity to deploy RE is constrained by grid limitations; however, there are no incentives to improve transmission infrastructure.
- Recognize that RE competes with other sectors for inputs, particularly land. Poor sitting can adversely affect local residents and disrupt tourism, which is typically a much larger source of income and employment.

- Assess potential projects using investment criteria, and not on the basis of short-term subsidy levels.
- Ensure local social acceptance by ensuring clear benefits to local communities and engaging them in the process. This is crucial, as local opposition can slow construction and may increase the difficulty of subsequent efforts to introduce RE projects. OECD (2011).

To conclude, the research demonstrates that there are no shortcuts to rural development. Policymakers should always take into account the overall cost of energy and implement the least expensive energy solution that can also satisfy carbon emission reduction requirements. Only a coherent and integrated development strategy can achieve the goal of promoting growth together with a better environment. Renewable energy is increasingly being championed as a new source of jobs in OECD countries, as well as addressing concerns with energy security and climate change. In most OECD member countries, governments have invested large amounts of public money to support renewable energy development and have also required that significant quantities of renewable energy be sold by energy providers. With most renewable energy facilities located in rural areas, what are the economic impacts of these policies and investments? Can renewable energy really help to develop rural economies?

These are some questions explored by this report, which presents the results of a two-year study of the impact of renewable energy on rural development. Drawing on case studies of renewable energy in 16 rural regions across Europe and North America, the report shows that renewable energy does not automatically create employment in rural regions. For renewable energy to trigger rural economic growth requires a coherent policy framework and the right set of local conditions (Gavan, 2012).

Positive impacts SWOT

- Local revenue
- Local jobs
- Innovations in products, processes, and policies
- Capacity building and local empowerment
- Affordable and reliable energy (GE Energy, 2010).

Strengths

- Under the EU's sustainable energy targets, the UK is obliged to generate 15% of its electricity from renewable energy sources by 2020.
- Average annual investment in renewable energy production has doubled over the past few years, reaching around £8bn in 2013.
- The UK is endowed with varied renewable energy resources in Europe, including wind, wave and tidal resources.
- Solar photovoltaics (PV) enable the domestic generation of renewable energy.
- The renewable energy market is supported by a number of government policies and incentives, such as Contract for Difference (CfD) scheme and Ofgem's Renewables Obligation (RO) scheme (EPIA, 2014).

Weaknesses

- Investment in renewable energy technology has been affected by financial issues due to the recession and market uncertainty.
- The cost of developing and building wind farms, biomass plants, and solar farms is high.
- Limited government funding for key technologies, such as onshore wind, solar and biomass, is likely to have a negative impact on investment in renewable technology.
- The lack of a consistent, long-term commitment from the UK government may have a negative impact on renewable investors' confidence, which is essential to achieve long-term plans for renewable energy.
- From the point of view of energy companies, to invest in large capital intensive renewable energy projects, these projects need to be commercially viable and generate enough return on investment; however, this is largely dependent upon the regulations and incentives provided by the government.
- The building of solar farms often involves protests by local groups and residents, as they are considered unsightly and damaging to the local landscape and wildlife (EPIA, 2014).

Opportunities

- Geographically, the UK is one of the windiest countries in Europe. This puts the UK in an excellent position to optimize the potential of wind power.
- The government's allocation of a £300m budget for low-carbon technology through the CfD scheme will prompt a new surge in renewable energy investment over the next few years.
- The UK's offshore wind market is one of the most established in the world.
- The UK can look to export its expertise to international markets.
- Technological advancements and innovations will help to boost renewable technology and reduce costs.
- Continued economic growth will stimulate overall energy consumption, including consumption of renewable energy (EPIA, 2014).

Threats

- According to EY in September 2014, the UK's attractiveness as an investment destination for renewable energy plants has dropped to seventh place, the lowest since December 2009.
- The UK government recently announced plans to cut subsidies for large-scale solar schemes — the Renewable Obligation (RO) scheme — from April 2015.
- As such, larger solar farm developers will be forced to compete for CfD subsidies. Furthermore, the lack of a consistent, long-term commitment from the government provides a degree of uncertainty and may have a negative impact on investors' confidence in the UK as a destination for renewable energy generation.
- Hydropower generated from inland sources has been affected by climate change, as it relies on regular rainfall.

- Nuclear energy may rival renewable energy sources and could become the preferred low-carbon energy source in the UK (EPIA, 2014).

