STATUS OF PHOTOVOLTAICS 2008 IN THE EUROPEAN UNION NEW MEMBER STATES

Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia with Croatia and Turkey
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1. INTRODUCTION

The purpose of this report is to provide up-to-date information about the photovoltaic (PV) sector within European Union (EU) 12 New Member States (NMS) Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia. This is already the 6th consecutive report which has been prepared to give you comprehensive overview of the NMS achievements in the PV field. The first report called “Status of Photovoltaics and Recommendations for PV Development in EU New Members and Candidate States” came out in 2003 within FP5 RTD PV-NAS-NET project, oriented on coordination of science and technology activities in PV sector within newly Associated States.

The leading institutions, in the field of PV, in New Member States joint forces to form a network promoting development of photovoltaic solar energy. The network existed even after the end of the project and published three annual reports. The new project PV-NMS-NET within Intelligent Energy Europe started in 2008 to continue activity of the existing network but it concentrates on market and legal issues. Key data for this publication come mostly from national survey questionnaires supplied by the representatives of each NMS. 12 project partners networked to provide the necessary information that has been combined into this status. In this report we additionally included two Associated States (Croatia and Turkey).

Photovoltaics is one of the most promising renewable energy technologies. PV permits to deliver electrical energy that comes from a clean source – the Sun. Potential of using solar light is so vast that it cannot be omitted while talking about sustainable energy supply systems of the 21st century. Scarcity of conventional sources and global climate change force mankind to supply energy intelligently. EU considers the PV power as one of the alternatives to the conventional sources of energy. This alternative not only seems to boost the low-carbon economy but also tightens up emissions and strengthening energy security represent major issues of international concern. Rapid pace of industrialisation and a global increase in living standards mean remarkable growth of energy demand. Challenges we face are immensely serious. PV is one of the key solutions.

European countries being the signatories of Kyoto protocol committed to reduce greenhouse gas emissions. To meet this obligation there is no other way but to increase the share of renewable energy sources in the total energy balance.

Many actions undertaken at the EU level help its member states to become more competitive and less polluting. Adopting in 2001 the RES Directive (Directive on Electricity Production from Renewable Energy Sources 2001/77/EC) created a basis for a future EU RES promotion framework. European Directive 2001/77/EC recommended an increase in the share of green electricity from 14% to 22% of gross consumption by 2010. In March 2007 European Heads of States and Governments signed up new binding target to source 20% of the EU member states’ energy needs from renewables by 2020.

The new Renewable Energy Directive replacing the existing measures has been adopted in December 2008. It is next highly important step towards low carbon economy. New RES Directive seems to be a historical piece of legislation as it pushes further RES power development on an unprecedented scale. Under provisions of the Directive each member state has a legally binding obligation to increase its share of renewables by 5.5% from 2005 levels, with the remaining increase calculated on the basis of gross domestic product (GDP) per capita. Total EU’s renewables share is to rise from 8.5% of the bloc’s energy mix today to 20%. By June 2010 each Member State must submit a National Renewable Action Plan (NRAP) detailing plans (indicative trajectory) to meet its 2020 targets. NRAPs are followed by progress reports presented every two years. If the “appropriate measures” to reach the targets are not undertaken, defaulting Member State is a subject to infringement proceedings initiated by the European Commission. Moreover EU addresses to its entire member states another requirement of “minimum levels for the use of energy from renewable sources in buildings”. Thus, integrating PV in buildings is to be developed as every new construction project shall include state guidelines for renewable technologies installations.

![Fig. 1. Targeted share of RES in final energy consumption in 2020](image-url)
Fig. 1 shows the initial and targeted by the Directive shares of RES in every NMS. Unfortunately there no biding obligation of the share of each RES sector, so most expensive (at the moment) technologies like PV may be excluded by some small Member States or Member States with a low GDP. Although photovoltaic technology is currently in its early development and its share remains relatively small in the overall renewable electricity balance at present, photovoltaics has one of the highest potentials among renewable energies to become a major contributor in the fulfilment of the target in the mid to long term. Indeed it has a high cost reduction and competitiveness potential.

European Commission in cooperation with relative stakeholders' representatives undertake measures oriented at renewable energy sources development, especially in terms of RTD progress. The Seventh Framework Programme for Research and Technological Development as the EU main instrument for funding research, provides opportunities that seem crucial for further PV development in Europe.

In November 2007, the European Commission put forward a European Strategic Energy Technology Plan (SET-plan), an agenda aiming at improving and speeding up the energy research and innovation in Europe. This new initiative was born out of deficiency in the field of new technologies due to insufficient funding on both, private and public levels. Maintaining the status quo is perceived as inadequate with regard to challenges of climate change, energy supply and competitiveness faced by EU economy. Therefore the European Commission emphasized the pending need of technology breakthroughs in RTD, a prerequisite for lowering clean energy prices and low-carbon-energy industry development.

One of key points of SET plan is to earmark more funds for the industry, especially in terms of RTD innovations. One of new priority initiatives is Solar Europe Initiative oriented at large-scale demonstration of commercial readiness of PV and concentrated solar power. Solar Europe Initiative aims also at reinforcing of European energy research capacities, networking through wide-scale programmes like European PV Technology Platform and ETAP and increasing human and financial resources. One of such programmes, the Environmental Technologies Action Plan (ETAP) was set up in January 2004. ETAP is oriented at overcoming of financial and administrative barriers that hinder new technologies. ETAP emphasizes the importance of cost-effectiveness of environmental technologies considering it as a prerequisite for sustainable growth and development.

The Competitiveness and Innovation Framework Programme (CIP) will be in operation from 2007 to 2013. CIP's main objective is to boost the competitiveness of European enterprises. Innovation, finance and services are three areas in which the CIP will provide significant support. One of CIP's parts is the Intelligent Energy Europe (IEE) programme aiming at RES and energy efficiency development. The IEE programme earmarks billions Euros every year on projects in the supported areas and covers up to 75% of their costs. The IEE programme is managed by the Executive Agency for Competitiveness and Innovation (EACI) on behalf of the European Commission.

World solar photovoltaic market installations reached a record high of 5.95 GWp in 2008, representing growth of 130% over the previous year. Europe accounted for 82% of world demand. The global PV market has been growing more than 40% per annum over the past five years. As one of the fastest growing industries, PV sector is expected to grow despite global financial crisis that affected all worlds' economies in 2008. This crisis turned out to be an opportunity for the entire RES sector. The USA with its new president Barrack Obama decided to highlight the importance of intensified renewable energy generation and include it in the recovery plan (the American Recovery and Reinvestment Act). From now on the US RES market will be stimulated by loan guarantees and tax credits.

Adopted in November 26th 2008 a European Economic Recovery Plan does not acknowledge the role of RES as one of the key solutions to recession. In this context only clean transport and energy efficiency have been considered as European priorities for the months to come. Nevertheless overall PV market condition should not deteriorate. Actually lowering of module prices may constitute a moderated push for the market demand. Optimistic trend forecasted for the coming years indicates such expansion of PV sector. Nowadays, global cumulative PV capacity reaches 10 GWp, half of this figure is provided by EU member states. Moreover, there is an industry sector prognosis on 12% of PV electric energy share in Europe's electricity supply by 2020.

Map presenting photovoltaic solar electricity potential in Europe (Fig. 2) has been elaborated by the Joint Research Centre, Ispra. Good irradiation is a natural factor influencing national policies of PV development and volume of investments in this technology. Irradiation on the European continent, presented on the map conditions shows exactly the potential PV power capacity in each NMS. Obviously southern exposure of Cyprus, Malta, Bulgaria, Romania and Slovenia represents a remarkable advantage in PV electricity output potential. However, in the long run, PV technology is cost-effective on all of the NMS’ territories.

![Fig. 2. PV potential in Europe.](image-url)
2. PHOTOVOLTAIC SOLAR INSTALLED POWER IN NMS

NMS PV market grew from 9 MWp in 2007 to almost 63 MWp of cumulative installed power in 2008. Although the PV NMS market is still rather small, it is growing rapidly proving its vast potential to become a considerable part of RES market in the EU. For the time being, barriers that hinder PV sector progress are still numerous. Disbelief of the general public that PV electricity can make a significant contribution to overall energy need at sensible price is one of the impediments to hamper the PV development. All in all the national policies and regulations along with private sector investments are based on dissemination of relevant, current information. Lack of political support, strong nuclear and coal lobbies, improper design of support schemes, poor consumer awareness and prejudice within utility sector are only some major obstacles for PV sector advancement.

