BEAST

Beyond Energy Action Strategies

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BEAST

D.2.1. - Guideline for identification of barriers

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01	10/12/14	Salvador Suárez	Guri Bugge Inga Kreicmane Salvador Suárez	Ylva Ek	P

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INTRODUCTION

The objective of the deliverable is to reinforce capacity for implementation of bankable local energy actions. Identification and initial preparation of local actions to be implemented was executed during the preparation period of the BEAST proposal. The aim of WP 2 is to mobilize and strengthen technical capacities of the local actors to prepare for successful partnerships and business model design for action implementation. This will result in concrete decision on how to identify and implement solutions that overcome existing barriers. It will also create understanding and the needed skills for strategic planning and action plan definition, including cost-benefit assessment and capacities for identifying suitable financial sources and new business models.

BARRIERS

There are barriers to maximum penetration of renewable energy that have to be properly identified and assessed, in order to define an effective strategy to overcome them. These includes technical, economic, political, social and environmental restrictions of different kind, that vary from region to region. . The report aims at defining a set of useful guidelines for regulatory authorities, policy makers, RES developers, utilities, and any other stakeholder with responsibilities or influence on the electric market.

The approach for looking for actions that might help to overcome existing barriers that are limiting the deployment of RES and energy efficiency, should consider:

- Thorough analysis of the existing situation, and identification of existing technical, economic and political (regulatory) barriers
- Analysis of possible solutions to overcome each of the barriers identified

- Estimation of the cost associated to the implementation of each of the proposed solutions
- Estimation of the impact of each implemented solution, towards the goal of maximizing RES penetration

The need for enacting policies to support renewable energy is often attributed to a variety of barriers that prevent investments from occurring. The objective is to offer a methodology that can support the definition of cost competitive policies necessary to foster RES development, so that the renewable energy potential of the regions participating in the BEAST project can be realized at a reasonable cost.

The barriers have been divided into a set of five categories:

- Technical barriers
- Economic
- Regulatory / legislative frameworks
- Social, including public awareness and externalities
- Market issues

TECHNICAL BARRIERS

Technical barriers are the most objective and difficult barriers to be overcome. The elimination of some existing barriers will only be possible through more intensive R&D efforts to look for solutions related to energy storage and reinforcement of grid stability expose to high penetration of intermittent RES sources.

The small and weak electrical grids are a main obstacle to maximum RES penetration, especially in island regions. The need to have back-up conventional power on standby for when the wind stops blowing or the sun does not shine, is an important cost that has to be supported by local utilities. Besides high percentage penetration of intermittent RES generated electricity induces stability problems electrical systems.

There are technical limitations and difficulties to manage power fluctuations in small electrical grids. The intermittence and variability of the RES such as solar and wind limits their maximum penetration in weak electrical grids. Rapid reductions in the power output from these sources, caused by the wind dropping off or a cloud passing overhead must be managed with appropriate control or short term storage systems to maintain constant power output.

The random nature of wind, solar and other RES sources makes it necessary to have conventional power systems in stand-by for when the wind does not blow or the sun do not shine.

Energy storage systems can help so that the capacity of the interconnection line is sufficient to meet the transfer capacity. There will be some loss of energy but may be more profitable or easier (due to environmental issues) than reinforcing the grid. Better planning of power systems with integrated energy storage, bottlenecks could be spotted in early phase with proper planning.

Reliable wind and solar prediction is possible through the development of climate models for 48 hrs forecast. This would be an important tool for electrical generation programming that would make a maximum use of available RES

Programmable loads to use excess energy from RES. Installation of RES that can provide some kind of "Ancillary" service: The use of RES, especially wind that cannot offer reduction of their output at many steps when required but only on/off decision creates more reduction when necessary to the wind power injection compared to the desired ones. Water desalination or H2 production for transport fuel could be two possible applications of variable loads capable of consuming excess electrical power from RES at valley hours of the demand curve.

Demand management, the possibility of displacing loads to level the demand curve. Peak shaving could contribute to adjust demand to supply from the RES generators.

Dynamic stability studies of the electrical grid to realistically asses the RES penetration limits, and cost effective solutions to reinforce the grids: The rigorous study of the grids is important to determine the weakest points which have to be reinforced in order to strengthen the capacity of electrical grids to absorb the RES electric power. This will allow making optimum investment decisions in the electrical infrastructures for maximum RES penetration

Reinforcement and extension of the electricity grid: Investment on transport lines and other generation and distribution infrastructure, could contribute to improve RES penetration.

Management tools with on-line dynamic security assessment tools: Using such software tools can provide aid to the operators of an vulnerable power system to quickly evaluate the danger of frequency deviations that could lead to a collapse of the power system. In such a way, they can place limits to RES penetration even more efficiently for various potential disturbances. The power of such tools is reinforced if they are combined with uncertainty management methods. Possibilities to remote control production of wind farms and other RES production systems, to adjust their output to the needs and grid capacity, could be important instrument to support the curtailment policy that could allow for increase of the installed RES power.

Hydropower provides an efficient balancing power cource in areas where this is available. Strengthening the grid between areas with and without hydropower water storage, can reduce the need of fossil fuels for backup.

New control concepts must be defined. Requirements on active power control, frequency control, voltage control: A critical indicator is the level of penetration in the electricity system, without harming the system as a whole. Improved focus on grid compatibility is the answer to this challenge. Development of new balance rules and reactive power capabilities coordinated under new philosophy for reactive balances and voltage control. Use of FACTS coupled with energy storage device enables two quadrant steeples control of VARs which means full range producing or consuming VARs.

ECONOMIC BARRIERS

Solutions to economic barriers should aim at supporting the developers of RES by reducing the risk of their projects, and practical policies that focus more on subsidies to RES generation, and the elimination of existing ones for fossil fuels and nuclear power.

Developing new renewable resources will require large initial investments to build infrastructure. These investments increase the cost of providing renewable electricity. Besides, renewables developers and customers may have difficulty obtaining financing at rates as low as may be available for conventional energy facilities. Financing costs can greatly affect the price and competitiveness of wind energy, since most of the cost is in capital and little is in operation.

Renewable energy investments generally require higher amounts of financing for the same capacity. Initial capital costs for renewable energy technologies are often higher on a cost-per-unit basis (i.e., $/kW).

Financing is unreasonably costly for renewable energy technologies. High financing costs are especially significant to the competitive position of renewables, since renewables generally require higher initial investments than fossil fuel plants, even though they have lower operating costs. Renewables developers and customers may have difficulty obtaining financing at rates as low as may be available for conventional energy facilities. Financial institutions are generally unfamiliar with the new technologies and likely to perceive them as risky, so that they may lend money at higher rates.

The initial high investment cost associated to renewable energy systems, makes it necessary to dispose of an stable price framework to guarantee that the investment can be recover in a reasonable time period

Small projects have high transaction costs at many stages of the development cycle. Renewable energy projects and companies are generally smaller than conventional energy projects. These small companies are less able to communicate directly with large numbers of customers. They will have less clout negotiating favourable terms with larger market players.

The reasons for high cost have to do with technological maturity. The biggest factor, however, is the lack of economies of scale. Unfortunately, as long as relatively few units are produced, prices will remain high. This leads to low demand and therefore low production volumes. Mass-commercialisation is needed for RES systems to be competitive with conventional technologies. This 'chicken-and-egg' relationship between production and consumption is one of the most fundamental challenges of commercialising a technology that competes with a mass produced incumbent

Risks associated with fluctuations in future fossil-fuel prices may not be quantitatively considered in decisions about new power generation capacity because these risks are inherently difficult to assess. Renewable energy technologies avoid fuel costs (with the exception of biomass) and so avoid fuel price risk. Thus, risks of severe fluctuations are often ignored. However, this benefit, or "risk-reduction premium," is often missing from economic comparisons and analytical tools because it is difficult to quantify.

No level playing field for renewable energy technologies. Undisclosed subsidies and some investment restrictions produce inefficient investment decisions. Public subsidies for conventional forms of energy, both implicit and explicit, are channelled in varying amounts to all forms of energy, which can distort investment cost decisions. Large subsidies for fossil fuels can significantly lower final energy prices, putting renewable energy at a competitive disadvantage if it does not enjoy equally large subsidies. Subsidies and lack of internalisation of externalities are principle problems to the development of all renewable energy technologies.

Conventional generating technologies have a lower tax burden. In many countries, fuel expenditures can be deducted from taxable income, but few renewables benefit from this deduction, since they do not use market-supplied fuels. Income and property taxes are higher for renewables, which require large capital investments but have low fuel and operating expenses.

