An Overview of Renewable Energy Sources in SE Europe, Challenges and Opportunities

The big challenges for the further development of the energy sector in SE Europe should be seeing in line with the European and global strategies for energy and environment. A number of significant developments in terms of policy and infrastructure are currently taking place in SE Europe which when completed, by the end of this decade, will have helped reshape the energy landscape of the region. Radical changes in the energy mix (mainly due to the introduction of natural gas and RES penetration), reforms already underway (unbundling procedures, market liberalization) and other transformations will enable the region to meet new challenges stemming from the need of increased energy security, which in turn means a more diversified energy mix and long term provisions to meet anticipated demand increase. The electricity market is emerging as one of the most vibrant and faster moving sectors within the broader S.E. European Energy sector. On the other hand the high potential of renewable sources in S.E. Europe, such as solar, wind, hydro, biomass, and geothermal still remains largely unexploited. However, the region of SE Europe is characterized by distinctly different (in terms of structure and operation) and frequently segregated, electricity “markets” and in various stages of development.

It is generally recognized that lignite and coal will continue to contribute to power generation but with decreasing trends in the long term. Over the next ten years solid fuel’s share is anticipated to steadily increase in some countries in the region to meet increasing demand. On the other hand, gas will continue to gain share in the energy mix, at least over the next 15 years in Europe and in the S.E. European region in particular, substituting old and inefficient lignite and coal units, mainly because of its environmental friendly characteristics and increased availability, the higher demand for gas-fired electricity and the expected socio-economic development. In contrast with natural gas, the share of oil in electricity production will keep decreasing the zero levels.

SE Europe’s geopolitical position is unique as an energy bridge between eastern producers and Western consumers. In this respect, the importance of the region’s diplomatic, strategic and economic advantages, which may result from extended electricity and gas interconnections for the whole SE Europe, must be considered.

The further development of the region's transmission grid and the proposed new cross-border electricity and gas interconnections is of a paramount importance for advancing the unification of the SE European electricity and gas markets. Energy security through the development of local energy sources and diversification of the energy mix is a major policy driver also for renewables. Growth of renewables' share generally contributes to energy diversification, in terms of technology but also in terms of geographical sources. Extensive use of renewables can also reduce fuel imports and insulate the economy to some extent from fossil fuel price rises and swings. This certainly is likely to contribute towards the strengthening of energy security in a region where most countries are net electricity importers.

Hydropower is one of the most important indigenous energy resources for electricity production in most countries of S.E. Europe and therefore it is an energy source with a great strategic importance. Hydro resources have a predominant share in power generation in Albania, Montenegro and Croatia while in Serbia Bosnia - Herzegovina and Romania where hydropower constitutes the most critical energy resource. However, the existing hydro plants provide inadequate electricity supply for the countries of the region. It is expected that refurbishment of existing old hydro power plants will improve the power generation output and the economics. Especially, for SHP (small hydro), new concepts in design, construction and operation with advanced electromechanical equipment and the automations result to the optimum exploitation of the hydro potential with parallel social and economic benefits. On the other hand, hydropower has the potential of becoming more economically attractive via improved turbine designs and cost effective plant construction in combination with new technologies for control and automation and generation optimization, as part of integrated water management systems. However, to exploit such potential, many administrative barriers must be overcome over the next years, minimizing bureaucracy, decreasing soft costs and introducing simple electronic procedures for the investors. Also, hydroelectric power plants have to comply with a number of environmental protection regulations.

The favourable climatic conditions and topographic relief in the Balkan Peninsula, especially of Western Balkans, create advantageous conditions for water sources and water head development with a considerable SHP potential and large hydro as well. Having in mind the expected high wind and solar penetration into the electricity systems the storage facilities through pump storage would be an important component of future electricity systems. Therefore, new concepts in the design of

medium and large hydro should be introduced. Moreover, new hydropower plants should be designed as multi-purpose plants to combine water uses, power generation/pump storage, protection against floods. However, despite this important potential there has not been adequate development in the exploitation of SHP and in the introduction of more efficient technologies and equipment with automation. In most countries in the region, existing SHP plants have in many cases old electromechanical equipment of low efficiency and reliability (e.g Romania), resulting in low energy output, while a number of older SHP plants have been abandoned or must be rehabilitated (e.g. Albania).

Several development efforts have been undertaken in recent years for the exploitation of the SHP potential in the region. Currently the installed capacity of SHP in the region is estimated to be 1.700 MW but the actual potential is much higher. For the effective exploitation of the considerable SHP resources in the region, efforts in the improvement of the institutional framework, the use of new and improved technologies and the introduction of new methodologies and optimal utilization concepts must be undertaken.