Until 2006, in NMS prevailed small off-grid PV installations. Big-scale on-grid installations took over recently. The most spectacular in this matter was the great “leap” in Czech Republic in 2008. The total installed capacity of PV power in NMS was constantly growing since 2003. At the end of 2008 it totalled some 63 MWp (Fig. 3 and 4, Table 1). Whereof on-grid installations constitute 96%. Such a growth of the annual PV markets is due to a successful implementation of support mechanisms. Market leaders such as Czech Republic, Slovenia, Cyprus and this year Bulgaria owe their growth to effective PV support mechanism, especially adequate Feed-in Tariff systems.

The Czech Republic confirmed its leadership in the NMS PV market rising to more than 54,6 MWp in 2008 (Fig. 7). This total installed capacity positions the Czech PV sector far ahead of the other countries. Czech PV sector takes the toll of responsible economic and fiscal policies. The staggering jump in cumulative installed on-grid capacity is a result of numerous large PV installations set up in 2008, further projects are under development. The largest PV installation of 3,368 MWp has been put in by EGEP a.s. in Vimperk. Divice power plant with 2,9 MWp output, started to operate in December 2008 (Fig. 5). It is second the biggest PV plant in the Central and East Europe covering surface of 12 ha with 40 000 panels. Yearly production is estimated at 3 200 MWh. The investor was Energy21, Czech investment company realising large-scale projects in South Moravia and Bohemia.

The other country with enormous growth is Bulgaria with the total installed PV capacity of 1375 kWp. Investors have discovered the opportunities, the market is growing rapidly. With 25-year guaranteed

<table>
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<tr>
<th>Country</th>
<th>2003</th>
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<td>1336</td>
<td>1837</td>
<td>1352</td>
<td>1881</td>
<td>3233</td>
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</table>

Fig. 3. Trends in total installed PV power in NMS (2003-2008)

Fig. 4. The cumulative installed PV power in each NMS (2008)

Fig. 5. PV system in Divice (2.9MWp)
market is growing rapidly. With 25-year guaranteed generous feed-in tariffs without degression and good insolation conditions Bulgaria is an important new market which has an enormous growth potential and a high attractiveness for investors. The Bulgarian first solar power plant of 200 kWp Zorniza is built close to the south town Sandansky (Fig. 6). The expected yield is 1450 kWh/kWp per year. The maximum achieved power is 97.5% of the PV modules nominal power. This installation is combining two subsystems: 100 kWp tracking and 100 kWp on the fixed construction. Since January 2009 the 1 MWp solar plant built at 25 km on the East from Sofia (village Paunovo) has been connected to the grid. The PV modules are on the base of thin films amorphous silicon technology. The cost of the plant was about 4 mio EUR invested by Intersol. This plant will contribute towards the country’s aim to provide 16% of its energy requirements from renewable sources by the year 2020.

Sinosol Group has signed an exclusive agreement with the project developer Plovdiv Solar Ltd. about the turn-key construction of solar parks on a 330 ha ground near Lyubimets. The authorities and the utility company have already granted permission for a capacity of 50 MWp in the first phase. In a second stage this will be extended to a total size of approx. 80 MWp. The coherent project site was divided into several smaller units with 5 MWp each, for the realization of the PV parks. The 5 MWp parks are sold separately to institutional investors. Start of construction for the first project will be in the middle of 2009.

Constant upswing in PV market allowed Cyprus to reach 2.19 MWp of the installed PV capacity in 2008. For the time being, in Cyprus there are 321 grid-connected systems with total power 1.6 MWp and 130 stand-alone systems with total power around 600 kWp. According to measurements of PV systems installed in many areas on Cyprus, 1 kW produces approx. 1500 kWh/year. Even though Cyprus has excellent solar irradiation, PV technology is not used on a large scale. The reason for that are the large initial cost and the relatively low efficiency of such systems. Government agents and investors perceive the investments in high power PV systems as economically disadvantaged. In 2009 and 2010 the Energy Service of Cyprus is going to install 1 MWp of PV power on public premises (schools, army bases, government buildings). The budget for this project reaches 5 mio EUR with considerable contribution from the Structural and Cohesion Funds.

Slovenian PV market grew by more than 1 MWp in 2008 due to satisfactory support mechanism and advantageous natural conditions in the Slovenia. Through the activities of the Slovenian PV platform and different promotional activities through the media the interest for PV is constantly increasing. There were 57 new grid-connected PV plants put in operation in 2008, mainly installed on the roofs. The market is increasing every year by number of
plants, investors and number of installers. The PV plants are becoming bigger, there are more than 10 plants over 60 kW. In 2008 the biggest PV plant was 100 kW and in early 2009 with the capacity of 220 kW. The investors are the energy supply companies. Due to the investment subsidy from regional found for RES projects, there is a big increase of interest for PV plants between farmers, who normally have buildings with big roofs. For installation of PV on the roof the formal procedure is quite easy, without the construction permit. For ground PV installation a construction permit is normally requested.

The Hungarian market grew moderately due to low feed in tariff. Some off-grid installations were made on motorways and rural electrification. Some on-grid systems were installed in private houses and on supermarkets.

Malta relies on imported electricity and fossil fuels. PV installations is Malta have not yet picked up due to the existing barriers. Most installations are in the public sector as demonstration projects of PV technology. 21 systems from the public sector have the total of 76,5 kWp of installed capacity. Households with 17 systems account for 23.3 kWp and the industry and commercial sector altogether have about 120 kWp.

Lack of feed-in tariffs and distrustful government’s approach towards PV affect adversely the development of Polish PV sector. Due to this fact, on-grid sector remains sluggish with merely 179 kWp installed (mainly demonstration systems). However, off-grid sector runs well with 833 kWp.

In Baltic States (Estonia, Latvia, Lithuania) there was no much progress over 2008. There were only few small PV systems.

Romania and Slovakia with new incentive mechanism may get the push for renewable and solar PV and could make the one of the major PV markets within NMS. In case of Romania, it will be interesting to see how multiply green certificates works.

3. SUPPORT SCHEMES

NMS PV market, just like other PV markets, is strongly dependent on governmentally supported programmes and decisions made by politicians. Political framework determines deployment of PV industry by defining support schemes. A stable long-term policy and differentiated programs are crucial to ensure the continuous market development. The Czech example shows that a stable solar policy really pays off, its market took off at a bullish growth rate. Many NMS still wait for major enforcement of support mechanism. Tax incentives and beneficial credit terms exist in the vast majority of new member states (Table 2). However the real engine of significant PV market growth is the effective feed-in tariffs. Vast majority of NMS benefits already from FIT. Nevertheless only high levels of guaranteed payment for feeding electric energy into the grid can attract investors.

The present situation of the regulatory framework for PV in NMS is heterogeneous. Not only situation varies by the countries, but there is a dose of uncertainty as changes of government policy are quite frequent in NMS. Decisions made on an EU level harmonise its member states’ policies to some extent. European Heads of State or Government agreed in March 2007 on binding targets to increase the share of RES by 2020 to 20% of the EU’s final energy consumption. Since then all of the member states are bound to fulfil individual requirements and adapt to new standards. Most of NMS implement national strategy plans that set out the objectives and policies to enable renewable energy sources to take a key position in energy sector. Those regulations come as a result of international obligations of Kyoto protocol and European directives. National action plans set targets for the share of RES in national energy mix. The renewables targets are calculated as the share of RES consumption to gross final energy consumption.

<table>
<thead>
<tr>
<th>Feed-in tariff</th>
<th>Quota system</th>
<th>Green certificates</th>
<th>Tax incentives</th>
<th>Preferential loans</th>
<th>Net metering</th>
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</table>

Table 2. Measures of RES support in NMS

Bulgaria

Bulgaria has got satisfactory national RES sector regulations by these means one can see Bulgarian market developing. The National long-term programme for the RES support 2005 - 2020 aims at achieving a 16% RES share in 2020 and sets an indicative target of 11% share of RES in gross electricity consumption by 2010. The Ministry of Economy and Energy is going to adopt “The Bulgarian Energy Strategy till 2020” in the middle of 2009. However, PV power is not in the centre for this strategy as Bulgarian RES sector is on hydrowpower.

Mechanisms supporting PV sector are seen as satisfactory. There are feed in tariff and preferential soft loans for PV investments. The FIT rate is derived from a portion of 80% of the average electricity price in the previous year. A variable surcharge is added that cannot be less than 95%. For installations smaller than 5 kW, this is 0,850 BGN/kWh (~0.428 EUR/kWh) (the new tariff is 0,755 BGN/kWh (~0.380 EUR/kWh). Feed in tariffs are yearly adjusted to electricity prices and allocated over a 25-year-period. For installations exceeding 10 MWp put in after 31 March 2009 this period will be shorter.