Externalities are not internalised in energy/fuel prices. Without internalising environmental and other costs, renewable generation is more expensive than conventional technologies. Many of the benefits of renewables are "public goods" which not always motivate everyone who benefits to pay for them. The environmental impacts of fossil fuels often result in real costs to society, although environmental impacts and associated dollar costs are often included in economic comparisons between renewable and conventional energy, investors rarely include such environmental costs in the bottom line used to make decisions. Renewables will be unable to compete on a level playing field with conventional generation until new policies are adopted to internalize the public costs of these fossil fuel sources. As well as the economic benefit, there are social and environmental benefits associated with renewable energy such as reduced noise, clean air, no risk of spillage of fuel, attraction of eco-tourists, and reduction of greenhouse gas emissions.

RES are suitable technologies for distributed generation and may not receive full credit for the value of their power. Utility generation planning departments generally consider only the cost of generating electricity with a distributed technology, not the potential savings in transmission and distribution costs. RES fed into distribution networks near final consumers rather than at centralized generation facilities may not require transmission and distribution, but utilities may only pay wholesale rates for the power, as if the generation was located far from final consumers and required transmission and distribution. RES can help avoid investments to upgrade transmission or distribution lines. Renewable technologies are sometimes cost-effective when this integrated value is considered.

There is the need for price-setting policies by establishing favourable pricing regimes for renewable energy relative to other sources of power generation. A government may provide the subsidy from its own funds or may compel utility companies to purchase the electricity thus produced, passing the costs on to its consumers.

REGULATORY / LEGISLATIVE FRAMEWORK BARRIERS

Full value of distributed generating technologies is not always well assessed. Small renewable energy systems for distributed generation can help avoid, not only investment in new conventional generation power and fossil fuel consumption, but also investments to upgrade transmission or distribution lines. Renewable technologies are sometimes cost-effective when this integrated value is considered, and it is important that this vision be shared by regulatory authorities, which are able to contribute to define a framework that gives priority to RES development.

Grid connection and access is not fairly provided. Utilities may not allow favourable transmission access to renewable energy producers, or may charge high prices for transmission access.

Wind turbines have faced specific environmental concerns related to siting along migratory bird paths and coastal areas. Also urban development or territorial protection of different kinds affect the availability of land where to develop and installed different RES systems

Although ambitious objectives are set by national and regional authorities with respect to RES promotion, not always a credible realistic planning to achieve the objectives exists.

Individual home or commercial systems connected to utility grids can face burdensome, inconsistent, or unclear utility interconnection requirements.

Long lead time to obtain necessary permits. Exact time to obtain a license is legislative set but always much more time is needed. Especially spatial planning related to permits can take many years. Permits for new renewable energy plants are difficult to obtain due to not optimized administrative processes. They often include unnecessary requirements and lack transparency of information

In the absence of a legal framework, independent power producers may not be able to invest in renewable energy facilities and sell power to the utility or to third parties under so-called “power purchase agreements”.

A high number of authorities at local, regional and national level are involved in the authorization processes. For both permitting and financial support, and RES developers should submit the same or very similar information multiple times to different authorities. Besides complex, long, expensive and non-transparent procedure for obtain RES licences and permits, there are many organizations and intermediate structures of consultation without having a coordination and common direction between them. Too many licences, approvals, decisions for small systems <50 kW.

The current situation demonstrates confusing and imprecise procedures for the customer, also due to the existing “non-organic” legislation for authorization and certification. To this aim, some EU countries are trying to simplify their legislation by the creation of “unique” tests. Nevertheless, it persists too many relevant documents.

SOCIAL BARRIERS

General public usually have insufficient information to make informed choices on energy use. Most utilities provide little or no information about their emissions or the fuels they use. Because renewable technologies are relatively new, most customers know little about them. Even local electricity companies may be unfamiliar with renewables. Most utilities have not studied how renewable resources could fit into their systems or what local resources are available.

Proven, cost-effective technologies may still be perceived as risky if there is little experience with them in a new application or region.

Although environmental impacts and associated dollar costs are often included in economic comparisons between renewable and conventional energy, investors rarely include such environmental costs in the bottom line used to make decisions.

In specific markets, skilled personnel who can install, operate, and maintain renewable energy technologies may not exist in large numbers. Project developers may lack sufficient technical, financial, and business development skills. Consumers, managers, engineers, architects, lenders, or planners may lack information about renewable energy technology characteristics, economic and financial costs and benefits, geographical resources, operating experience, maintenance requirements, sources of finance, and installation services.

Information about RES to the population is essential for the acceptance of RES technologies and sites. Even local electricity companies may be unfamiliar with new types of renewables. Most utilities have not studied how renewable resources could fit into their systems or what local resources are available. Urban planning departments or building inspectors may be unfamiliar with renewable energy technologies and may not have established procedures for dealing with siting and permitting.

MARKET BARRIERS

These barriers could be considered “market distortions” that unfairly discriminate against renewable energy. Market failures will limit the development of renewables unless special policy measures are enacted to encourage that development.

Proven, cost-effective technologies may still be perceived as risky if there is little experience with them in a new application or region. The lack of visible installations and familiarity with renewable energy technologies can lead to perceptions of greater technical risk than for conventional energy sources.

GUIDELINES

KEY CONSIDERATIONS

Proposed schemes for development in the EU of energy and environment-related markets needs adaptation to local specificities. Local conditions for implementing RES and energy efficiency projects in the participating regions, should look at the existing restrictions, and consider actions to overcome these barriers. In the case of island regions, like the Canary Islands, the fragmentation of the territory and the existence of seven relatively small electrical independent island systems, condition small and weak electrical grids that limit the penetration of variable and intermittent RES. Regarding deployment of suitable RES technology, there are also important territorial constrains that limit availability of suitable land for RES systems, given the high environmental protection of a big percentage of the territory. To maximize the environmental benefits of RES, the systems should be installed minimizing the territorial requirements. In the case of PV, efforts should be made to promote the installation in urban and industrialized sites, making use of available roof spaces of existing residential and industrial buildings. Small power wind turbines could also be deployed at such sites. In the case of coastal regions, regarding big multimegawatt wind turbines, efforts should be made to deploy in the medium and long term, off shore technologies based on floating platform solutions, since conventional off-shore technologies are in many cases not suitable considering the depths of the surrounding waters of the islands.

Some European regions dispose of excellent direct solar radiation conditions, suitable for solar concentration thermoelectric technology. Nevertheless current commercial technology has been developed without considering restrictions of land suitable land availability or technical grid stability restriction typical of limited electrical systems. Currently commercial Concentrated Solar Power (CSP) plants with technical and economic thresholds of 50 MW, require 200 hectares of relatively levelled ground that are difficult to find in many European regions. Efforts should be made to develop solutions more adapted to rural areas, with technical and economic thresholds under 5 MW. Technology that could be developed in e.g. European islands, but that afterwards could be transferred to satisfy energy needs of other similar regions around the world and of small remote rural communities of Europe, and specially of less developed countries.

Reverse osmosis desalination systems to guarantee supply of fresh water, and the foreseeable mass introduction of electric vehicles in the medium term, offer two very interesting manageable loads for Demand Side Management, to offset the variability and non-manageability nature of RES.

Besides the existing relation between energy and environment highlighted by the European Commission 20-20-20 goals, the security of energy supply should also be a key aspect energy policy. Investment in complementary electrical infrastructure (energy storage, submarine interconnection, etc.) that can allow to make maximum use of available RES should reduce the exposure of regional, national and the European economies, to volatile fossil fuel markets. Heavy investment in RES and complementary electrical infrastructure could contribute to price stability in local energy markets, in most probable high rising oil prices scenarios.

All financial efforts to promote maximum use of available RES is not enough, if an effective policy promoting energy efficiency and savings is not also implemented. Currently in many European countries national policy of guaranteeing the same electricity prices all over the country, translates into important subsidies to local conventional fossil fuel electricity generation. This public support is introducing market distortions that don’t contribute to rational decision making processes related to investment on energy efficiency solutions by consumers.

ENERGY INFRASTRUCTURE

RES has achieved grid parity in many regions of Europe, especially in European island regions, where generation cost of electricity from wind and PV is below the generation cost of conventional fossil fuel power plants. Nevertheless these are variable and intermittent primary energy sources and bulk energy storage infrastructure is a key element to integrate Renewable Energy Sources (RES) into the electricity market. Energy storage systems are needed to stabilize small and weak grids in scenarios of high RES penetration. If investment in energy storage systems are included, RES electricity loses its cost competitive advantage when compare to conventional fossil generation (no grid parity if cost of energy storage is considered). Nevertheless if all positive and negative externalities are accounted for, public support in terms of subsidies for energy storage systems could compensate the market failures to deliver energy storage and other infrastructures needed to achieve higher RES penetration.

