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# Impact assessment on energy grids of current EU research undergoings

Thorsten Ruhnke
IMR Engineering GmbH
Essener Str. 5, TZU IV
D-46047 Oberhausen, Germany

***Abstract**: Among all the available sources of alternative energy, solar energy has huge potential. The raw material, technology and geography of Europe are supporting this form of energy. However, a very little consideration is given to photovoltaic system for generating energy, but it has huge potential to provide to cheap energy to national grid. In this paper, a decentralized photovoltaic system is presented through which household consumers not only can consume energy according to their requirements, but also can supply energy to national grid. It is the need of 21st century, where global warming and depleting sources of conventional energy are demanding for transition.*

***Keywords**: Fossil fuels, incentives, target, technology, decentralized energy grid, photovoltaic energy, alternative energy*

## I. Introduction

According to Beurskens et al (2011), Global warming caused by greenhouse gases, and the decline in peak production of primary energy sources are two problems associated with the use of fossil fuels, the main source of power generation in European Union. Given the recent crisis of rising oil prices, several developed countries have taken action and regulatory frameworks that promote the use of various sources of renewable energy (RE), at different levels. In 2009 European Union (EU) had also devised policy not regionwise, but also for each member state to promote renewable energy, so that the target of 20% could be met (Klessmann et al, 2011). There are various methods for generating renewable energy, but best available method that can be locally connected with national grid is the solar energy.

## II. Motivation for Renewable Energy

Renewable energy sources are characterized in their processing and utilization in useful energy not consumed and exhausted on a human scale. These sources of energy are hydro, solar, wind and ocean. In addition, depending on the form of exploitation of biomass and geothermal energy, these can also be classified as renewable energy (Scarlat et al., 2013).The character of "unconventional" is given by the lower level of development of technologies for use in relation to other sources and lower penetration in the energy markets (El-Hofy, 2013). Thus, a hydroelectric plant on a large scale can be considered renewable energy but does not fit the category of unconventional. By generating significantly lower than conventional energy sources environmental impacts, Non-Conventional Renewable Energy (NCRE) can contribute to the objectives of secure supply and environmental sustainability of energy policies (Omer, 2012). The growing global concern for gradually reducing emissions of greenhouse gases, which could be identified as culprits of climate change, has led to the promotion of these energies. Added to this, the increasing global energy demand and historical fuel prices, NCREs are emerged as an attractive choice for producing energy. It is clean option, and, therefore, many environmentalists companies are supporting as well as pressure governments to give incentives to private companies as they could invest in this sector (Yanine & Sauma, 2013). It is believed that by 2050, renewable energy could provide more than half of global electricity demand. However, for Europe the road is just beginning. Currently, only 12.4% of the energy matrix corresponds to NCRE.

## III. European Union Roadmap For the Future course of Action

In 2009, directive was issued by the European Parliament. The core issue of this directive was to make sure that all member countries are focusing on the renewable energy and also take measures for energy consumption (Hildingsson et al, 2012). In this way, there would be energy saving and efficiency that will ultimately benefit to reduce the emission of dangerous gases and also to meet the framework of Kyoto Protocol of United National for Climate Change. To make it particularized, it can be said Community should improve technology, provide assistance to public transports, efficiently use energy and focus on the renewable energy, so that dependence on fossil fuels could be reduced (Folkmanis, 2011). They have acknowledged many opportunities that can be achieved through sustainable, innovative and competitive policy. In this regard, the role of small and enterprises (SMEs) is very critical and the need of time, as they can help in achieving the objectives of a decentralized model (da Graça Carvalho, 2012). Moreover, encouragements to local and regional investments for producing energy from non-conventional sources are vital opportunities for job creations and economic growth. Therefore, it is an ethical and moral responsibility of all member states and Commission to support nationally as well as

regional measures for the production of renewable energy. Also, all stakeholders should make arrangements for structural funds and invite potential customers to participate in this movement (Weidlich et al., 2012).

When there market of renewable energy will be developed, it will benefit the local and regional development, exports will increases as more industries will operate with full capacity and jobs for all levels will be created, particularly in independent power producers (IPP) and SMEs. Haas et al. (2011) say that a transition from conventional to non-conventional energy is also closely associated with the efficient use of energy. This will benefit the Community in two ways; one to decrease the dependence on huge imports of oil and gas, and second cutback in fines and getting more points for emission reduction. The best practical way for following a policy is that respective governments should demonstrate by taking practical steps so that people from all walks of life get to know it is the future of Community. In addition, member states should quickly start the commercialization phase for the decentralization of technologies. The decentralization phase prioritizes the usage of local energy resources, security of smooth energy supply, lessens distances for transportation and minimizes the line transmission losses. In this way, the cohesions will increase, development in many economic sectors will foster and income opportunities for local Community people will increase (Amer & Daim, 2010).