European Bank for Reconstruction and Development along with the Bulgarian Government and the European Union Funds offers an attractive credit line for RES and energy efficiency projects. The loan is called Bulgarian Energy Efficiency and Renewable Energy Credit Line. Six Bulgarian banks which participate in this credit line give special soft loans.
Cyprus
Two legal acts promoting renewable energy sources: the Law Regulating the Electricity Market (this is only for electricity) and the Law for the Promotion and the Encouragement of the Use of RES and of Energy Efficiency entered into force in 2003. In 2004, the revised Grant Scheme for the Promotion of Energy Conservation and the Use of Renewable Energy Sources has been set up for 2009-2013 period. According to the Grant Scheme, RES are promoted by feed-in tariff and investment subsidies.

There is a tax of 0.00222 EUR/kWh on total energy consumption, levied from all electricity consumers. This tax is earmarked for the Special Fund for the Promotion of RES and Energy Conservation. The Special Fund along with Electricity Authority of Cyprus are responsible for FIT payment.

Currently only small-scale PV investments, of maximum installed power of 20 kWp, are eligible for investment subsidy. Small PV off-grid systems in households, schools and non-profit organizations are eligible for an investment subsidy of 55% whereas entities engaged in economic activity can get 40% subsidy for their off-grid installations. Entities are allowed a tax return which is 15% of the total system cost, hence the subsidy amount is the same for both household and for entities.

For small on-grid PV systems in households, schools and non profit organizations, not only is there a 55% subsidy of the investment cost but also, since 2009, FIT amounting to 0.225 EUR/kWh (0.205 EUR/kWh in the period 2004-2008). Small PV system installed by companies benefit from similar support scheme with slightly lower investment subsidy (40%) and FIT reaching the maximum of 0.205 EUR/kWh (for 15 years).

Small systems not benefiting from investment subsidy get higher FIT rate per each produced kWh – 0.383 EUR/kWh for non-profit householders and 0.36 EUR/kWh for companies and organisations engaged in economic activities (for the first 20 years).

Currently there is no investment subsidy or FIT for PV systems with power capacity greater than 20 kWp. However a new part of the grand scheme that will be set in operation at the end of 2009 will provide a FIT of 0.34 EUR/kWh for PV systems with capacity 21 to 150 kWp. This payment will be applicable over 20-year period. The price is lower if installation capacity exceeds 150 kW, Cyprus Energy Regulatory Authority set it in 2009 at around 0.09 EUR/kWh.

Czech Republic
The Czech Republic has got one of the most transparent regulatory systems in NMS. In 2004, the parliament of Czech Republic approved the National Energy Policy until 2030 supporting a rapid switch towards the use of renewable. The Act on Promotion of Use of Renewable Sources (adopted in March 2005) introduced a supporting scheme for RES. Feed-in tariff exists in Czech Republic since 2002 A new RES Act brought up another measure of support, a green bonus – extra payment on top of the market price. PV electric energy producers have now choice between FIT and green bonus, both paid by the distribution system operator.

The Energy Regulatory Office determines the FIT and the green bonus rates every year. Degression may change on a yearly basis, too. However FIT is guaranteed over 20-year period. Green bonus scheme brings a bigger risk factor for the producer, as free market in unpredictable, and the green bonus rate can change every year. However this risk is compensated by higher potential revenues. The rates can not be lower than 95% of the value of the previous year (Table 3).

PV electricity producers receive subsidies from the European Structural Funds. Operational Programme Environment allocates grants from the Cohesion Fund for projects in the field of renewable energy. The Cohesion Fund is a European Union fund which provides financial resources to its member states for country-specific subsidy programmes aiding underdeveloped regions upon application.

PV plants may be subsidized up to 20 % for ground installations or up to 40 % of the eligible costs of:

<table>
<thead>
<tr>
<th>Date of PV plant commissioning</th>
<th>Feed in tariff CZK/MWh</th>
<th>Green premiums CZK/MWh</th>
</tr>
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<tr>
<td>After 01 Jan. 2009</td>
<td>&lt; 30 kWp - 12,89 CZK</td>
<td>&lt; 30 kWp - 11,91 CZK</td>
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<tr>
<td></td>
<td>&gt; 30 kWp - 12,79 CZK</td>
<td>&gt; 30 kWp - 11,81 CZK</td>
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<tr>
<td>Between 01 Jan. 2007 - 31 Dec. 2008</td>
<td>13,730 CZK</td>
<td>12,750 CZK</td>
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<td>Between 01 Jan. 2006 - 31 Dec. 2007</td>
<td>14,080 CZK</td>
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</tr>
<tr>
<td>Before 01 Jan. 2006</td>
<td>6,710 CZK</td>
<td>5,730 CZK</td>
</tr>
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BIPV and roof-top installations. Maximum subsidy can not exceed 50 mio CZK (about 1,785 mio EUR). Organizations eligible for the support are: municipalities, NGO’s, regions of the Czech Republic, Churches, public universities, etc. First call for applications is open from 4.5. – 30.6.2009.

It is very likely that in the nearest future the investors will have a possibility to take out a subordinated loan at the Czech-Moravian Guarantee and Development Bank in the frame of Operational Programme Business and Innovation. These loans will be earmarked exclusively for SMEs.

For the time being, one of significant incentives for investors in Czech Republic is the 5-year income tax exemption on all incomes that come from RES activities.

Estonia
Estonian Energy Strategy was approved on 26th of January 2009. The backbone of the strategy is nuclear power reactor construction project that shall be accomplished by the 2023, RES position seems to be much less important.

PV electricity is promoted through feed-in tariff or
bonus system, subsidies and tax incentives. The producers of electricity have a choice between the tariff and the bonus. Electricity supplier appointed by the transmission grid operator is bound to purchase electricity from the RES plant operator at a guaranteed feed-in tariff. Feed-in tariffs exist since 2003, in 2007 the price per kWh was set at 1.15 EEK (about 0.073 EUR/kWh) and are limited to a maximum of 12 years beginning at the day on which systems reaches 80% of its nominal capacity.

Alternatively, operators of RES plants can sell electricity on free market and get a bonus on top of the market price. Bonus scheme is also limited to 12 years. Transmission grid operator publishes an assessment of the costs of guaranteed payments. These costs are proportionally added to every single kWh of grid service.

Hungary

The Hungarian Energy Strategy for 2008-2020 was accepted by the Hungarian Government which committed itself to achieve 13% of RES share in final energy consumption by 2020. In Hungary there is also KECP - Operative Programme for Environment and Energy binding over 2007-2013 period. It is focused on RES electricity and heat generation. Programme uses EU funds to cover the projects (total amount reaches 200 mio EUR).

The Hungarian Energy Act regulates feed-in tariffs and grid connections. Feed-in tariffs, net-metering and subsidies from Energy Efficiency Fund favour PV investments. FIT rate for PV in 2008 reached merely 0,093 EUR/kWh (26.46 HUF/kWh) so its PV-favouring influence is rather dubious. Rates are changed every year, except from the payback period (generally more then 25 years) when there is no more supported FIT. PV electricity producers are eligible for the net-metering system on the entire volume of the electric energy that they consume themselves. Net-metering is used in more than 50% of PV installations.

Latvia

Latvia's Renewable Energy Strategy 2006-2013 does not mention PV. Electricity market is regulated by Electricity Market Act that entered into force in 2005, last amendment being made on May 15, 2008. This act reinforces RES promotion and their access to the grid on fair conditions.

Latvia's RES support mechanisms rely on EU Structural Funds and price-regulation. About 140 mio EUR will be allocated to the energy sector Cohesion Fund in the next Structural Funds utilization period of 2007-2013. This amount is earmarked for projects increasing district heating systems' efficiency, development of cogeneration plants to meet the annual quota for mandatory procurement of RES electricity. The priorities for the use of EU structural funds are listed in the Development Plan. PV is at a disadvantage compared with other RES. Generally, photovoltaics and geothermal sources are not included in the promotion mechanisms. State support in the energy sector is only given to projects relating to heat supply system.

Purchase price for RES in Latvia differs depending on the source of renewable energy and capacity of installation. Its rate is calculated as natural gas price multiplied by several factors (coefficient relative to the size of the plant).

Lithuania

National Energy Strategy promoting RES generation, energy consumption efficiency and setting targets for the production of electricity from renewable sources at 20% of national gross electricity consumption by 2025 was adopted in 2007 by Lithuanian Government.

PV electricity generation in Lithuania is supported by feed-in tariffs and investment subsidies. There are prospects for green certification and value added tax waiver.