Reinforcement of electrical grids by including bulk energy storage capacity would help to guaranty increments of RES penetration without jeopardizing electric grid stability. Also important, in order to facilitate higher penetration levels of RES in the electrical systems, is replacing aging conventional fossil generation with new and small high efficiency generation running on diesel, natural gas or adjustable hydropower. The random nature of wind, solar and other RES sources makes it necessary to have conventional power systems in stand-by for when the wind does not blow or the sun do not shine. New more efficient generators with low technical minimum and fast response will give the needed flexibility in high RES penetration scenarios. This may lead to higher preventive limits to RES penetration (Dynamic limit). This small conventional power generation is also suitable for solutions based on hybridization with RES such as wind farms and PV systems. The hybrid RES-conventional generation is able to satisfy manageable power requirements that a RES system on itself is not capable of delivering. Small conventional decentralized generation will also allow for cogeneration. High heating demand in tourist resorts for heating of swimming pools for example could in partly benefit from cogeneration integrated with district heating.

SYSTEM STABILITY AND GENERATION ADEQUACY

Electrical European markets in Spain have advanced in the liberalization. Nevertheless small sizes of some markets, for example in European island regions, create conditions for a natural monopoly. Under these circumstances it is difficult to foresee that market forces can operate effectively by themselves to create an efficient electricity market. Regulation is needed to compensate structural failures that do not allow the market by itself to deliver the needed RES generation, transport infrastructure, and bulk energy storage systems. Public support mechanisms are needed for subsidizing investment cost of infrastructures and implementation of effective support schemes such as feed-inn tariffs for RES generation. Distribution grid infrastructures will also have to be reinforced to cope with distribution generation from PV, small scale hydropower andsmall wind turbine connected to the low voltage grid. These distribution grids will also have to face the challenge of handling mobile and unpredictable demand from a large fleet of electric vehicles in the future.

Information and Communication Technologies (ICT's) in general will be necessary for an intelligent and optimal management of the electrical systems under distributed generation with high RES penetration on the supply side, bulk energy storage capacity and electric vehicles and other manageable loads on the demand side. ICTs will be key to develop smart grids, contributing to the optimal management of the electricity value chain from generation (with a big share of RES), transport grids (reinforced with bulk energy storage systems), distribution grids (handling small RES generation and EVs), and consumption (with Demand Side Management for peak shaving, applied to RO water desalination plants, EVs recharging, and other manageable loads).

High levels of RES penetration will require energy storage capacity, adjustable hydropower and conventional fossil fuel generation to guarantee reliability and quality of supply. Therefore it should be addressed the need to maintain enough spin-off installed power. Markets by themselves will not assume this investment, and an appropriate remuneration scheme, supported both by public funding or tariff, should compensate capital and other operation cost of maintaining this idle generation equipment.

TECHNOLOGY NEUTRALITY AND MARKET FAILURES

A low carbon path to sustainable energy development, and energy security, should be a priority, and should influence the national and regional authority's efforts for promoting a regional policy of maximum RES penetration and energy efficiency.

Current support to conventional fossil generation in some regions, as in European islands, is a market distortion that reduces the impact of market based systems such as the European Trading Scheme (ETS) to promote the deployment of low carbon energy technologies.

Current subsidies to the fossil generation, which is aimed (with social and political criteria) at guaranteeing the same electricity prices all over the country, disregarding of conditions that might affect generation cost locally (as in the case of European island regions), might disincentive energy efficiency and does not does not allow to appreciate the real cost competitiveness of some mature RES technologies. The subsidies are working as environmentally harmful subsidies (EHS) promoting the status quo in the energy system of the Canary Islands, characterized by an energy mix with 93 % share of fossil fuels. Nevertheless it would be simplistic to just propose to eliminate current EHS such as existing public support for fossil generation, for the sake of creating a level playing field. There are important positive externalities to be considered from having cheaper prices of electricity. Thanks to subsidies to the fossil generation (reduce inflation, competitiveness of the tourist industry, reasonable desalinated water prices, etc.).

The key issue for increasing competitiveness of RES in the European regions participating in BEAST is to level the playing field by internalizing all benefits and cost associated to positive and negative externalities, of all energy alternatives. A complete region by region analysis of the impacts of all alternative energy technologies is needed. Aspects such as emissions are important, but other issues should also be considered, related to security of energy supplies, jobs, and compatibility of energy sources with the preservation of fragile ecosystems and impacts on the tourist industry.

There is an important issue with respect to visual impact and security to birds of aerial electric transport and distribution lines. Even if burying underground the transport lines is much more costly than the aerial alternative, in the case of islands, considering that distances for transporting electricity are small relative to mainland transport lines, public support should be given to the Transport System Operator (TSO) to commit necessary funds for the extra cost of investment on transport infrastructure.

SUPPORT TO RENEWABLE ENERGY SOURCES (RES)

Most promising technologies with potential to contribute to GHG reductions need market support mechanism to compensate the lack of cost competitiveness in the initial phase of their development. Support schemes that consider the future potential positive externalities of the new technology should be designed to support pilot projects. Implementation in European regions of this public support intervention to compensate market failures will help the new technology to develop through its cost reduction curve, until technology maturity allows it to be converted into a cost-competitive technology.

As an example, do to the general economic crises, and structural tariff deficits in Spain, feed-in tariff schemes to support RES have been suspended. New taxes have also been introduced that affect negatively the profitability forecast made initially by promoters of RES in the Canary Islands. These decisions affect investors' confidence and complicate financing of new RES projects. A special energy retribution regime is being considered for the Canary Islands Government to guarantee reasonable return on investment to RES projects, and to reduce uncertainties to private investors. These should contribute to the general goals regarding RES penetration set in the regional energy planning on the Canary Islands.

Grid integration of RES in weak grids is a key issue, as RES penetration levels increase. It is important to keep in mind the need for energy storage capacity demanded by fluctuating RES, when arguing about the current cost competitive of RES technologies such as small scal hydro power, bioenergy, onshore wind energy or PV. The generation systems by themselves have achieved commercial maturity and in cases grid parity, but when considering investment in needed energy storage infrastructure to integrate RES into the grids, the cost of is higher than the conventional fossil fuel power generation option.

Biofuels based on energy crops is not a cost-competitive option in the many European regions. Scarce water resources and the lack of suitable farming land due to complex orography, does not allow efficient harvesting of energy crops. Nevertheless there is a potential of available biomass currently not being used: the organic fraction of Municipal Solid Waste, the sludge of waste water treatment plants, animal farming manure, waste from agricultural and marine activities and forest biomass. Regulation and public support for effective market mechanism should accelerate the process for biomass introduction in electric power generation and for heat production, especially in the tourist sector (e.g. for heating of swimming pools). Also for new fuels for transport obtained from implementing biomass-to-liquid technologies.

APLICATION OF THE GUIDELINES

The implications of energy in the environment have especial interest in the participating regions, given their current economic reliance on imported fossil fuels.

There are important opportunities for the sustainable energy development in the European regions participating in BEAST, coming from the EU cohesion policy in the period 2014-2020. It foresees that an important share of the European Regional Development Fund (ERDF. 20% of the in more developed and 6% in less developed regions) be spent on the shift towards a low carbon economy, mainly on energy efficiency and renewable energy.

European funding for supporting sustainable energy development should specially target European islands and rural regions. The aim was to identify local actions that could be implemented by the European regions, to contribute to the goals set by the European Commission of reducing 20 % emissions of Green House Gases (GHG), by increasing 20 % RES and improving energy efficiency by 20 % by 2020. BEAST addressed the elaboration of the regions Sustainable 23 potential RES and energy efficiency projects have been identified in all nine participating European regions, and they will undergo a thorough and for in-depth techno-economic analysis, for assessing their potential for contributing on CO2 emission reductions. The analysis includes the assessment of public support needed to achieve reasonable return on investment for private investors, of these environmental friendly projects

Besides public support to achieve economic feasibility, other actions are necessary. Given the high upfront investment cost and the long investment recovery periods associated with RES, energy storage systems and other complementary infrastructure, a stable energy price framework is needed to reduce uncertainties and financial costs of these projects. A stable price framework to guarantee that the investment can be recovered in a reasonable time period.

Renewable energy technologies have experienced in the last two decades an impressive cost reduction, both in terms of investment and generation cost. In the process they have expanded their integration in the electrical market to become an important share of the energy mix of many European regions. Nevertheless increment of variable and intermittent RES electricity generation introduces challenges for grid stability, especially in small and weak island grids.