As far as wind energy is concerned, the region has a relatively small penetration of wind installations totaling some 5.500 MW of installed capacity mainly in Greece, Romania, Bulgaria and Croatia. It is interesting to note that since 2011 the installed capacity of new wind installations in SE Europe (exclud. Turkey) was almost 3.300 MW. Despite the lack of wind investments in the rest of the countries of the region (Montenegro, Serbia, Albania, FYRO Macedonia) the wind regime in the Balkan peninsula, due to the geographical/meteorological conditions and the ground relief, is very attractive for power generation.

(Table shows the installed electricity capacity from various forms of RES notably Hydro, Wind and Photovoltaics in the different countries together with the corresponding total installed electricity capacity of each country's interconnected grid. This comparison reveals rather high RES penetration in the electricity mix of the various countries ranging from 28% in the case of Turkey to 96% in the case of Albania. It is characteristic of the West Balkan region that hydro is the predominant form of RES to the almost exclusion of all other types, save biomass which is used for space heating and cooking purposes, which in most cases remains unaccounted for due to lack of verifiable data. However, biomass, especially in the case of West Balkans could turn out to be a significant RES source with good potential for commercial

exploitation. In the case of hydro it is important to note that the installed capacity as it appears in the above table includes both large and small hydro plants.)

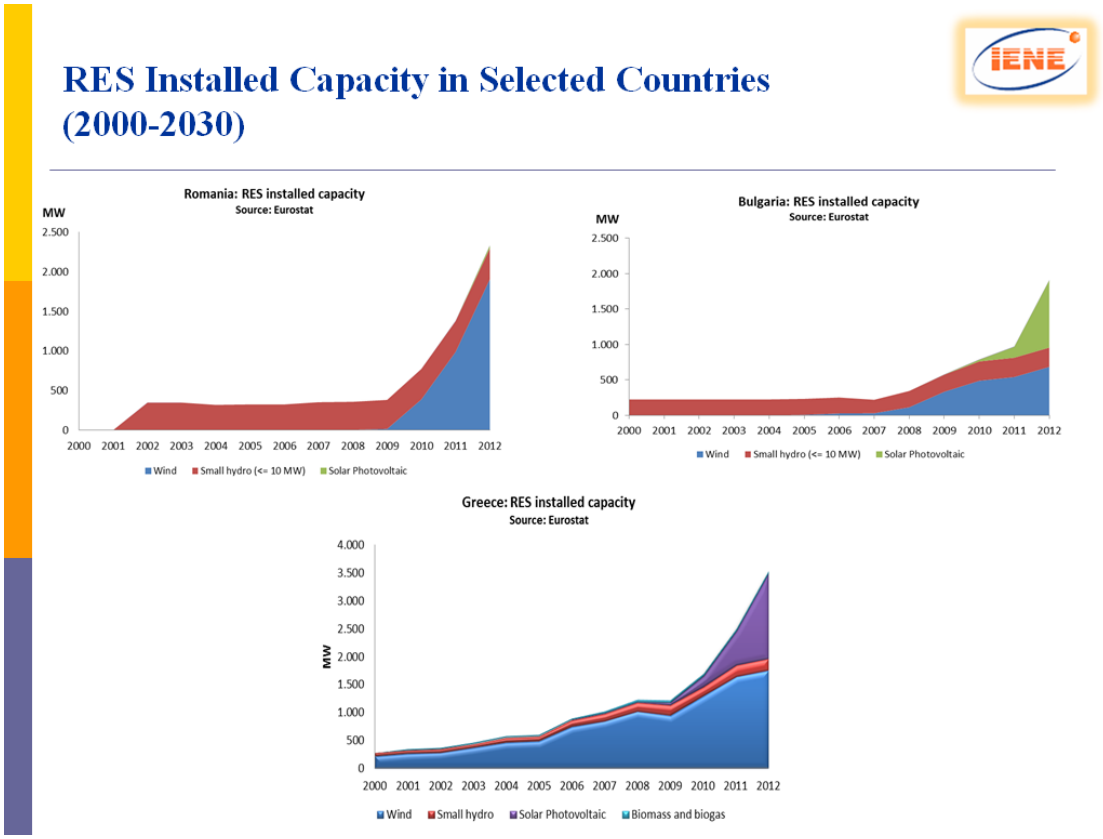
Installed Electricity Capacity in SE Europe, and the share of RES in electricity generation (MW, 2012 - 2013)