At present feed-in tariffs for PV energy is one of major support mechanisms in Lithuania. Until 31 December 2020 electricity suppliers are obliged to purchase electricity from RES at a guaranteed minimum prices determined in contracts. Those prices are calculated on the basis of the rate set by the National Control Commission for Prices and Energy. However the maximum amount eligible for price regulation is limited. Participants are requested to submit every year by 15th July to the Ministry of Economy a forecast on the amount of electricity they expect to generate in the following year. The Ministry publishes the maximum annual amounts by 1st September of the current year.

In 2008 the maximum capacity for solar generation eligible for minimum prices was 1.4 GW. The transmission grid operator is obliged to pay the feed-in tariff. The costs arising from the feed-in tariff are borne by the consumers through the electricity prices. Law envisages that the plant operator (on his own initiative) and the supplier are entitled to agree on price lower than FIT. However so far any PV system took advantage of this law and rate for PV in not set. From 01 January 2010, there will be no value added tax on the energy generated by renewable sources. Green certificates system is planned for 2021.

The Lithuanian Environmental Investment Fund (LEIF), established by the Ministry of Environment, allocates soft loans for RES investments. The main fund source of the LEIF is environment pollution tax and financial means from different institutions (e.g. PHARE programme). The Fund receives 30 % of the revenue gained from the environmental pollution tax (Art. 10 of the Law on the Environmental Pollution Tax). The remaining 70% comes from other sponsors. The procedure of granting loans depends on those sponsors, role of LEIF is to mediate between the debtor and the sponsor. Applications for subsidy are open to all public and private entities involved in economic activities in Lithuania. Maximum amount of loan is 1,5 mio LTL (about 0,44 mio EUR) for one project with the repayment period not exceeding 5 years.

The amount of the subsidy for one beneficiary may not exceed 350 000 LTL (about 100 000 EUR) in 3 years and 70% of the total investment amount. Amendment put forward on 9 November 2007 raised the maximum subsidy to 600 000 LTL. The prerequisite for receiving a subsidy, among other things, is getting a bank loan for the project. The President of LEIF shall sign both: the project subsidy contract and the cooperation agreement with the bank.

Malta

The discussion on Energy Policy for Malta was launched on 16th April 2009 for public consultation. Mechanisms and plans for the penetration of RES
in order to meet binding target of 10% of energy derived from renewable sources by 2020 will be defined in the policy. Solar is one of the priority sources. Existing regulations of energy sector are established by Parliament through the Malta Resources Authority Act XXV of 2000.

The subsidy for PV technology has been reviewed in November 2008 and there are two schemes now. First one, for the residential sector, is a 50% grant on capital investment for a maximum of 3 000 EUR. The second one for the non-residential sector amounts to 50% grant on capital investment but projects with capital costs from 25 000 EUR up to 200 000 EUR may participate.

Fig. 8. Bakery company, Malta. (19.2 kWp). Co-Funded by the EU.

Net-metering is applied along with import – export power metering by the Distribution System Operator. Malta Resources Authority must accept the notification and authorize the application. The consumer having the PV system installed would then pay for the difference between the imported kWh and the exported kWh the power meter is read and a bill issued. There is a spill-off tariff in case that the exported kWh to the grid is larger than the imported consumed kWh. This spill-off tariff is credited at a lower feed-in tariff rate than the market value. Hence any consumer will size the PV capacity based on the consumption so that there is no cheap spill-off gain, but only exchange of kWh consumed with kWh sent to the grid, at the market price. Hence net-metering can only be feasible to consumers. For investors willing to become energy producers net metering will not be of use and Government is planning to introduce a feed-in-tariff for such cases.

One of the local banks, offers a beneficial loan for residential installations paid over 10-year period at a rate discounted by 2.5%. This loan ranges between 500 EUR and 60 000 EUR. Loans for non-residential systems amount min. 25 000 and max. 200 000 EUR. For industry, Government also offers a tax credit on the investment. Prior to the scheme of November 2008, there was a 20% grant on capital investment with a maximum of 1164 EUR for the first 1 kW peak installed and 582 EUR for every additional installed kilowatt peak +/- 5%, subject to a total maximum input power of 3,7kWp.

Poland

Poland has got several normative acts that stress the need of further RES utilization development. Since 2001 the Renewable Energy Development Strategy is in place, four years later Polish Energy Policy until 2025 has been implemented. In 2006 the Ministry of Economy issued Programme for Electric Power Engineering. All of the acts promote RES, including PV. The entire energy sector is regulated in Energy Law Act (in force since 1997) providing for further RES promotion. Energy policy of Poland until 2030 is now being discussed and should be accepted in the middle of 2009.

In Poland several institutions support RES development. One of them is the Provincial Fund for Environmental Protection and Water Management (WFOSiGW) which awards soft-loans for small and medium PV investments. Only new plant construction projects submitted by legal entities or natural persons are eligible for the loan.

Investors may benefit from the Cohesion Fund, European Regional Development Fund through Operational Programmes co-financed by EU Structural Funds. Operational Programme Infrastructure and Environment (2007-2013) does not include PV electric power generation. For other RES, minimum investment cost is 20 mio PLN, funds subsidy up to 70% of total investment cost (40 mio PLN). Overall budget for RES within this programme amounts to 91 mio EUR. During 2007-2013 period 18 927 mio EUR will be allocated.

The Environment Protection Bank (BOŚ) in cooperation with the National Property Bank (BGK) gives 5-year soft loan (usually at a half of the commercial rate), covering up to 25% of the investment cost on energy efficiency upgrading using RES. During the first six months of the year 2008 more than 2700 loans have been granted (total amount > 580 mio PLN), but none on photovoltaics.

The Environment Protection Bank with the support of The National Fund for Environmental Protection and Water Management (NFOSiGW) gives credits for the projects in line with one of the priority programmes set by the Fund, unfortunately PV is not mentioned as one of the prioritised electric power generation source. The Environment Protection Bank with the support of The Provincial Fund for Environmental Protection and Water Management act locally, supporting regional investments with preferential loans. There are also some preferential loans from commercial banks like Sygma Banque which offers a special “green loan” for small RES investments (including PV).

Fig. 9. The Outdoor Test Facility at Warsaw University of Technology
Poland fiscal measures give also excise exemption for the electric energy produced from RES. Poland introduced a system of Green Certificates being a primary financial incentive for RES. In compliance with directive 2001/77/EC tradable titles are allocated to RES electricity producers for each MWh. The market price is about 250 PLN/MWh [March 2009]. There are no multiply value or special certificates for PV. Under this regulation, utilities must buy electric energy and heat from producers who use renewable energy sources. However to sell energy the concession is required even for the smallest system. The procedures are very difficult and take a long time. At the moment Agency for Energy Regulation did not register any energy from PV systems.

Power plants, utilities and grid operators have to prove the RES origin of certain percentage of the electric energy they sell. This renewable sources portfolio imposes 7% share of RES in 2008 (10.4% by 2010), but there are no specific provisions for PV. Instead of purchasing a Green Certificate, it is possible to pay the replacement fee. Even though this law is considered as an important step in developing renewable energy technologies in Poland.

Polish scheme of state support for foreign and domestic investors includes initial investment support (material and non-material assets) and subsidy for, the parallel to this investment, jobs creation. Only investments within regions where GDP rate is lower than the average GDP in EU countries. Initial investment support consists on tax exemptions or governmental money grants.

Concerning taxes, there are two waivers for CIT and real estate tax. Both exemptions are granted by the local authorities. Financial aid for investors is granted by the Ministry of Economy upon individual negotiations (Central grant). It is also possible to apply for money support originated from EU funds, but this can only take place through national institutions intermediary. Poland is very efficient in fundraising when it comes to benefit from EU budget.

State support for job creation is allocated for investment of min. 10 mio EUR that offer at least 250 jobs. This investment and jobs have to be maintained for 5 years (3 years in case of SME).

**Romania**

In 2007, the Romanian Government adopted its “National Energy Strategy 2007-2020”. The main objectives established in the document are:

- promotion of electricity production from renewable sources of energy;
- setting of targets for the production of electricity from renewable sources at
- 33% of national gross electricity consumption for 2010, 35% for 2015 and 38% for 2020;
- ensuring energy security by diversifying routes and sources of primary materials used to obtain energy;
- increasing energy efficiency;
- implementation of new technologies and clean technologies (low carbon technologies);
- modernisation of existing production facilities;
- increasing the proportion of electricity produced from nuclear sources in the overall energy mix.

In 2007, the national target of 33% of electricity produced from renewable in gross national electricity consumption was nearly achieved (originally set for 2010), as calculated on the basis of the new draft Commission Directive for the promotion of renewable energy sources (published on 23 January 2008).