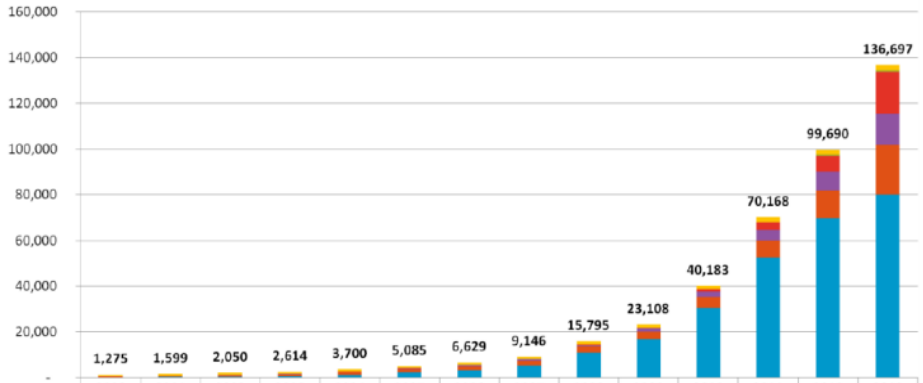
It seems important to note that transparent and clear rules for the calculation of the contribution of each source in the renewable energy are also important. Therefore, the energy in oceans and seas in the form of tides, waves and current must be included. Given the savings potential emission of greenhouse gases, organic waste to produce biogas source offers significant environmental benefits both in which relates to the production of heat and electricity as its use as bio-fuel. The decentralized nature of this model that is solely based on the local and regional investors, biogas plants for energy production can play significant role in the sustainable progress in remote areas and rural areas along with new attractive earning opportunities for local farmers (Zamfir, 2012).

In the light of views, the EU Parliament, Council and Commission had made it mandatory that there should be 20% share of renewable energy in national energy mix and 10% in the transportation by 2020. The mandatory condition is a sign that Community is serious for renewable energy and sends a positive signal to investors. At the same time, the Community had also made it sure to all member states that to achieve the target of 20% enhancement in energy efficiency. These targets are not easy for many member states, because they have not developed enough infrastructures. Therefore, it is necessary that these member states should devise practical policies that enable them to achieve their national targets for the cause of Community targets. The practical actions should focus on all ways of generating renewable energy and also efficient use of biomass, wind, solar and water. For finance, member states can take help from regional banks and neighbour countries (Krozer, 2013).

To achieve the objectives laid down in this Directive, it is necessary that all member states should reserve special funds for the Research & Development (R&D), so that most efficient resources could be used for renewable energy (Hervás & Mulatero, 2011). Member States have different potential in terms of renewable energy and have different support systems from renewable energy sources nationally. It is also necessary that member states should introduce schemes for renewable energy investors e.g. tax reduction on important material, good price for supplying energy to a national grid and technical assistances. All this process should be transparent and non-discriminatory, and benefits should reach the potential producers.

## IV. Renewable Energy in European Union

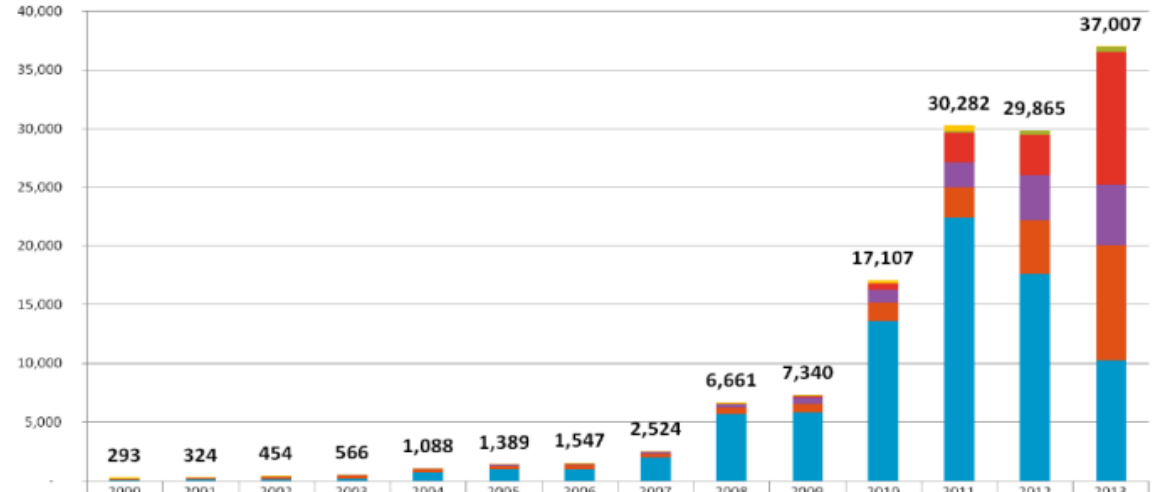
### A. Evolution of cumulative installed capacity worldwide