The link between energy and environment is especially evident in European island regions. The existing tax regime in these regions usually includes enough incentives for private investment in all economic areas. Nevertheless, considering the environmental benefits of RES, and their contribution to energy self-sufficiency, more specific fiscal subsidies should be included for investment in RES generation facilities. To promote the idea of European Islands as a testing lab for new clean energy systems, especially tax incentives should positively discriminate investment in new less mature RES technologies.

In the case of islands, given the relatively small size of its seven islands, the small and weak island grids, and the abundance of autochthonous clean and renewable energy sources, are excellent laboratories for testing new energy and complementary technologies. Support for the deployment in islands of less mature clean energy technologies will create market opportunities for them to develop, allowing to advance in the learning curve and cost reduction curve, before commercializing the new energy technologies in the continent.

Conventional generating technologies have a lower tax burden. Fuel expenditures can be deducted from taxable income, but few renewables benefit from this deduction, since they do not use market-supplied fuels. Income taxes are higher for renewables, which require large capital investments but have low fuel and operating expenses.

Low carbon should be not only considered when talking about electricity generation, but also should be applied to mobility, and even, in regions such as the Canary Islands, to water production. Due to lack of fresh water resources, islands are increasingly dependent on reverse osmosis desalination to cover an important part of its fresh water needs. In Lanzarote for example, almost all fresh water consumed comes from water desalination plants; systems that consume high quantities of electricity in the sea water desalination process.

Demand management addresses the possibility of displacing manageable loads to level the demand curve (peak shaving). The capacity of the RO systems to operate at partial loads makes them an excellent manageable load to complement the unmanageable RES generation (contribute to adjust demand to supply from the RES generators).

The electric vehicles are a very interesting option not only to substitute fossil fuels in transport, but also because their energy storage capacity makes them an excellent manageable load that could contribute to peak shaving of the electric demand curve, and also as a means to compensate for the non-manageable random nature of renewable energies.

Waste is currently an important environmental problem that could be converted into an energy business opportunity. Currently the organic fraction of waste goes to the landfill, and methane resulting from natural decaying goes to the atmosphere. There is urgent need to deploy suitable energy technology to make use of this biomass resource that also includes sludge from the waste water treatment plants which currently is being dumped at the landfills.

Public intervention is needed to guarantee a more level playing field for renewable energy technologies. Current public subsidies for conventional forms of energy, both implicit and explicit, are channelled in varying amounts, which can distort investment decisions. Large subsidies for fossil fuels significantly lower final energy prices, putting renewable energy at a competitive disadvantage if it does not enjoy equally large subsidies. Subsidies and lack of internalisation of externalities are some of the mayor barriers to the optimum development of renewable energy technologies in the archipelago. There are market distortions that unfairly discriminate against renewable energy, and that contribute with other market failures to limit the development of renewables unless special policy measures are enacted to encourage that development.

Although ambitious objectives have been by the Regional and national authorities of the participating regions/countries, with respect to RES promotion, not always a realistic planning to achieve the objectives have been in place, especially regarding territorial planning. Territorial protection of different kinds affects the availability of land where to develop and installed different RES systems. All communities should aim to supply part of their energy needs from RES, and therefore should look for suitable land that should be available for RES project developers. Pre-planning mechanisms should be implemented in which municipalities and Island Authorities are requested to assign locations for different RES types. Development of more rigorous impact assessment studies which should also consider social environmental positive impacts from RES should lead to the elaboration of territorial planning which identifies maximum percentage of RES in a specific area, accepting reasonable negative impacts with respect to the benefits obtained from RES development.

EXCEL FILE

There are important opportunities for the sustainable energy development. Coming from the EU cohesion policy in the period 2014-2020. It foresees that an important share of the

European Regional Development Fund (ERDF. 20% of the in more developed and 6% in less developed regions) be spent on the shift towards a low carbon economy, mainly on energy efficiency and renewable energy.

One of the aims of BEAST was to identify local actions that could be implemented by European regions, to contribute to the goals set by the European Commission of reducing 20 % emissions of Green House Gases (GHG), by increasing 20 % RES and improving energy efficiency by 20 % by 2020.

The BEAST initiative should allow learning from successful experiences in other regions, regarding effective strategies to accelerate RES projects implementation processes. It also will promote the creation of local discussion groups that will include the private investors, public administrations, and other stakeholders, to contribute ways to overcome all existing barriers. Barriers detected for implementation of new RES in the BEAST participating regions go from purely technical, to political/administrative, territorial, and economic. In the case of island regions, the mayor technical restriction is related to the small and weak island electrical grids that restrict the amount of intermittent and variable RES. The main political barriers have to do with existing different levels of Public administrations: National Government, Regional Government, and Municipalities (in the case of island regions, also Island Authorities). Besides the excess bureaucracy, there are also conflicts of competence regarding energy and territorial planning, which delay the authorization procedures of new RES infrastructures. Existing economic restrictions are related to high upfront initial investment requested by RES projects (with low or inexistent variable cost throughout the lifespan of the project).

Identified barriers will be the basis for most of the work to be carried-out in the project. The good and thorough diagnosis of the barriers is essential for defining and effective strategy to overcome this barriers and advancing in the project implementation. The correct identification of barriers is an important input for the Jam sessions, which are basically a brainstorming exercise. The issues in which participants will be asked to brainstorm are the “Problems” (barriers) and “Opportunities” (possibilities to overcome the barriers) to implement the proposed projects. Furthermore, the each Action Plan will be a compilation of Actions to advance in the project implementation, each one of these "Action" trying to develop a solution to overcoming an existing "barrier ". Therefore to identify properly the "barriers" (and correctly filling-in the template for each barrier is part of the job) is a key point off achieving the overall BEAST goals.

All 9 partners should contribute gathering information of the projects they have proposed in the region/country they represent. A total of 23 projects that will be reported in Deliverable of D 2.2 (Local present-state reports for implementation actions), These 23 projects were initially identified in the BEAST proposal preparation, and each partner should be responsible for reporting the ones he proposed.

Different templates in Excel format have been developed, for gathering information for each of the 23 proposed projects. The idea is to have all the information related to a project (project description, stakeholders and related barriers) in only one Excel file. Each of these 23 Excel books includes:

- **1st spread sheet:** template for gathering general information of the proposed project (to which the stakeholders and the barriers are related).
- **2nd spread sheet:** a template for including information of the different stakeholders, relevant to the project implementation.
- **3rd spread sheet:** A spread sheet for compiling information for each barrier. The Excel book will have as many of these spread sheets as barriers for the project has been identified.

How to fill-in the spread sheets:

- All 9 partners should contribute gathering information of the projects they have proposed in the region/country they represent
- When filling-in the different templates in the Excel format, you will see that some text is written in blue. The blue colour indicates those cells where you are required to choose from an existing list that will be displayed when you click to the right of the cell. In the rest of the cells you will be required to type text.
- Each partner is responsible for filling-in the Excel file for the projects he proposed

- Each partner will submit to ITC a Word document, explaining and analysing the information gathered on the templates of the Excel book of his project

The barrier analysis will be carried-out in Deliverable D 2.2. All 9 partners will receive support from ITC in the preparation of their contributions, and ITC, as WP 2 Leader will compile the information received from the partners for the 23 proposed projects into a unique deliverable that can be submitted to the EC. The partners will submit 23 Excel books with all necessary templates properly filled-in. Nevertheless the partners will also prepare a WORD document as part of the deliverable, where they can analyse and explain the information gathered in the Excel files. The excel files will include general project information, stakeholders information and several for the identified barriers to the project implementation.

Description sheet

In this sheet it is collected all the essential information necessary to set up a project's idea and to be the basis to carry out a project. It is divided in five main sections:

- General project information: It is important to identify the project and place it in its geographical context, as well as to know its promoters and the duration and proposed project starting date.
- Project description: The background to the situation that motivates to put the project into execution, the desirable objectives to be achieved by implementing the project and the expected results.
- Location: The exact proposed location within the island where the different elements taken into account in the project's implementation will be situated. The site description and the available or planned infrastructures in the area indispensable to achieve a high performance of the project's results.
- Energy technology description: This section describes all the available information regarding the energy system developed in the project, of its state of the art, and of projects carried out previously based on the same technology.

ENERGY SYSTEMS OF THE PARTICIPATING REGIONS

EAST SWEDEN

The Swedish energy system is based partly on domestic sources of renewable energy such as water, wind and biofuels. In addition, a large proportion of the energy supplied is dependent on imports such as nuclear fuel for electricity production in nuclear reactors and fossil fuels like oil and natural gas for the transport system. Swedish electricity production is based to a large extent on hydro-power and nuclear power, but the use of biofuels for electricity production and heating is constantly rising.