Subsidies, net-metering, tax incentives and green certificates support RES in Romania.

The subsidy within a programme called The Growth of Economic Competitiveness funded by Structural and Cohesion funds. There are 5 main priorities, the 4th one being called the growth of energetic efficiency in the context of fighting against the climatic changes. Under this priority there are several kinds of subsidies destined to bail out the RES investments:

- for small companies – up to 70%, except for the ones in Bucharest that can get up to 60%,
- for medium companies – up to 60%, except for the ones in Bucharest that can get up to 50%,
- for large companies – up to 50%, except for the ones in Bucharest that can get up to 40%,
- for city halls and other local authorities designed subsidy can reach the maximum of 98%.

The overall budget in 2008 year was about 70 mio EUR, the minimum single subsidy was 100 000 EUR and the maximum one 50 mio EUR. Value added tax is not an eligible expense nor is a purchase of second-hand photovoltaic module. Main obstacle is the inertia of evaluation team not able to examine all of the applications in due time.

In Romania there is a mandatory quota system accompanied by Green Certificates system. In 2008, the mandatory quota of RES in national gross electricity consumption was 5.26%. Over 2008-2014 period, the GC value will range between 27 EUR and 55 EUR. In November, 2008 GC value reached 38.87 EUR/MWh. The solar electricity producers get 4 Green Certificates for every MWh (more than for any other RES). Distributors who would fail to meet the quota are subject to a 70 EUR fine per each missing GC.

Another incentive is the Romanian government's guaranty for 50% of the total loan amount on long term. Investors benefit also from the income tax waiver in the first 3 years of RES plant operation. Favourable tax discount is provided for private persons producing more than 20% of their energy consumption from RES. In their case, the total annual income used for tax evaluation is reduced by 50% of the value of the RES system components.
Net metering applies to less than 50% of PV Plant Power with installed power smaller than 1MWp.

**Slovakia**

Energy Security Strategy until 2030 was approved on 15 of October 2008 by Slovak Government.

Investment subsidies are based on the Act on Investment Support, which is focused on regional development and creation of new employment opportunities in general. PV is less favoured than biomass or small hydro according to the government strategic energy documents. It is expected that from August 2009 a new law on the support of RES will come into force.

Currently in Slovakia, there is a feed-in tariff, tax incentive and subsidy support to promote PV. FIT differs for every source of energy. In 2008, the PV tariff (price excluding VAT) was 8,410 SKK/MWh. Tariffs are cut down by a fixed percentage in case the plant operator receives the subsidy on the national or EU level. The rate is granted on a yearly basis and is increased annually by the national core inflation. Degression was not applicable in and before 2008. A new law that is to come into force on the 1 August 2009 envisages a new FIT scheme with 10-percent degression rate and new diversified tariffs for smaller and bigger systems. In 2009 FIT for PV is 0,45 EUR.

The Slovak Innovation and Energy Agency (Slovenská inováčná a energetická agentúra) through the Operational Programme Competitiveness and Economic Growth of the European Structural Funds grants RES projects through calls for applications. The Slovak Innovation and Energy Agency is a department of the Ministry of Economy. Eligible projects must be located in regions meeting the convergence objectives. Those regions where the GDP per inhabitant was lower than 75% of the average GDP per inhabitant within the EU 25 during the same period of time constitute the convergence objective area. Based on this, several regions in Central, Eastern and Western Slovakia are eligible. The amount of subsidy amount to a minimum of 20 000 EUR and a maximum of 200 000 EUR. European Regional Development Fund’s contribution amounts to 772 mio EUR. Slovak funds total 136 mio EUR. In 2008, 700 mio SKK (ca. 21,7 mio EUR) has been subsidized. Subsidies are granted for a period of 24 months.

Since 1 January 2008, the electric energy generated from renewable energy is exempt from consumption tax. From the 01 July 2008 to the 31st of December 2009 the tax on electricity is 0,02 SKK/kWh. From the 1st of January 2010 the tax will amount to 0,04 SKK/kWh.

In Slovakia, foreign and domestic investors may receive state support in four major areas: industrial production, technology centres, strategic centres and tourism. There is no RES specific support scheme. Only initial investment is eligible. If investment is undertaken in those Slovakian regions where the unemployment rate is low or average, the investment has to amount to at least 26 mio EUR. In regions of higher than average unemployment rate investment shall amount at least to 13 mio EUR. In case the unemployment rate is at least 50% higher than the average the minimum investment cost is 6,6 mio EUR. Investment can not amount to less than 40 mio EUR and has to create 50 jobs. The state support is allocated only if at least 25% of the investment cost is covered from other sources than state budget. The jobs created by this investment shall be maintained for minimum 3 years.

**Slovenia**

In 2004, Slovenian Government adopted National Energy Programme (NEP). It provides a legal basis and political consensus for the instruments and mechanisms to achieve the main requirements regarding energy services. The key objectives are: reliability of supply, competitiveness and protection of environment. According to the NEP Slovenia’s potential for increasing the utilization of photovoltaic systems is estimated at 1 to 10 MWp until 2020. Slovenia encourages PV market with feed-in tariffs, bonuses, subsidies from regional found and soft loans.

Slovenia introduced in 2001 the FIT as the main fiscal measure of RES support, with guaranteed minimum prices and premiums, defined by the government. Fixed price for PV is 399,57 EUR/MWh and bonus reaches 347,19 EUR/MWh. In the past years the prices and premiums were adjusted once a year adequately with regard to inflation rates, changes of oil prices, season and time of day factors. FIT rates didn’t depend on size of PV installations. Installation operator has got a choice to select between FIT price or bonus.

Right now the FIT system for RES is in the process of changing. Following the request of the DG Competition the FIT has to be reorganised according the roles for state aids. The energy law was already revised in 2008 and the Governmental Decrees are under the process of discussion and approval. The main changes will be that FIT will be prolonged from 10 to 15 years, the collection of the money for the FIT scheme will be changed from the fee to kWh consumption to lump sum on connection and the whole system will be managed by an independent Institution Centre for state aids. The Centre will be obliged to purchase all the produced electricity by RES and sell it on the market. Up to 5 MW the producers will have the possibility to select between fixed purchase price or operating premium. Above 5 MW the producers will have the right to get the operating premium and will have to sell the produced electricity on the market and foresee also for regulation and deviation fees. The tariffs are calculated for 15 years pay-back period and for size.
classes: up to 50 kW, 1 MW, 10 MW and 125 MW. If the investor is getting any kind of investment subsidy, this will be calculated adequately in lowering of the guaranteed price or premium.

For the PV the prices will be generally on the same level as they are now, with some modifications. The prices will be higher for smaller PV plants and lower for bigger plants. For the integration on the buildings there will be an increase of price of 15%. The prices for PV plants installed on the ground will be slightly lower. A yearly degression of 7% is foreseen for new constructed plants in the future.

The regional fund of the Ministry of Agriculture grants subsidies for RES, including PV. The Agency for Agricultural Markets and Regional Development (AKTRP) subordinate to the Ministry of Agriculture is in charge of allocating of subsidies. Such a subsidy amounts to 50% of the investment cost (without VAT). Conditions for every project are set individually. The investment must be implemented in the farms, out of defined urbanized localities, maximum investment of the plant is 480 000 EUR, maximum subsidy is limited to 200 000 EUR. The subsidy scheme applies to all RES during the period 2007-2013.

The Environmental Fund of the Republic of Slovenia (Eko sklad) grants low-interest (3.9%) loans to RES projects covering up to 90% of investment. Paying off period is not more than 10 years with maximum credit amounting to 200 000 EUR. Eligible projects must be put forward by public or private legal entities or natural persons. Contributions from national budget and voluntary offerings supply this fund.

Summary of the FIT for PV in NMS is shown in Table 4.

<table>
<thead>
<tr>
<th>Country</th>
<th>Feed-in tariff rate for PV (EUR/kWh)</th>
<th>Granting period (years)</th>
<th>Degression</th>
<th>Price of electricity (EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>&lt;5KW – 0.428</td>
<td>25</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;5KW – 0.380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyprus</td>
<td>0.383 for houses and non-profit entities</td>
<td>15 or 20</td>
<td>no</td>
<td>0.12-0.16</td>
</tr>
<tr>
<td></td>
<td>0.36 for companies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>20,5-22,5 with subsidy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0.4603-0.4634 or bonus</td>
<td>20</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Estonia</td>
<td>0.073</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>0.093</td>
<td>investment payback</td>
<td>no</td>
<td>0,156€/kWh for households</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.427 since 02.2009</td>
<td>10</td>
<td>no</td>
<td>0,106</td>
</tr>
<tr>
<td>Lithuania</td>
<td>to be set by National Control Commission for Prices and Energy</td>
<td></td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Malta</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>GC = 250 PLN (57 EUR)</td>
<td>0,09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Romania</td>
<td>CG = 4 x (27 – 55) EUR</td>
<td>15</td>
<td>no</td>
<td>0,144 – 0,256</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0,280</td>
<td>1</td>
<td>yes (from 2009) 10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0,45 since 2009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slovenia</td>
<td>0,399 or bonus</td>
<td>15</td>
<td>7%</td>
<td></td>
</tr>
</tbody>
</table>

4. PV INDUSTRY in NMS

By 2020, the EU photovoltaic industry has the potential to create more than 200 000 jobs. Employment within PV sector will be find in its diverse areas. Profiles and qualifications for the job in PV vary from craftsmen who work in services, directly with customers, to high-tech experts.