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROW | 751 | 807 | 887 | 964 | 993 | 1,003 | 1,108 | 1,150 | 1,226 | 1,306 | 1,590 | 2,098 | 2,098 | 2,183 |
| MEA | - | - | - | - | 1 | 1 | 1 | 2 | 3 | 25 | 80 | 205 | 570 | 953 |
| China | 19 | 24 | 42 | 52 | 62 | 70 | 80 | 100 | 140 | 300 | 800 | 3,300 | 6,800 | 18,100 |
| AMERICA | 21 | 24 | 54 | 102 | 163 | 246 | 355 | 522 | 828 | 1,328 | 2,410 | 4,590 | 8,365 | 13,518 |
| APAC | 368 | 496 | 686 | 916 | 1,198 | 1,502 | 1,827 | 2,098 | 2,628 | 3,373 | 4,951 | 7,513 | 12,159 | 21,992 |
| Europe | 116 | 249 | 381 | 580 | 1,283 | 2,264 | 3,258 | 5,274 | 10,970 | 16,777 | 30,352 | 52,462 | 69,699 | 79,952 |
| TOTAL | 1,275 | 1,599 | 2,050 | 2,614 | 3,700 | 5,085 | 6,629 | 9,146 | 15,795 | 23,108 | 40,183 | 70,168 | 99,690 | 136,697 |

↑ 35%

### *B.* Annual evolution of installations worldwide 2000-2013 (MW)




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROW | 88 | 56 | 80 | 77 | 29 | 10 | 105 | 42 | 76 | 80 | 284 | 508 | - | 85 |
| MEA | - | - | - | - | 1 | 0 | 0 | 1 | 1 | 22 | 46 | 125 | 365 | 383 |
| China | 19 | 5 | 19 | 10 | 10 | 8 | 10 | 20 | 40 | 160 | 500 | 2,500 | 3,500 | 11,300 |
| AMERICA | 2 | 3 | 30 | 48 | 61 | 82 | 110 | 166 | 306 | 500 | 1,082 | 2,181 | 3,774 | 5,153 |
| APAC | 126 | 128 | 190 | 230 | 282 | 304 | 325 | 271 | 530 | 745 | 1,578 | 2,562 | 4,646 | 9,833 |
| Europe | 58 | 133 | 134 | 202 | 705 | 985 | 997 | 2,023 | 5,708 | 5,833 | 13,616 | 22,407 | 17,580 | 10,253 |
| TOTAL | 293 | 324 | 454 | 566 | 1,088 | 1,389 | 1,547 | 2,524 | 6,661 | 7,340 | 17,107 | 30,282 | 29,865 | 37,007 |

If we compare the growth of energy from photovoltaic in worldwide, Europe is the fasted growing region in the world. The total installed energy in the world is 136,697 MW and contribution of Europe 79,952 ME, and there is about 35% growth since the last four years (Menegaki, 2013). This trend is continuing as technology is now proven, and many new investors are attracted from all over the world to invest in Europe. As per the figures of 2012, the share of renewable in the total energy production of EU was just 12.4%, and the share of solar energy was 0.7%. The share of Biomass & renewable waste remained highest with 7.1% share. In terms of countries, Sweden produces a maximum amount of energy from renewable energy that is 47.9% of the overall energy production. Finland, Latvia and Austria also have more than 30% renewable energy production.