New sources of revenue to support key public services and infrastructure

Renewable energy deployment increases the tax base in hosting rural communities and generates extra income for landowners and land-based activities. Developers have to pay taxes to the hosting community. Some of these taxes are paid at once, such as building permits; others are paid on a yearly basis and are related to the businesses' turnover. Local taxes provide revenue for the hosting community and can have a dramatic impact on service delivery, especially in countries – such as the United States – where local services are more dependent on local taxes. In several case studies (Abruzzo, Italy; Scotland, United Kingdom; Prince Edward Island, Canada), these tax revenues have increased the availability of key public services such as schools and senior residences. Local authorities can themselves deploy renewable energy installations in public space, taking advantage of public subsidies for alternative energy. Renewable energy in rural areas can also generate extra income for landowners and can be integrated with specific productive processes. For instance, in several of the case study regions, farmers and forest owners themselves produce renewable energy, allowing them to diversify, stabilize or increase their income (Selfa et al., 2010).

Jobs and business opportunities, especially when integrated into the local economic

Renewable energy can create valuable job opportunities for people in regions with few employment opportunities, although the number of direct jobs created is limited. Most of the direct jobs are in operating and maintaining the installations. Some of these jobs pay high salaries and can have an important impact on the long-term sustainability of rural communities. However, the largest share of long-term jobs is not in direct energy generation, but along the renewable energy supply chain – in construction, manufacturing, specialized services, and also rural activities such as farming, forestry, etc. Those regions which have policies to attract renewable energy on a large scale can generate a large enough demand for installations and components to attract supporting manufacturing services. Manufacturing companies may decide to base their operations in these regions to reduce transportation costs (e.g., transporting pillars for wind turbines), or to benefit from subsidies, grants, and tax breaks. This was the case of the Québec policy to deploy wind energy, for instance. Often, the presence of renewable energy installations can revive existing manufacturing activities not previously related to energy production. This was the case in Extremadura, Spain where the newest manufacturing jobs were created in firms producing metal frameworks to support solar energy installations, and in Maine, where the policy aims at reviving the shipbuilding industry through off-shore wind deployments (Frauenhofer, 2012).

A number of operational and infrastructure measures can be taken to address the challenges posed by variable renewables. These include:

- Adapting the operation of power systems. This can include the

application of advanced forecasting techniques, and adapting the market and power plant dispatch rules, for example reducing the time between the commitment of power plants to generate electricity and real-time operation.

- Extending the transmission grid to capture remote resources and increase cross border trade, so as to reduce the elects of variations in solar irradiation and wind speed on the system. This can be especially effective for wind (Schamber et al., 2012).
- Promoting demand-side integration. Modifying electricity demand according to the variable supply could reduce the system impacts of wind and solar and also avoid the need for other integration measures.
- Investing in storage (such as pumped hydro storage, compressed air, hydrogen or batteries). If deployed on a small scale (such as batteries for solar PV), storage can help to sustain reliance on local generation and defer grid investment (IEA, 2014b).
- Balancing fluctuations from the variable renewable output with flexible forms of generation, such as gas turbines.
- Curtailing extreme wind and solar power generation peaks, when variable renewables output is very high compared to electricity demand, to reduce the ramping up and down of power output from other sources (Baited, 2012).

While all measures may be advantageous individually, co-ordination between the integration measures is needed to maximize their benefits.

Getting the policy framework right

Renewable energy policy is expected to deliver in three key areas: energy security, climate change mitigation, and economic development. To many, sustainable energy is seen as a *panacea* for several policy challenges. They stress that

- Community-based coordination approach – "energy has to have a job"
- Renewable energy will contribute to energy security and independence in countries and regions. OECD countries have been seeking energy security since the first oil shock of the early 1970s, and it is still on the agenda today for geopolitical reasons and the need to reduce national and regional import costs.
- Renewable energy will dramatically lower carbon emissions.
- Investment in renewable energy will trickle down to other sectors such as construction, manufacturing, and services, thus creating new employment opportunities (Kamden et al., 2004).

Balancing the pace of deployment with regional capacity

Where renewable energy deployment in rural areas is largely incentive-driven, it is unclear if deployment levels can be maintained once current public incentives are phased out. In this context, specialization in the production of renewable energy responds to the economic opportunities associated with public incentives, rather than a demand for additional energy (Mills et al., 2012).