The development and presence of PV industry in NMS is important in order to enhance the broader public interest for photovoltaics and can represent a long term driving force for PV research and deployment activities. PV industry base is still relatively small in NMS. Its development is geared to public interest and state policies. In 2008 further development of PV industry in NMS has taken place (Table 5).

In Czech Republic there are about 200 installation companies, 5 modules producers, 1 cell producer. SolarTec – Czech solar cells and modules producer has a 5-MWp capacity and it performs it own PV RTD activities.

In Bulgaria there are four PV manufacturing companies: SolarPro, BG Solar Panels, Energy Solutions and Institute of Non-ferous Metals. Only Institute of Non-ferous Metals is currently producing c-Si wafers. The total production capacity in Bulgaria is 38 MWp. A new manufacture with capacity of 18 MWp started the production of the thin films amorphous silicon modules at the beginning of 2009.

In Cyprus there is EN Foton Solar ltd modules producer with 5-MWp capacity.
In Hungary (apart of existing Sanyo plant of 100 MW capacity) and Korax plant of 10 MW capacity two national plants were established in 2007. Heliogrid amorphous silicon module plant in Rétság (final capacity of 24 MW) The pilot production in Heliogrid started in 2008. The initial production line will be expanded to 4 lines during 2008. The second facility will be Genesis PV in Környe with the future module production capacities of 300 MW.

Lithuania - industrial PV development targets are set by the PV technology cluster – a non-governmental group uniting industry and R&T institutions. In 2008, UAB Precizika-MET has started a pilot production of solar grade poly-Si feedstock, in 2009 the production of c-Si solar cells will start, until 2015 a new factory of c-Si solar cells will be opened. Investor is ACHEMA-group – a major chemical industry corporation.

Romania - Producers of PV Modules: DGM solarsystems, Piatra Olt Town. It is a new company with a production capacity of 4MW. The modules with nominal power of 250Wp and 210Wp are based on monocrystalline and polycrystalline silicon solar cells.

Slovak industry is in the area of PV lagging behind majority of European countries. The only performing realm is installation, where more than 10 companies work so far. In the year 2010 the first silicon producing company will start processing. Potential is also in the area of components’ production - in Slovakia already operates the company producing solar inverters (Delta Electronics).

Slovenia - The company Bisol reached the full operation with the production of 15 MW of solar modules in the year 2008 and they have the plan to increase the production to 40 MW yearly. Bisol already reached a good maturity and is well situated in the national and international PV market. The company Trimo, a producer of prefabricated industrial and commercial buildings, started the production of solar roof, integrating already in the production line the thin film a-Si PV modules on their metal roof sandwiches. The commercial name of the product is EcoSolustions. There are also companies like Adria Solar and others starting or preparing the production of solar modules. There are also some companies like ETI, ISKRA, Kon Tiki Solar producing controllers and other electronic equipment, or TAB producing batteries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Producer of:</th>
<th>Modules [production/capacity]</th>
<th>BOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>Institute of Non-ferrous Metals, Plovdiv</td>
<td>SolarPro [-18 MW]</td>
<td>Many small companies propose such kind of activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BG Solar Panels [10 MW]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy Solutions [10 MW]</td>
<td></td>
</tr>
<tr>
<td>Czech</td>
<td>-</td>
<td>Solartec - SchottSolar [-200 MW]</td>
<td>Poulek Solar Co. Ltd, tracking systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>CZ Elektronika, tracking systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>FRONIUS CZ, inverter transformer</td>
</tr>
<tr>
<td>Estonia</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hungary</td>
<td>-</td>
<td>-</td>
<td>Sanyo [-100 MW]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Korax SIX [-10 MW]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Heliogrid [-24 MW]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Genesis PV [-300 MW] - under construction</td>
</tr>
<tr>
<td>Latvia</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lithuania</td>
<td>UAB Saules energia [-30kW]</td>
<td>UAB Precizika-MET plans for 2009 – 2.5 MW</td>
<td>-</td>
</tr>
<tr>
<td>Poland</td>
<td>-</td>
<td>SILIMAT, CZ ingots and wafers</td>
<td>-</td>
</tr>
<tr>
<td>Romania</td>
<td>-</td>
<td>DGM SOLARSYSTEMS (-/4 MW) crystalline</td>
<td>-</td>
</tr>
<tr>
<td>Slovakia</td>
<td>-</td>
<td>-</td>
<td>SolarNed (BP Solar)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>ACERA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Schuco International KG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>Delta Electronics</td>
</tr>
<tr>
<td>Slovenia</td>
<td>-</td>
<td>-</td>
<td>ETI, ISKRA, Kon Tiki Solar, controllers and electronic equipment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>TAB, batteries</td>
</tr>
</tbody>
</table>

Table 5. Producers of the components of PV system.
5. ACCESS TO GRID

Access, transmission and distribution of energy coming from RES is guaranteed by law in all of the NMS. Not all of them give priority to energy coming from solar systems, but the principle of non-discrimination protects the PV producers. Proceedings – their complexity and duration vary among the countries. On one hand most of NMS are improving administrative bottlenecks, seeing the simplicity of connection procedure as important incentive towards RES development. On the other hand technical barriers represent insurmountable obstacle for investors. In many NMS adjustment of the utility and its modernization may only be made on PV systems operator initiative and at his expense. Obviously such expenditures are often lethal for PV investments. Preliminary results of the research on this matter are shown in Table 6.

Grid connection procedure in Malta seems to be the shortest and the least complicated. Since so far the capacity installed at a site was not critical. One need to remark that net-metering with a low spill-off tariff does not encourage electricity production more than consumption, so physical connection to the grid is not yet an issue. NMS average time needed to go through the entire procedure is below 6 months. In Slovenia the approach to grid connection is shallow, what means that the grid operator is obliged to connect all RES producers and foresee and finance necessary grid reinforcement, the producers have to finance the connection to the grid. Still, there are countries like Poland, Slovakia, Slovenia and Bulgaria where investors need to be much more patient.

Crucial point is the financial participation of grid operator in the connection process. If the investor is obliged to cover all of the costs, it often means that he is to pay for the grid extension and modernisation. These expenditures discourage potential investors in Slovakia, Latvia and Estonia. However, Polish 50% discount is just a facade. In reality grid operators often refuse to connect RES producers because of infrastructure deficiencies, while the producers are not able to pay for the renovation of the system. In order to encourage RES development and fulfill the requirements outlined in RES Directive it is essential to remove administrative barriers and head towards one-step authorization that would no longer be an issue to worry about. Advanced streamlined solutions should not be underestimated.

Despite numerous bottlenecks, NMS seem to be on track to simplify grid connection procedure and make the utility accessible for PV on both legal and real life levels.

6. RESEARCH & TECHNOLOGY DEVELOPMENT (RTD), DEMONSTRATION AND DISSEMINATION

The vast majority of RTD in NMS is led by academic and research institutions. They are represented by Centres of Excellence, the major centres are located in Bulgaria (Central Laboratory of Solar Energy and New Energy Sources at the Bulgarian Academy of Sciences), Lithuania (Applied Research Institute for Prospective Technologies), Poland (Centre for Photovoltaics, Warsaw and SolarLab, Wroclaw), Romania (Academy of Scientists from Romania - AOSR), Czech Republic (Academy of Sciences of the Czech Republic) and Estonia (Tallinn Technical University is a member of Nordic PV Centre of Excellence along with Sweden, Finland, Norway and Russia).