## V. Photovoltaic system

### *A.* Photovoltaic systems connected to the network

The main components that make up a photovoltaic system "grid connected" are:

- Photovoltaic modules
- Inverter for grid connection
- Swap device to the mains
- Bidirectional power meter

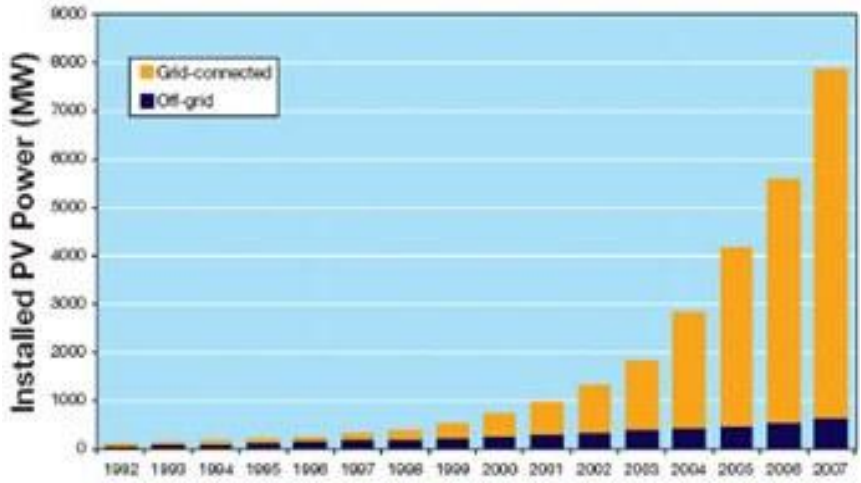
The inverter is one of the core elements in grid-connected systems, and maximizing current output of a photovoltaic device and optimizes energy step between the module and the load (Omran et al., 2011). This device helps in converting power that is produced with the help of modules (12-V, 24-V and 48-V) in alternative energy (usually 220-V) to power the system and / or enter in the network, which works on an exchange.

Investors for connection to the mains are equipped with an electronic device that allows extracting the maximum power, step by step, the PV generator. This device follows the maximum power point (MPPT) and has precisely the function of adapting the production characteristics of the PV array to the load requirements (Jusoh et al., 2014). The exchange device of the network is used for the electric power fed into the network has all the features required for the same. Finally, the energy meter measures the energy produced by the PV system during its operation.

## VI. A decentralized model for injecting renewable energy into National Grid

The injection of energy to the electricity grid (network connection) is a rapidly growing area with vast potential for industrial and domestic applications. The key to the networked systems are working in parallel with the mainstream system so the maximum use of all the energy produced by the non-conventional source is achieved (Solangi et al, 2011) Indeed, the network connection seems to use energy more energy friendly, mainly because they do not require energy stores or elements need to disconnect the generator when there is surplus production (Richter, 2012).

For generating photovoltaic modules, which is more suitable to implement in places where there is good solar radiation, these can range from small installations of 1-5 kWp (single phase) in private homes with integrated photovoltaic modules architecturally (Fig. 1) facilities for up to 100 kWp roofing industries, universities or land (Fig. 1), and even plants of several megawatts. Solar photovoltaic systems connected to the grid (grid-connected), have grown rapidly promoted by global incentive laws (Fig. 2). In some countries the selling price of energy is also fixed by law so that the production of solar electricity are encouraged to be redeemable these facilities over a period of time ranging between 7 and 10 years (Haas et al, 2011).




While technical problems have been resolved, there are still five hindrances to international levels, for a wide use of this technology. These barriers are: 1) the high cost of PV modules, 2) the cost of balance of system components, 3) the lack of standardized interconnection requirements, 4) lack of standardization of facilities and lack of installers and inspectors trained 5) measurement of the energy produced (and appreciation of) that is injected to the grid (Eltawil & Zhao, 2010). Furthermore, in European countries, there are no incentives to individuals for mass dissemination of these technologies, leading to a vicious circle of lack of professional, standards, etc.

## VII. Conclusion

Currently, the share of solar energy among the member states is at lowest ebb, but it can be assumed from the available figures that this technology is now growing at very fast pace. Investors on a global scale are taking interest in it, as raw material for it is easily available. To encourage local peoples for installing networking systems can reduce the burden of governments for generating electricity from fossil fuels. Local people can be encouraged by the relative governments through incentives in the form of capital, information, availability of all inputs and easier laws. Solar energy is the cheapest and at the same time easily available method of generating electricity. It has the potential to help EU in meeting defined target..

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