In 1990, 33 % of Sweden's energy was coming from renewable sources, and has since then increased to 48 % in 2010. Much of this increase is due to greater use of biofuels, particularly for the production of electricity and heat, and by the forest industry. Recent years have also seen an increase in the use of heat pumps, in turn contributing to a greater proportion of energy from renewable sources.

In the transport sector, by not later than 2020, the proportion of renewable energy used at EU level shall make up at least 10 % of the total demand for motor fuels. Sweden's target for renewable energy in this sector is the same as that of the EU. In addition, the country has a long term aim of the country's vehicle stock being independent of fossil fuels by 2030.

The annual supply of energy in the Swedish energy system is about 600 TWh. In 2011, the amount of energy supplied was 577 TWh. Fossil fuels accounted for about one third, 206 TWh, of the total. Oil products, natural gas, town gas, coal and coke accounted for 129 TWh of the total, with the remainder being made up of losses and use for non-energy purposes.
A total of 132 TWh of the energy supplied in 2011 came from biofuels, peat and waste, with peat accounting for 4 TWh and waste for 13 TWh.1 The district heating and industrial sectors are the largest users of biofuels, but a small proportion of the total is used as transport fuel.

Electricity production from hydro-power and wind power was 67 TWh and 6 TWh, respectively, in 2011. Wind power's contribution to electricity production increased by more than 70 per cent compared with 2010. About 30 per cent of the energy supplied, 168 TWh, came from nuclear fuel. Of this, 60 TWh was converted to electricity and the rest was accounted for by conversion losses.

In 2011, total final energy use amounted to 379 TWh, which is a reduction of 4 per cent from 2010. The industrial sector and the residential and services sector each used the same amount of energy, 144 TWh.

This is a reduction of about 7 per cent for the residential and services sector compared with 2010. Energy use in the residential and services sector is affected in the short-term by, primarily, the outdoor temperature as a large proportion is used for heating. Energy use in the transport sector amounted to 90 TWh, which is almost the same as in 2010.

Electricity is the dominant type of energy used in Sweden, and total final electricity use in 2011 was 126 TWh. The residential and services sector used the largest amount of electricity, followed by the industrial sector. Oil products constitute the second largest energy carrier after electricity, and their total final use amounted to 109 TWh. In Sweden, oil products and gas are used almost exclusively in the transport sector.

Different sectors 2005–2012, percent

Year	Share of renewable energy	Heating, cooling, industry etc.	Electricity	Transport
1990	33			
1991	34			
1992	35			
1993	36			
1994	36			
1995	36			
1996	36			
1997	37			
1998	37			
1999	38			
2000	38			
2001	39			
2002	39			
2003	40			
2004	40			
2005	41	52	51	4
2006	43	56	52	5
2007	44	59	53	6
2008	45	61	54	6
2009	48	64	58	7
2010	47	61	56	7
2011	49	62	60	9
2012	51	66	60	13

COMUNITÀ MONTANA VALTELLINA DI MORBEGNO - ITALY

Italy is highly dependent on energy imports as it has scarce domestic energy sources, producing less than 20% of its total energy consumption.

Italy is an energy dependent country, with 81.29%in 2011, much above the EU-27 energy dependency (53.1%). It is among the most energy dependent countries.

Italy imports most of its needs in oil and gas products, being a main net importer of primary energy in the European Union, after Germany.

Italy does not have nuclear power. In 2011, Italians expressed their opinion, by voting for the second time against nuclear power. Italy today is now the only G8 country without its own nuclear power since 1987, and is the world's largest net importer of electricity.

Biomass and waste energy holds the main part in total primary production of renewable energy, with 33.97%, followed by geothermal energy, with 32.59%, Hydro power accounts for 28.65% of the primary production of renewable energy, Wind energy accounts only for 3.82%, while solar energy 0.39% only.

Italian energy prices are indisputably higher than the European average, although the gap has been gradually narrowing, especially in the electricity sector, partly due to a higher competition. Italian prices are higher than average European rates, partly because Italy produces 70% of its electricity from hydrocarbons, while in the rest of Europe the same percentage is produced from coal and nuclear fuel.

In 1995, the government created an independent body, the Electricity and Gas Authority, to regulate and control Italy’s gas and electricity sectors. The Authority for Electricity and Gas sets the prices every 3 months based on the fuel price trend. Thus, the gas and electricity bills of Italian consumers continue to be strongly exposed to oil price fluctuations. Additionally, national and local authority taxes account for a large part of electricity bills.

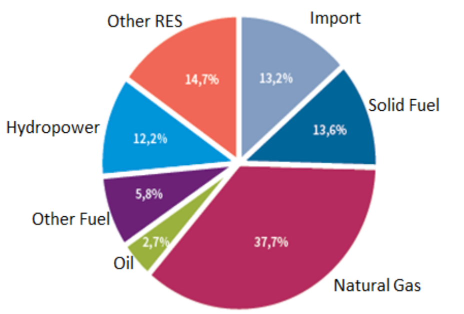
Following full liberalization of the electricity market for domestic customers too, which took place on 1 July 2007, Enel (the Italian largest power company) and other energy providers launched several commercial offers promoting responsible energy consumption. These offers guarantee that the energy source is renewable or because they include a small amount of financing for renewable sources.

The National Energy Strategy to 2020 (Interministerial Decree March 8, 2013) has the aim of substantially improving the competitiveness of the Italian energy system together with the pursuit of environmental sustainability.

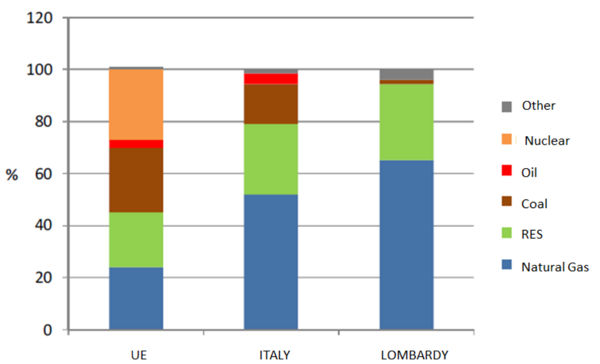
In particular, the objectives of the National Energy Strategy to 2020 include:

- reducing energy costs: alignment of prices to European levels (national electricity and gas bill saving estimated at about € 9 billion per year);
- exceeding the targets set by the 2020 European Energy Climate Package;
- greater security of supply, reducing foreign energy bill of around € 14 billion per year;
- boost to growth and employment with the launch of investment, both in traditional and in white and green economy, up to 180 billion euro by 2020.

The actions proposed in the national strategy are consistent with the EU process of decarbonisation to 2050, and assign a priority to energy efficiency, because of its strong contribution to the achievement of all four energy policy objectives, and renewable energy with special regards to thermal RES.



Italian production of electricity by primary source. Year 2012 (%)



Electricity mix: a comparison between European, National and Regional level
(Source: Lombardy Region, DG Energy)

The installed generation capacity in Lombardy region in the 2011 has reached 20,500 MW, corresponding to about 20% of the national plant system. About 60% of installed capacity is made up of thermal power plants fuelled by natural gas. In the last decade, the total installed capacity has increased to 6,800 MW, of which 30% related to renewable energy plants.

The Lombard Park's electricity generation is characterized by high energy and environment efficiency that makes the Lombardy an excellence in the landscape of the national energy system. The thermoelectric conversion efficiency has been improved overall by 10% (from just over 40% to over 51%), thus guaranteeing a reduction in overall energy requirements, with the same electrical output.

Renewable energy sources have substantially increased their role in composing the mix of electricity production, up to 30% in 2011. The energy produced from renewable energy sources in Lombardy, both electrical and thermal, in 2010 amounted to about 2.1 million toe, representing approximately 8.2% of gross final energy consumption in the region.

Lombardy Region considers the technologies for the exploitation of renewable energy sources and efficiency in production and use of renewable energy, powerful tools for economic growth. For this reason, the local energy policy seeks to invest in the green economy in order to stimulate the development of skills within local SMEs.