<table>
<thead>
<tr>
<th>Country</th>
<th>Priority access to the grid for solar systems</th>
<th>Simplified procedure</th>
<th>Number of institutions conditioning approval</th>
<th>Complexity of the procedure</th>
<th>Time spent on administrative procedure before installing the PV system</th>
<th>Grid connection costs paid by PV electricity producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>NO</td>
<td>NO</td>
<td>difficult but improving</td>
<td>6-12 months</td>
<td>None for small systems</td>
<td>Shared</td>
</tr>
<tr>
<td>Cyprus</td>
<td>NO</td>
<td>NO</td>
<td>2-5</td>
<td>difficult but improving</td>
<td>&lt;6 months</td>
<td>50% larger PV systems (&lt;100kWp) and when grid extension is required</td>
</tr>
<tr>
<td>Czech Rep.</td>
<td>YES</td>
<td>NO</td>
<td>4-7</td>
<td>difficult but improving</td>
<td>&lt;6 months</td>
<td>Shared</td>
</tr>
<tr>
<td>Estonia</td>
<td>NO</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Hungary</td>
<td>YES</td>
<td>YES</td>
<td>reasonable</td>
<td>&lt;6 months</td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>Latvia</td>
<td>NO</td>
<td>NO</td>
<td>3-7</td>
<td>difficult but improving</td>
<td>&lt;6 months</td>
<td>Total</td>
</tr>
<tr>
<td>Lithuania</td>
<td>NO</td>
<td>NO</td>
<td>1</td>
<td>reasonable</td>
<td>&lt;6 months</td>
<td>40%</td>
</tr>
<tr>
<td>Malta</td>
<td>YES</td>
<td>YES</td>
<td>1-3</td>
<td>reasonable</td>
<td>&lt;1 month</td>
<td>Total</td>
</tr>
<tr>
<td>Poland</td>
<td>NO</td>
<td>NO</td>
<td>&gt;10</td>
<td>difficult</td>
<td>&lt;1 year</td>
<td>50%</td>
</tr>
<tr>
<td>Romania</td>
<td>YES</td>
<td>YES</td>
<td>3-6</td>
<td>difficult</td>
<td>6 months</td>
<td>none/shared for &gt;10MWp</td>
</tr>
<tr>
<td>Slovakia</td>
<td>soon</td>
<td>NO</td>
<td>&gt;10</td>
<td>difficult</td>
<td>1-2 years</td>
<td>Total</td>
</tr>
<tr>
<td>Slovenia</td>
<td>YES</td>
<td>NO</td>
<td>3-6</td>
<td>difficult but improving</td>
<td>&lt;6 months</td>
<td>Shallow</td>
</tr>
</tbody>
</table>

Table 6. Grid connection process in NMS
NMS research infrastructure focuses on basic materials used in PV such as thin-film, chalcogenides (Estonia, Poland), tandem and heterojunction cells based on the amorphous silicon/crystalline silicon systems (the Czech Republic), efficiency and stability improvement of the dye sensitized solar cell technology (Slovenia) and organic solar cells (Latvia, Lithuania, Poland). In spite of significant scarcity of RTD funding, this area is relatively well developed in NMS.

The National Technology Platform for Integrated Micro and Nanosystems has been established in Hungary in 2008. In the frame of this Platform the Hungarian Photovoltaic Platform started to operate. The first national conference and exhibition was held in Budapest on 27 March 2009.

In Lithuania at the beginning of 2008 in Vilnius the PV Technology Cluster has been established. The objective of the Cluster is to consolidate 19 Lithuanian companies operating in PV technologies sector in order to increase sustainability and competitiveness of national PV sector.

Polish Centre of PV is capable of leading detailed research of cells, modules and systems thanks to high-tech measurement equipment. Since 2007, Centre of PV uses Outdoor and Indoor Test facilities to evaluate PV technologies under simulated and accelerated indoor and outdoor conditions. It allows a tighter cooperation between industry and RTD representatives in unifying standards and codes of PV devices. The similar outdoor test centre to evaluate different PV modules in Nordic conditions is founded in Estonia.

The Agency for the Research (ARRRS) approved the financing of the research program Photovoltaics and Electronics to the Faculty for Electrical Engineering, in the period 2009-2014. The EC approved the financing of the research program “SOLAMON” (7.OP, DG RTD). Coordinator of the program is CEA, the Slovenian partner is the Faculty of Electrical Engineering.

Further development in PV sector will be achieved by combining market experience with laboratory research. Market pull along with technology push are crucial if we want to see prices falling and efficiency growing, to get the market up and running.

There is still a pending need of strong coordination PV research activities in NMS and reinforced support of PV research on European and national levels. European policy plays key role in the supporting of general RTD in NMS, due to relative scarcity of financial means earmarked for this purpose on national level. Many areas of research are still waiting for sufficient support, before they can develop properly, inter alia: better equipment technologies, inclusion of PV into grid integration, new generation high-efficiency technologies, substitution materials and storage. According the SET Plan, the EU intends to increase RTD expenditures in order to boost RES market by means of new technologies. To reach the energy policy goals the adequate measures in RTD field must be undertaken.

7. EDUCATION and TRAINING

Bulgaria

High school programme "Solar technician" is launched in the special colleges. There are special courses on PV materials, solar cells and PV systems in the educational programmes of different Universities (e.g. Gabrovo Technical University, South-West University in Blagoevgrad). Many workshops and special Advanced Studies Institutes with educational programmes in the field of PV for engineers and Ph D students have been organized. Ph D courses and training programme on PV and the other RES are performed in the Institutes at the Bulgarian Academy of Sciences and at the Universities.

The CL SENES, established as Bulgarian Centre of Solar Energy, is a main leader in PV activity in Bulgaria. One of its most important activities is the education and training of young researchers to get a high qualification in the field of solar energy and new energy sources. The PhD students and the young researchers in Bulgaria have attended different International Scientific Forums and Schools. That is due to their good scientific results, as well as to the opportunities provided by a number of European programs for support of such participations and BAS particular budget for PhD students financing. The financial support of the European Social Fund on operative programme “Development of Human Resources”, which included about 15 young researchers and PhD students, started in 2008 and will result in improvement of the level of the education and training of the young researchers in the field of alternative energy systems.

The CL SENES has contacts and signed agreements for a joint educational activity in the field of renewable energy sources with universities and high schools in the country for attending different courses and training on measurement of the characteristics of solar cells.

The Bulgarian Centre of Solar Energy at CL SENES organized specialized workshops, conference and school on PV solar energy conversion in order to raise the scientific and technological level of solar energy conversion in Bulgaria and spread awareness about solar energy technologies and their environmental impact.

Cyprus

In Cyprus the main leader in research and technology development in the photovoltaic technology is the University of Cyprus. In the department of Electrical Engineering there is an elective program in undergraduate and postgraduate level, conserving the Renewable Energy Sources the emphasizes in photovoltaic technology. The main objective of the program is to give a good understanding of the PV technology and to demonstrate the potentials for further development and expansion of the use of PV systems in Cyprus.

Additionally the Photovoltaic Technology group of the electrical department of the Cyprus University carries out a strong scientific research in the field of PV performance, in collaboration with other foreign Institutes. The main aim of this group is to evaluate and monitor the performance of PV systems in Cyprus environment by analyzing the data taken
from a small PV research park that is located at the premises of the University. This park is constituted of 14 different types of PV systems that are examined under various parameters such as weather conditions, irradiation, etc. The results are used to provide information for the establishment of more effective pv systems. This project is funded by the German Ministry of Environment.

Moreover in department of Geotechnical Sciences and Environmental Management of the Cyprus University of Technology there are studding and research programs in renewable energy sources that includes pv systems.

Czech Republic
Czech RE Agency organizes special workshops for designers of PV plants. Workshops are accredited by the Czech Chamber of Certified Engineers and Technicians Engaged in Construction.

4th International Workshop on Teaching in Photovoltaics - IWTPV’08 organised by the IET Czech Network in co-operation with the Faculty of Electrical Engineering (Department of Electrotechnology) Czech Technical University in Prague took place in Prague, 27 - 28 March 2008. The workshop provided forum for technical discussion in the field of photovoltaic, especially problems connected with education in this field. A round table discussion on “An optimum curricula for teaching photovoltaics and international cooperation” took place during the event. The same Department conducts several lectures on RES and PV.

Estonia
The same academic and research bodies are responsible for demonstration and dissemination of PV technologies. The new international curricula for Master studies was opened at Tallinn University of Technology, concentrating on different alternative energy sources with the main attention to PV. Education, spreading information among general public, construction of demonstrative installations represent major activities aiming at popularization of PV among different stakeholders.

Estonia
In Estonia PV has been used only for demonstration. Several demstration panels at the roofs of schools and our university. Photos of panels on the roof of our laboratory building will be in attachment.