	Hydro[1]	Wind	PV	Total RES	Total Electricity (MW)	RES (total %)
Albania	1.466	0	0	1.466	1.496	96%
Bosnia & Herzegovina	2.058	0	0	2.058	3.803	53%
Bulgaria	2183	682	980	3.874	13759	29%
Croatia	2.112	180	2.9	2.295	4.268	54%
FYROM	580	0	1	581	1.600	36%
Greece	3.060 +218	1750	2.600	7.673[4]	17700	44%
Montenegro	660	0	0	660	870	73%
Romania	6.400	2.095	94	8.640[5]	17360	50%
Serbia & Kosovo	2.831	0[6]	2	2.833	8.360	34%
Turkey	14.000	2312	2	16.500[7]	60.121	28%

[1] Including both large and small hydro
[2] Including some 50 MW of biomass installation
[3] Including some 40 MW of biomass installation
[4] A wind farm of 120 MW is under construction since September 2013
[5] Including 180 MW of geothermal power plants

However, concentrated growth of variable renewable sources can make it harder to balance power systems, which must be duly addressed. The Western Balkan countries should avoid the mistakes of countries like Greece and Bulgaria which introduced exceptionally high feed in tariffs without a proper financial analysis and cash flow projections slowing the impact that RES would have on the national accounts and electricity market operation over a long time period. This rapid and unplanned build up of renewable energy based on high feed in tariffs had a dramatic impact on the operation of the electric system leading to large financial deficits for the market operator with big payments delays to producers. Currently Greece and Bulgaria had to introduce retroactive measures with lower Feed in Tariffs. However this is having a strong negative effect to the investors as they ponder over reduced earnings and extra new taxes. (*As can been seen in Figures 1 to 3 the RES installed electricity capacity has risen steeply in Bulgaria, Greece and Romania from 2009 onwards mainly on account of photovoltaics and wind. In Turkey RES applications have also risen fast over the last five years on account of hydro, wind and geothermal.*

According to latest information and in view of extensive revisions in the Feed in Tariff system, RES's growth trend in Greece and Bulgaria is to be seriously curtailed over the next few years during which time we shall see a rationalisation in the RES market with a more normal growth pattern returning after 2016.)



The non-binding targets imposed by the EC for 2030 is a good opportunity for the countries of West Balkans to not attempt a sharp penetration of RES over a short time period but rather follow a step by step approach trying new and innovating funding schemes together with a rationalized feed in tariff system. The non binding targets of the EC can further provide the opportunity for national policy innovation and competition of ideas and projects for best practice and one should therefore look for key success factors in RES policy.

Although feed-in tariff policies have gained worldwide popularity, their cost effects have become a primary concern for policy makers in many countries. Whether the rising costs are recovered from ratepayers or taxpayers, they can create both political and economic pressures as the experience in Greece, Bulgaria, Spain and Italy has showed. Households in emerging economies are particularly vulnerable to rising

tariffs, as spending on energy accounts for a larger share of their incomes than for households in mature economies. Under this perspective the development of the RES sector should be based also on public sector's involvement in large scale projects in order to avoid transferring the production costs from the Transmission Grid Operator to the final consumer. It should also be mentioned that the higher penetration of RES in the electrical system of a country, the greater must be the transformation of the electricity network as a whole. Again something which is not happening in countries such as Romania, Bulgaria and Greece which have experienced strong RES penetration in recent years.

In the electricity systems of today, the new challenges are how best to integrate and manage RES ensuring a reliable electricity supply. Integration of RES into the operation and management strategies of the systems must be introduced regarding also the intermittent character of solar and wind power generation. The efforts in this area provide a vision of the future electricity networks with RES integration and storage. The storage should be based on RES energy available during the low demand periods and high generation, e.g. wind energy, in tandem with water storage to avoid more CO2 emissions and to meet with the intermittency character of most renewable energy sources.

It should be underlined that a new era in the development of electricity networks has already started with the change of the energy mix and the introduction of new technologies in order to address environmental considerations. All the involved parties in these actions must share the same vision in order to achieve the best results.

The mix among renewable resources, based on their complimentary aspects and the available potential, with conventional resources should be optimized for the system aiming at high penetration of RES with social and economic benefits. An important aspect for the system operator is the geographical distribution of RES units over the country and the use of advanced new technologies (e.g. one man technologies) in order to attain more benefits for the network, low costs and facilitate RES penetration in the grid.