In many regions, policy interventions aim at creating manufacturing jobs in renewable energy technologies in a very short time,

creating a large and concentrated demand for components and installations hoping that the business community will immediately react to this opportunity. Often, rural economies struggle to generate the institutions and accumulate the knowledge to meet this demand in time. Small local labor markets, "sticky" skills, and a lack of intermediate institutions to co-ordinate collective action may force rural regions to rely on workers and investors from outside the region. In this way, long-term impact on regional development path is limited, external investors absorb most of the benefits generated by the public investment or subsidies, and the long-term impact on rural development is very limited, despite the cost of the policy (EnerNex, 2011).

Results

The overall impact on economic growth is generally much lower than expected. National and regional renewable energy policies have set very ambitious targets and high incentives for renewable energy production that have caused distortions. Incentives have triggered rent-seeking behaviors, and installations often compete with agriculture and tourism for the use of land or landscape amenities. In this context, many local communities have started opposing further deployments (IEA, 2011).

Renewable energy policy is expected to deliver in three areas: energy security, climate change mitigation, and economic development (job creation). However, this is not always the case and there can be significant trade-offs among them. For instance, large biomass heat and power plants can generate new employment opportunities in rural communities but may have a negative CO_2 balance due to land-use changes and transportation of feedstock over relatively long distances. Similarly, RE is in most instances a capital-intensive activity, and energy as a whole represents a small share of employment in regional economies. Small-scale installations typically source labor and equipment from international suppliers, so the impact at the community level in terms of job creation is rather limited. Listed in the list below are some of the factors helping or hindering renewable energy in achieving its three goals. Focusing on ensuring the supportive ingredients at present will be a step forward in putting renewable energy to work in rural communities (IEA, 2011).

Supportive

- High-quality RE resource
- Relatively expensive current energy
- Provision of small subsidies
- Ability to link RE to existing economic activity
- Good existing energy transport/transmission infrastructure
- Strong local community support
- Integration of RE within a broader energy framework that facilitates dispatch
- Mature technology
- RE relies on regional inputs that have limited current uses/RE complements existing input uses
- RE policy aims at producing cheap energy (renewable heat) (UNEP, 2011).

Impeding

- Low to moderate quality RE resource
- Low-cost conventional energy
- Provision of large subsidies
- RE is a standalone sector within the regional economy
- Project produces stranded energy that cannot be exported
- Significant local opposition
- Inadequate backstop energy for intermittent power sources
- Novel or infant technology
- Inputs for the RE project have a high opportunity cost in current use
- Excessive focus on job creation absorbs a large quantity of public resources that could be better spent connecting RE to the rural economy (UNEP, 2011).

Recommendations

Renewable energy (RE) is being championed as a potentially significant new source of jobs and rural growth in OECD countries, and a means of addressing environmental and energy security concerns. In most countries, governments have invested large amounts of public money to support RE development and are requiring significant quantities of it to be sold by energy providers. But what are the economic impacts of these policies and investments? Can RE really help to develop rural economies? These are some of the questions explored by this report, which presents the results of a two-year study of the impact of RE on rural development (Eisentraut et al., 2013). Drawing on case studies in 16 regions across Europe and North America, it finds that while RE indeed represents an opportunity for stimulating economic growth in hosting communities, it also requires a complex and flexible policy framework and a long-term strategy. RE is not going to create lots of jobs, but rather some additional employment opportunities in rural areas. Making a positive connection between RE development and local economic growth will require more coherent strategies, the right set of local conditions, and a place-based approach to deployment and will result in:

- Job creation and entrepreneurship in rural areas
- Preventing the migration of rural people to earn an income
- Poverty reduction in rural areas
- Developing and advocating eligible industry and best practices
- Rural development and agricultural economics
- Sustainable development in villages
- Increased electricity and heating
- Improvement to enhance desired characteristics
- Biofuel productivity
- Poverty reduction in rural areas

The report recommends putting renewable energy to work in rural areas. This implies a new paradigm for rural development. Reducing the use of spatially blind incentives, introducing a flexible policy framework, and taking into account the characteristics and specific needs of hosting economies could be a way to capitalize on the investment in renewable energy in terms of economic development. In particular, alternative energy should not be considered as a standalone sector within regional rural economies. Potential backward and forward linkages with rural industries such as forestry or manufacturing should be developed through an integrated approach to

renewable energy deployment. Collective action should be stimulated through intermediate institutions active in rural communities and policymakers should aim at involving a larger number of stakeholders in policy interventions to stimulate sustainable development and improve local support.

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