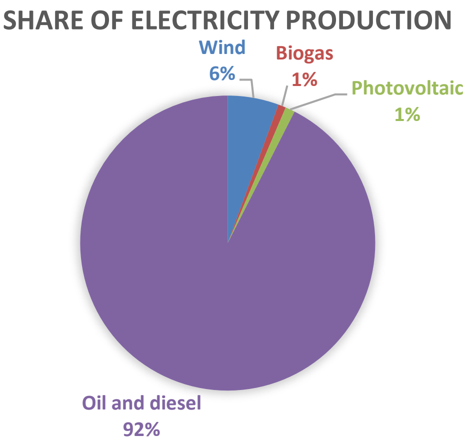
CYPRUS

In Cyprus about 97% of the primary energy use was imported in 2008. However, the European Union RES target (2020) for Cyprus is 13% giving Cyprus an opportunity to promote its own energy production and increase its energy independence of export in the near future. According to the national action plan Cyprus expects to meet this target. With feed-in tariff for large wind power plants the Cypriot National Renewable Energy Action Plan targets the largest renewable electricity share from wind power by 2020. Development has been fast. The Cypriot target of solar power including both photovoltaic and concentrated solar power is combined 7% of electricity by 2020, which will be one of the top ones in the European Union markets. Solar heating is the usage of solar energy to provide space or water heating. Solar heating per capita in 2010 was the highest in Cyprus of all European countries.

The energy profile of Cyprus in numbers is given below:

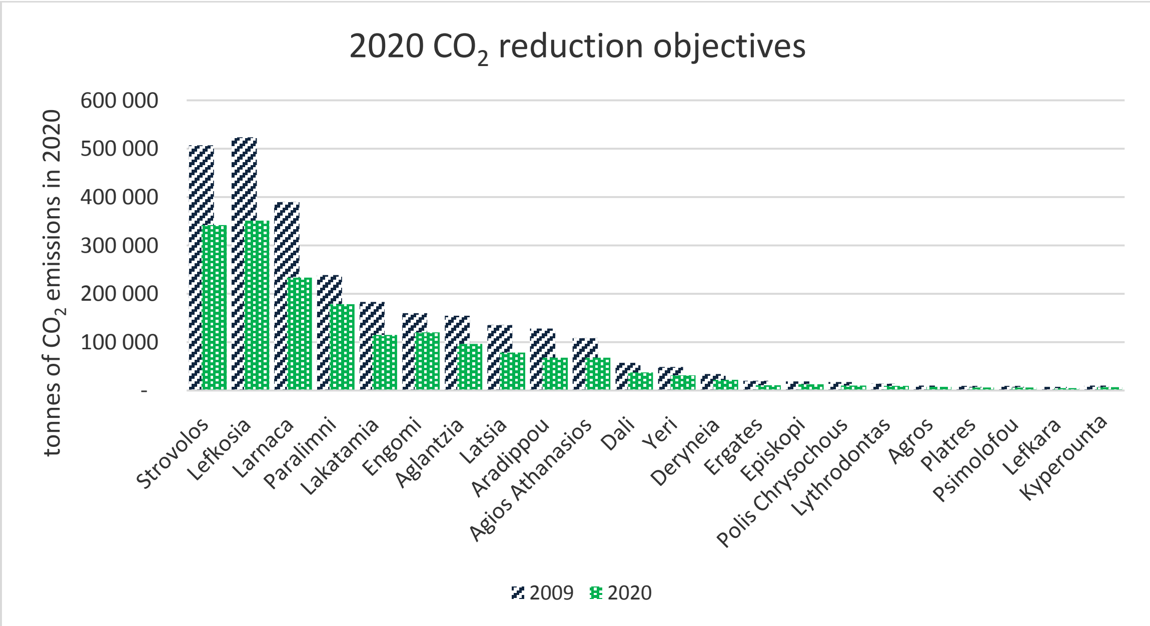
147 MW of wind parks are now in operation in Cyprus (230 GWh).	
32 MW of photovoltaics (both residential and commercial 45 GWh)	
9,7 MW of biogas plant (from pig manure 3.2 GWh)	
92% of the households has a solar collector for the production of hot water. 1m2 solar collector per capita	
Total installed capacity for electricity production 1477,5 MW Power plants utilize heavy fuel oil and diesel	

The Share of renewable energy sources on electricity production in 2013 was about 8% as shown to the pie chart below.



Until now 22 Sustainable Energy Action Plans have been prepared by the Cyprus Energy Agency. The work is conducted in the framework of "Covenant of Mayors" or the "Pact of Islands". The Energy Agency is the executive agency for the promotion of the "Covenant of Mayors", by appointment from the Organizations of Local Authorities in Cyprus. In total, the expected impact from the full implementation of the 22 existing SEAPs by 2020 is to achieve energy savings of 1,843 GWh, increase the energy usage of Renewable Energy Sources by 95 GWh and reduction of CO2 emissions by 612 kTons equal to 35% reduction in comparison with the year 2009.

The graph below presents an overview of the CO2 reduction objectives for the 22 local authorities.



MORE AND ROMSDAL FYLKESKOMMUNE - NORWAY

Most years, Norway is a net exporter of renewable energy to the European Union through international cables. This is though largely weather dependent. New transmission cables are planned to several countries, and if this gets implemented, the national electricity prices are expected to increase. These cables are not unanimously accepted by the political parties. The renewable electricity production in Norway is increasing, due in part to green certificates and other support schemes, and without exporting the surplus energy, it is expected that the electricity prices will get and stay so low that most bioenergy and small scale renewable projects will be unable to compete in the market.

The electricity produced onshore in Norway is almost 100 % renewable, but the total energy consumption varies between 60 and 65 % renewable. The transport sector uses mainly fossil fuels, and the oil platforms are fuelled by fossil gas. The goal is to increase the renewable share of the total energy mix to 67,5 % by 2020. This will be achieved by electrifying the transport sector (electric cars, buses, boats), other renewables in the transport sector (biogas buses, hydrogen buses, biogas trucks and lorries), and electric cables from the mainland to the offshore oil industry.

Electricity production in the county of Møre and Romsdal is 100 % renewable, except for natural gas and diesel backup generators in case of emergencies. The main source is hydro power, but there are also some influx from wind, biogas and solar (the latter two are negligible). The regional electricity production (6-8 TWh) is large enough to cover the general consumption, but due to large demand from industry, the total electricity consumption is twice as large as the production (12-14 TWh). The largest single electricity consumer is the aluminum producer Hydro Sunndal, who increased their consumption by almost 1 TWh in 2014 because of larger demand for aluminum.

The general electricity consumption per capita is high, as electricity is also the main source of heat. Although the county has plenty of resources for bioenergy and waste heat, less than 300 GWh of district heating is currently produced. One of the main barriers to district heating is the very low cost of electricity.

The grid is vulnerable to storms and other unforeseen events, and has a limited capacity. This limits the development of new renewable electricity projects. A new 420kV national grid line is under construction that will reduce the number of blackouts and need for fossil fuelled backup, and increase the grid capacity for new projects.

Financial Support

In a report from 2012, the research institution "Vestlandsforskning"showed that it is the lack of drivers, not the presence of barriers, that is hindering the Norwegian green shift. While private investors are reluctant to invest in green projects, the government has tried to introduce a varied list of economic benefits. Some of them are:

- Green certificates are awarded to new renewable electricity producers. Through a cooperation agreement with Sweden, Norway had promised to fund 13.2 TWh of renewable electricity projects before 2020.

- Enova is funded through the energy fund, presently containing 5 billion Euro. The money in the fund comes from state subsidies and a .1 Eurocent addition to the cost of each kWh of electricity. It is possible to apply Enova for funds to establish new renewable energy, district heating, low energy buildings, energy efficiency projects in buildings or industry, etc. Enova will not provide funding for projects that recieve funding through green certificates.

- Transnova has been a project under the ministry of transport, to provide funding for environmentally friendly transport projects. They have covered up to 45 % of the cost of speed chargers for electric cars, and have supported several projects to develop zero emission boats. From 2015 it is expected that Transnova will be integrated in Enova.

- Innovasjon Norge is owned by the Ministry of industry and fisheries, and the 19 county councils. It supports new businesses and new ideas in old businesses, and has a total yearly budget of 750 million Euro. Green industries is one of the major focus areas. Innovasjon Norge provides loans and grants. Under certain conditions, it is possible to get support from both Innovasjon Norge and Enova for the same project.

- Regional development funds are state subsidies distributed to the counties to ensure economic growth in all areas of the country. The funds are divided between municipal development funds (administered by the municipalities), Innovasjon Norge, and RUT (administered by the county administration).

- Since almost all hydropower companies in Norway are publicly owned, some counties and municipalities receive substantial dividends every year. The power plants are also required to pay property tax, and provide the host municipality and county with electricity to a reduced price (konsesjonskraft). Some of these municipalities and counties have established energy funds

- The agricultural sector can provide many of the most important commodities for bioenergy, and are important land owners. There are several funding schemes aimed towards this sector, examples are "SMIL" and "BU" funds administered by the County Governor.

- The County council in Møre and Romsdal has used the income from licenses to the marine industries to establish a "Marine environment safety and development fund". This fund targets local research institutions, municipalities and businesses, and aims to improve the environmental impact of the fish farming industry.