Moreover, introduction of modern grid codes leading to advanced RES power generation technologies for successful integration into the network with high penetration should be considered. Access and connection to the grid, reinforcement

of the grid and interconnection lines with high capacity between neighbouring countries is needed for in large scale RES applications (e.g. wind, solar).

Cross-border trade is also of extreme importance for all countries in the region. To exploit the high energy trade potential of the region we should undertake concrete measures to overcome existing differences in traditions, cultures, economic level, and bureaucratic status and to adopt the appropriate legislation in order to encourage foreign investments and trading. In addition we need to strengthen the existing interconnections and build new infrastructure in order to enhance the Net Transmission Capacities available for Cross Border Trading.

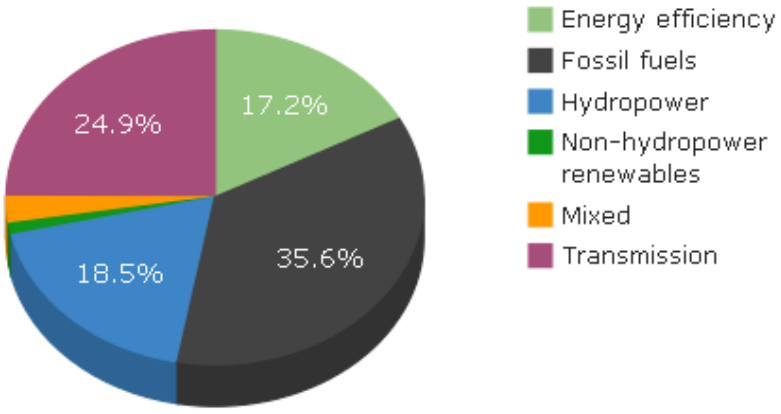
Infrastructure across borders is an important prerequisite for electricity market integration in SEE countries. If there is a need for developing infrastructures, investments should be carried out in a co-ordinated way and follow market integration. Improving the infrastructure can further increase the security of supply and contribute to a better environment and increased competitiveness. Ideally, RES investments in the region should come on stream together with large-scale strategic investments on new power generating capacity from conventional sources, grid infrastructures and interconnections.

Each country should develop an energy security strategy in conjunction with its neighbors. More interconnectors should therefore be built while greater infrastructural connectivity could cut costs of energy by a half and could balance out unpredictable fluctuations in wind and solar energy. In this sense it is vital to develop storage capacities, especially for renewable energy. As already stated development of RES can also contribute towards improving SEE countries' energy security and independence. Start early with expensive and difficult reforms instead of putting them off. Energy reforms require long-term thinking. EU is very willing and able to provide technical advice, but reforms require domestic action. In terms of energy security Renewable Energy Sources in SEE Europe already contribute to a fair extent mainly through the participation of hydro units, both large and small, and their key role in maintaining storage capacity. For wind energy systems to be effective in terms of energy security they will have to be linked to pumped storage schemes.

SEE remains energy intensive and improving its efficiency is a key priority for the countries in the region. Increasing the volumes of green energy generation, including hydropower, is helping to achieve that while cutting carbon emissions. As facilities using certain types of fuel − coal and fuel oil in particular − have been finding it

increasingly more difficult to attract funding and secure public support, the cleaner hydro power production today receives much more attention than a decade ago and is seeing increased funding. Indigenous hydro power resources would allow the countries to curb this reliance. It should be noted that between 2006–2012, fossil fuels received a massive 32 times more financing in West Balkans than non-hydropower renewables from the IFIs and the EU's IPA funds (Instrument for Pre-Accession) or 1.8 times more than renewables including hydropower. On the other hand energy efficiency received only 17 percent of the total EUR 1.68 billion invested by the IFIs and IPA during the same period.

EBRD, World Bank Group, EIB, EU-IPA: Energy financing in the Western Balkans 2006-2012 (in % and 100 million EUR)



Security of energy supply should be a key objective of governments of the SE European region. With a number of threats to future accessibility of conventional energy supplies having been identified, there is growing concern that alternative energy sources need to be found. In this respect renewable energy systems are well placed to help reduce the risk of energy supply disruptions (when fully developed) and the current reliance by many countries on imported fuels. Renewable energy sources can be widely distributed and, in many locations, can provide alternative choices for generating electricity, producing heat and biofuels for transportation. There is not doubt that Hydro electricity is one of the main assets of the SE European region and together with wind energy and solar can provide an efficient and viable solution toward energy security and protection from environmental degradation while at the same time playing a catalytic role in reducing energy poverty.