- Research institutions may receive funding from the Research Council of Norway, or from the different Regional research councils. Møre and Romsdal belongs to the Regional research council Midt (middle Norway). The total budget for these research councils exceeds 1 billion Euros.

- The industry has established a NOX fund in cooperation with the government. This fund may be used by the member businesses towards projects that reduce NOX emissions, for instance replacing diesel powered trucks or boats with LNG or electric vehicles.

- Through the EEA and Norway Grants, Norway supports developmental and environmental projects in other European countries. For the periode of 2009-2014, the funds totaled 1.79 billion Euros.

ROVINCE OF FLEMISH BRABANT - BELGIUM

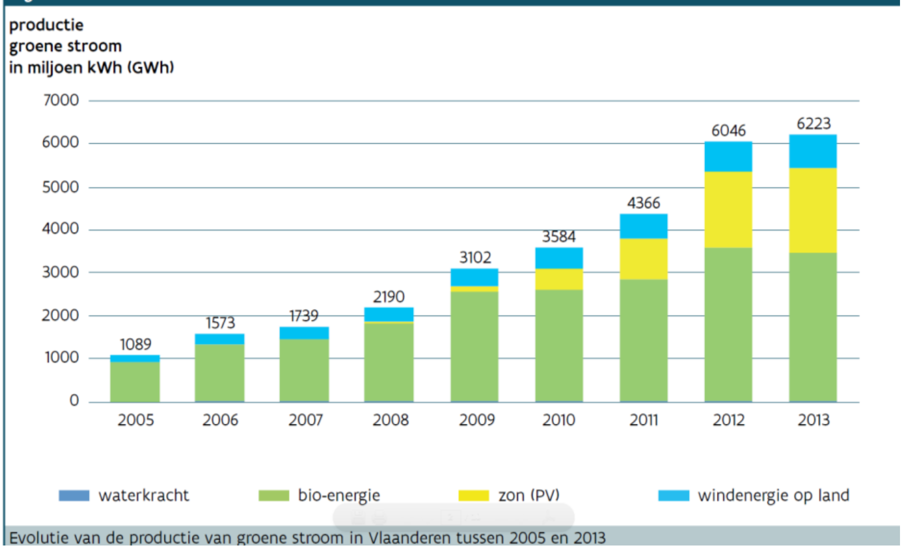
The Belgian energy system is heavily based on nuclear power and import. The share of nuclear power in electricity production is about 50%, one of the highest in Europe. In April 2014, 48% of electricity production was nuclear, 5% wind energy, 6 % solar energy, 30% gas and only 2% hydropower. Belgium aims to close down its nuclear plants by 2025, but this date will probably be postponed.

Belgium aims for 13% renewable energy of its final energy consumption by 2020. The region of Flanders aims for 10,5%. In 2013 5,9% of Belgiums energy consumption came from renewable sources, with a total of renewable energy production of 6.223 GWh. For electricity, the share of RES is 10,5%, for heating (mainly bio-energy) and transport both 5%. For transport, 77% comes from biodiesel, 17% bio-ethanol and only 5,6 electricity mainly for railroad. There are still very few electrical cars in Belgium.

Solar energy: till 2012 there was an exponential growth in photovoltaic installations due to extensive subsidies (“green energy certificates”). Since the subsidies strongly decreased in 2012, there is a substantial decrease in new PV-installations. Flanders has a total of 230.607 photovoltaic installations (total production capacity of 2.123.762 kW), of which 84.632 in 2011, 44.101 in 2012 and 3776 in 2013.

Belgium has 119 (onshore) wind turbines with a total production capacity of 440 MWe and only 17 hydropower installations.

On the other hand, since 2012 there is a growing share of residential and professional contractors who choose a “green” contract for their energy supply. In 2014 35% choose to buy energy from 100% renewable sources (32% in 2013, 20% in 2012). As this is more than the domestic production of RES, the Guaranties of Origin come mainly from Norvegian hydropower plants and since 2013 also from geothermal energy from Iceland. In 2013 the import of renewable energy consists of 70% hydropower, 15% wind energy and 6,5% biomass.



Evolutie van de productie van groene stroom in Vlaanderen tussen 2005 en 2013

CROATIA

There is a decreasing trend in final energy consumption in Croatian energy system between 2008 and 2011 by 6% and energy intensity of the economy is higher than EU27 average (160% of EU 27 in 2011). Total primary energy supply in 2011 in Croatia amounted to 383.65 PJ, and there is a relatively high energy dependence which was 54.4% in 2011 in which are dominant carbon energy sources like oil and gas who covered two thirds of the final energy consumption in 2011.

Since Croatia is importing 54% of its energy demand it is facing many challenges in the security of supply and continuous growth of imports in covering the overall energy demand. Oil and oil products represent 50% of primary energy supply in Croatia, and natural gas has a 25% share. Croatia has share of 15.7% of energy produced from renewable energy sources (RES) which is above EU27 average in 2011 which is 13%. When looking at the sectors 34% of gross electricity consumption was generated from RES while in heating and cooling consumption share of RES was 12.8%. In transport sector share of renewables is very low and in 2011 amounted to 1.4%. Electricity generated from renewables made for 26.3% of total electricity consumption generated in Croatia in 2011. Here, the electricity from large hydro power plants had a share of 24.6%, while the electricity from other renewables made 1.7% of total electricity consumption.

The total emission of greenhouse gasses (GHG) in Croatia in 2011 amounted to 28.3 mil/t CO2eq, with the largest share of the carbon dioxide (CO2) emissions which were 73.9% followed by methane (CH4) with 12.6% and nitrous oxide (N2O) at 12.4%. Emissions from GHG gases were growing steadily from middle of 1990 to 2008 when they started to decrease because of the economic crisis and collapse of the industry. The sectors with largest contribution to GHG emission in 2011 in Croatia were energy industries (27.6%), transport sector (25.9%) and agriculture (14.6%). The largest sectors in final energy consumption are the households/services (mainly buildings including public sector) with share of 49% and transport with 33% while the industry sector has a share of 17%. The transport is the fastest growing sector in terms of energy consumption in Croatia whose share has increased from 21% in 1991 to 33% in 2011 even though there was a relative (small) decrease in the past years.

It is important to note that almost 70% of energy spent in the building sector is attached to cooling and heating purposes. District heating (DH) systems, besides being old and inefficient have a very low coverage (just some 10% of the households). In the City of Velika Gorica the largest part of households is connected to district heating boilers owned by public company HEP Heating. The energy produced by this system was 63.32 GWh of heat and has the highest share in final energy consumption of 18.81%. Fuel used for producing this heat was mostly fuel oil. DH system consists of 14 boiler rooms from which are 13 fuelled by fuel oil, and only one by natural gas. The DH network isn't connected so there are actually 13 separated systems in the City and building of new biomass cogeneration plant could create one system. Use of biomass for producing electricity and heat is promoted in national renewable energy action plan NREAP.

There is a strong development potential on the islands in the field of energy production, more precisely related to renewable energy sources (solar and wind energy), which so far hasn't been recognized to sufficient level as an investment opportunity. The islands in Dubrovnik-Neretva County have a very good potential regarding solar energy because the value of medium annual irradiation on horizontal plane is between 1.5 to 1.6 MWh/m2. Currently in the county there is one operational wind power plant with capacity of 34 MW, with estimated annual production around 80 GWh, several PV installations, hydropower plant Dubrovnik with installed capacity of 216 MW (a half of capacity or 108 MW belongs to Croatia as well as an average yearly production of 690 GWh, the other part belongs to Bosnia and Herzegovina), and SHPP Zavrelje with installed capacity of 2 MW and average yearly production of 4.74 GWh.

Transportation sector in the Dubrovnik Neretva county has very high percentage in final energy consumption which is 50.22%, so the national goal to have 10% of RES in gross final energy consumption in transportation sector by 2020, if reached, will significantly reduce CO_2 emissions. To further reduce the consumption in transportation sector there should be promoted electric vehicles which could be charged with RES which are abundant in this region.

WESTERN ISLES – UNITED KINGDOM

The Western Isles economy is heavily dependent on imported fossil fuels. Fossil fuels account for **75%** of the total energy consumed in 2013. Liquid fuel sources make up a significant proportion of energy supplied. The largest fuel source in energy terms is gas oil, which accounted for **25%** of the total supply in 2013.

Energy is supplied by a small number of key players. These organisations import the bulk of petroleum products through the ports of Stornoway, Loch Carnan, and Ardveenish. The total non-electric fuel supply to the Western Isles in 2013 was **583 GWh**.

The Western Isles energy system faces a number of challenges, including:

Exorbitant energy costs – The Western Isles are reliant on imported liquid and gaseous fuels to meet their energy needs, but pay high prices due to their position at the end of the supply chain (i.e. transportation costs incurred from local shipping routes).

Exposure to supply interruptions – The Western Isles experience a higher frequency of grid supply interruptions than mainland areas and poor weather conditions interrupt fuel imports. The islands possess a local power generation infrastructure for times when a backup supply is necessary i.e. due to grid supply interruptions.

High energy consumption and emissions per capita – High use of liquid and solid fuels and inefficient appliances can result in high energy use and emissions on a per capita basis. High levels of energy consumption per capita are also understood to impact the levels of fuel poverty.

Gas oil is the most versatile fuel consumed. Gas oil supplied to the Western Isles is consumed by a wide variety of sectors including: commercial space heating, energy intensive industrial processes (e.g. aquaculture processing, and textiles), marine transport (e.g. ferries and fishing vessels), agricultural transport, and generation for back-up power supply in the islands power stations.

The domestic sector is the largest consumer in energy terms and residents on the Western Isles consume **25%** more energy per capita compared to the mainland. The total annual expenditure on domestic fuel sources was approximately **£25.36 million** in 2013. The average dual fuel bill is approximately £2,012. This is **49%** higher than the UK average.

The high levels of energy consumption per capita and the high fuel prices are consistent with the *Fuel Poverty Report 2013/14* which reports that the number of households on the Western Isles in fuel poverty is approximately 57%. This is significantly higher than mainland Scotland where 27% of households are in fuel poverty. The per capita carbon dioxide emissions of inhabitants on the Westerns Isles are 3% higher than those on the mainland.

The size of the Western Isles annual energy requirements, coupled with high fuel costs and its location at the end of the energy supply chain, present strong drivers for the exploitation of the abundant indigenous renewable energy resources. The Western Isles is home to a rich resource of renewable energy, particularly wind, wave and tidal energy. Island wide domestic and non-domestic renewable energy schemes generate approximately **74 GWh** through exploitation of these resources. This is expected to rise to 1.33 TWh should all of the planned and consented renewable energy schemes become operational.

To date, exploitation of these resources has been restricted due to low levels of indigenous demand and a constrained capacity for the export of electricity off the island network via interconnectors to the mainland. The larger scale renewable energy schemes planned for the Western Isles are heavily reliant on the subsea interconnector to the mainland, the installation of the subsea interconnector will unlock delivery of a substantial capacity of recently consented wind farms but is not anticipated to be operational until 2019 at the earliest.

CANARY ISLANDS

The Canary Islands are almost totally dependent on imported fossil fuels to meet its energy needs. It imports 7.18 million tons of fossil fuel (2011), with 3.25 million tons going to satisfy internal energy market needs. 64.46 % of this fuel goes for electric power generation, and 35.54 % goes to transport. Due to lack of fresh water resources, an important part of electricity production goes to water desalination production. The archipelago experienced high increment of consumption of transport fuel and of electricity and water demand in the last three decades, in accordance to high economic growth driven by its tourist and construction industry. Currently the archipelago is going through and economic crises that have reduced since 2008 its energy demand.

The 3,177 MW of installed electric power produces 9,368 GWh/year of electricity (2011). It is distributed among the independent electric island systems of the seven islands that make up the archipelago: Gran Canaria (1,251.7 MW; 3,707 GWh/yr; peak demand 576.9 MW), Tenerife (1,333 MW; 3,715 GWh/yr; peak at 573.5 MW) Lanzarote (229.1 MW; 874.7GWh/yr; peak at 143 MW) Fuerteventura (210.8 MW; 677.97 GWh/yr; peak at 111.8 MW) La Palma (116.4 MW; 272.5 GWh/yr; peak at 49.9 MW) La Gomera (23.2 MW; 44.87 GWh/yr; peak at 12.2 MW) El Hierro (13.1 MW; 44.87 GWh/yr; peak at 7.7 MW). Only Fuerteventura and Lanzarote are currently interconnected by submarine cable. Due to separating distances and the depth of the surrounding ocean waters (islands of a volcanic origin), submarine interconnections of the rest of the islands are expensive and complicated.

The fact that they are independent small island electric systems is an important restriction for increasing penetration of renewable energies. There are technical limitations and difficulties to manage power fluctuations in small electrical grids. The intermittence and variability of the RES such as solar and wind limits their maximum penetration in weak electrical grids. Rapid reductions in the power output from these sources, caused by the wind dropping off or a cloud passing overhead must be managed with appropriate control or short term storage systems to maintain constant power output.

The Canary Islands has excellent solar radiation conditions with more than 3,000 hours per year, and 6 kWh/m^2-day. Wind conditions are also excellent with constant winds with mean average speeds of 6 – 8 m/s, and with sites with potentials of 3,000 to 4,500 equivalent hours. The 143.93 MW of installed wind power produces (2011) 354.8 GWh, 3.8% of electricity demand. Photovoltaic installed power of 153.42 kWp (2011) produces 231.6 GWh, 2.47 % of electric demand. The PV and wind electricity production is contributing to the reduction of 460.910 Tons of C02/yr.

CONCLUSIONS

There are important technological, economic, political and social barriers that would have to be overcome in order to achieve the goal of maximizing the use of available renewable energy resources in different European regions. Through BEAST projects have been identified during the proposal preparation stage, the objective of this document is to offer a methodology to address the existing barriers of each project, and gather information on them on a more or less standardize way for all the 23 projects to be analyse.

Developing new renewable resources requires relatively high initial investments to build infrastructure. Initial capital costs for renewable energy technologies are often higher on a cost-per-unit basis (i.e., €/kW). These investments increase the cost of providing renewable electricity. Besides, renewables developers and customers may have difficulty obtaining financing at rates as low as may be available for conventional energy facilities. Financing costs can greatly affect the price and competitiveness of wind energy, since most of the cost is in capital and little is in operation.

Financing is usually costly for renewable energy technologies. High financing costs are especially significant to the competitive position of renewables, since renewables generally require higher initial investments than fossil fuel plants, even though they have lower operating costs. Renewables developers may have difficulty obtaining financing at rates as low as may be available for conventional energy facilities. Financial institutions are generally unfamiliar with the new technologies and likely to perceive them as risky, so that they may lend money at higher rates.

The initial high investment cost associated to renewable energy systems, makes it necessary to dispose of an stable price framework to guarantee that the investment can be recover in a reasonable time period.

The reasons for high cost have to do with technological maturity. The biggest factor, however, is the lack of economies of scale. Unfortunately, as long as relatively few units are produced, prices will remain high. This leads to low demand and therefore low production volumes. Mass-commercialization is needed for RES systems to be competitive with conventional technologies. This 'chicken-and-egg' relationship between production and consumption is one of the most fundamental challenges of commercializing a technology that competes with a mass produced incumbent.

No level playing field for renewable energy technologies. Undisclosed subsidies and some investment restrictions produce inefficient investment decisions. Public subsidies for conventional forms of energy, both implicit and explicit, are channelled in varying amounts to all forms of energy, which can distort investment cost decisions. Large subsidies for fossil fuels can significantly lower final energy prices, putting renewable energy at a competitive disadvantage if it does not enjoy equally large subsidies. Subsidies and lack of internalisation of externalities are principle problems to the development of all renewable energy technologies.

Risks associated with fluctuations in future fossil-fuel prices may not be quantitatively considered in decisions about new power generation capacity because these risks are inherently difficult to assess. Renewable energy technologies avoid fuel costs (with the exception of biomass) and so avoid fuel price risk. Thus, risks of severe fluctuations are often ignored. However, this benefit, or "risk-reduction premium," is often missing from economic comparisons and analytical tools because it is difficult to quantify.

The capacity of the proposed projects to generate a return on their investments is the primary bankability criteria that private investors will look at, in their decision making process. Nevertheless it has to be kept in mind that there might be public benefits, economic returns to the community, in terms of positive externalities of the proposed bankable projects, that have to also be valued an accounted for. They include job creation, emissions reductions, reduction of energy dependence from outside polluting fossil fuels, etc.

Until all negative externalities associated to the use of conventional fossil fuels are considered and the positive ones related to RES benefits are fully valued by energy markets and correctly internalized in the electricity prices, RES will still need public support. While RES have environmental benefits compared with conventional electricity generation, these benefits may not be fully reflected in electricity market prices, and cost-benefits to the society, and not just to the private investors, are currently not appropriately represented in the production cost of electricity.

After the elaboration of the preliminary list with the 23 identified potential projects in the 9 participating regions, the identification and characterization of the existing barriers have been done for each project. The next important milestone is the elaboration of feasibility analysis for the projects.