PV RD is financed in Estonia from different sources:
(2008 data)

- Target financing 520 000 Euro
- Estonian Science Foundation 190 000 Euro
- EU programs 120 000 Euro
- Infrastructural support from Government 830 000 Euro

During the year 2009 3-rd Nordic PV Conference will be organised in Tallinn.
We have about 10 university seminars every year in different problems of PV (chemistry, physics, application) with several foreign quest lecturers.
The new spin-off company was founded at TTU aiming to implement developed by scientists of TTU technology of solar cells. Negotiations with investors are ongoing. Planned investment for 2009 year is about 400 000 Euro. Planned cofinancing from Estonian Investment Agency has to be about 600 000 Euro

Malta
Research and Technology Development in Photo Voltaic technology is practically non-existent, since no industry in manufacturing of such technology exists yet in Malta

However studies on the performance of PV systems in such environment have been going on, on individual basis by technical experts from the Institute of Energy and Technology, and various other professors from the University of Malta.

A particular initiative has been taken by a local industry, specializing in innovative products, mainly in batteries technology, to install and monitor over the years the performance and reliability of various technologies of PV systems.

Romania
The most important PV Activities, Doctorate, Masterate, Courses, take place in the following Universities: University “Transylvania” Brasov, Polytechnic University of Bucharest, “Valahia” University of Targoviste, “Dunarea de Jos” Galati University, University of Timisoara, Polytechnic University of Cluj.

New and Renewable Resources Association SunE, Founded in 2008. The main activities are: Improving the RES legislation in Romania.
- Getting strong relation with Government Organisations:
  - ANRE-National Agency for Energy Regulations,
  - ARCE-National Agency for Energy Conservation,
  - Ministry of Economy- Department of Energy,
  - Ministry of Environment.
- Development of RES Market through – Organising conferences and Trade Fairs (like RENEXPO South-East-Europe 2008 in Bucharest and 2009 in Arad)
- Organising training and courses for installers in the field of RES

Academy of Scientists from Romania – AOSR,
A new Research Center (ECC) The Energy and Environment Consulting Centre for Black Sea and The Balkans area Foundation together with ENEA-Italy was founded in 2008.

ICPE – NESL act as a National center for RES development in Romania and specially photovoltaic through organising three National Annually Conferences on RES. It is a member of PV-NMS-NET.

The Center CERRES – The center for RES is responsible for Evaluation of the development of RES applications in Romania.

Slovakia
Comenius University - Faculty of Mathematics, Physics and Informatics
Department of Experimental Physics:
The department has received an academic accreditation for new study programs which include photovoltaic research – Bachelor’s and PhD.
Programs: Renewable Energy and Experimental Physics (Bachelor) and New and Renewable Energy Sources (PhD. program). The doctoral program is largely focused on nanotechnologies, new trends in material technology and renewable
energy sources. Photovoltaics is an independent and obligatory subject within the program. The department declares a will to strengthen applied research in photovoltaics and the newest PhD. themes offered by the department include photovoltaic research (mainly focused on Third generation photovoltaics). The rising trend of applied PV research will be supported by the new centre for excellence – with a laboratory for testing PV materials – a 100 kW installation has been built on the University roofs and should be finished in 2009 already.

Slovak University of Technology
In 2008, the University started a project of Renewable Energy Sources Centre of Excellence, with funding of 1,5 mio €. Research of PV will be supported by new devices oriented on electric measurements, organic semiconductors and transparent conductive materials. Several departments and faculties of the University have joined the project including Faculty of Electrical Engineering and Information Technology. There were only two seminars that specialized purely in photovoltaics promotion and information dissemination. “Photovoltaics – our sunny future” and “Seminar on Promotion of Building Integrated Photovoltaics”.

Slovenia
At middle school level a programme "Solar technician" is in preparation in some selected specialised schools, based on their individual initiative. At the time being they are organising education for interested groups.

At Bologna 1st (BSc) and second level (MSc) there is still no dedicated subject for Photovoltaics. But at Bologna 3rd levle (PhD) that starts in October 2009 there will be a post-graduate subject Photovoltaics (5 ECTS, 30 hours in one semester) at PhD programme "Electrical Engineering" at the University of Ljubljana. Another subject Renewable energy sources combines modules: Solar Energy, Photovoltaics, Hydro&Wind at PhD programme "Protection of Environment". There is a one day PV seminar (3-4 seminars per year) for interested potential investors and others, organised by Slovenian Institute of Standardization.

The Faculty for Electrical Engineering and Slovenian PV platform organized the SLO-PV 2008 conference, with 240 attendees. Slovenia organised the General Assembly of EU PV Technological Platform in June 2008 in Ljubljana.

8. PERSPECTIVES and SUMMARY
New member states of the EU are still at an initial stage of PV market development, for which dramatic leaps in the installed power capacity is observed. In 2008 there was remarkable growth in certain NMS like Czech Republic or Bulgaria, the rest of new member states saw moderate growth or even stagnancy of PV market. Key incentive still seems to be well designed feed-in tariff system, encouraging PV investors not like any other mechanism of support. Czech Republic is expected to remain the PV installation leader, and Bulgaria are to benefit from its generous feed-in tariff and considerable solar potential. Slovenian and Cyprus markets are developing with a steady pace. The other two potential countries are Slovakia with new FIT and Romania with multiply Green Certificates.

Unfortunately, in Hungary and Poland development is only in the off-grid systems. However in the decades to come PV sector is expected to evolve at rapid pace.

The environment, labour market and national budgets benefit enormously from PV market growth. Today’s challenge is to reach higher penetration of PV, and make it a mainstream energy source. To spur market development not only legislative framework is necessary but also further progress in PV technologies. In order to unleash the potential of PV market it is important to bring the cost of solar energy for customers and cost of energy from the grid closer together. Moreover, this PV cost must be stable and reliable in the long run. Unfortunately, still long way ahead of NMS before they will be able to enjoy the grid parity in NMS since the cost of electricity is lower than in the EU-15.

Global financial crisis has impact on the entire economy. The bad economic times will be felt on the entire branch of PV market. Financial crisis affected the global economy hard. Plunging oil prices, complex procedures to take out any loan hit the industry sector. There is a chance that this situation will not dampen the market and on the contrary it is going to cause a breakthrough in the PV sector. Slashing of number of loans granted by the banks at the end of 2008 caused a slow down of a global demand on PV installations. As a result, module prices fall which is good news for the customers and an opportunity to become more independent from EU and national support schemes. Exploitation of solar energy will become economically sound when oil prices go up again.

Those PV manufacturers who will survive the global decrease in demand and economic downturn in 2009, and maybe 2010, will have a bright future and infinite market potential ahead. There is also another advantage of global crisis as it raised awareness of societies that issues of global concern that are not being solved in a due time represent a real threat to all.

Photovoltaics is one of the key energy technologies of our low-carbon economy. It helps to combat climate change and improve the security of energy supply. In order to render PV a real alternative to other energy sources it is vital to combine a continuous policy support with industry – research cooperation. Unfortunately the awareness of PV power advantages is still insufficient among NMS’ decision makers. Another obstacle is the state of the majority of transmission grids that still need to be modernised. To boost PV NMS market it is also vital to enhance cooperation between European energy regulators and between grid operators.

Rising concern about the relationship between energy and environment is at the heart of European Union policy making. EU regulations influence NMS legislations, but there is still long way ahead of them. Without proper legal framework, no further PV development can be made, but it is crucial that PV communities in each NMS monitor and evaluate the adopted measures. The stress shall be put on transparency, reliability and cohesion of law influencing PV sector in those countries.
Croatia and Turkey are prioritised for membership in EU. As official candidate member states both countries try to meet Copenhagen criteria and prepare their economies to the common market reality that is likely to be extended in the coming years. Turkey, Croatia and the EU countries are all Energy Charter Treaty signatories, so the notions of the energy cooperation are already established. With the accession of the two countries, this process will be reinforced, as the entire legal order of EU will bind them. From the economic point of view, the membership of Croatia and Turkey is strategic for EU, especially with regard to energy security. However, the final decision is still to come and depends mostly on the political will of major EU countries. In the meanwhile, the Status of PV in NMS includes already Croatian and Turkish PV markets, recognizing their high potential for future development and further integration.

Croatia

Croatia is the official candidate member state of the EU since 2004. It recovered from the collapse of former Yugoslavia and is second country, after Slovenia, with the strongest, market-oriented economy and stable democratic political system. Croatia has ratified the Kyoto Protocol and lowered successfully its carbon emissions. With RES sector in development, Croatia is an interesting country for investors. Solar electricity generation has vast potential due to good irradiation of Croatian territory with the max. PV output potential reaching 1450 kWh/kWp. Despite favourable conditions the installed PV capacity in 2008 totalled only 0,78 MWp (including 0,12 MWp on-grid). The Croatian government set a non-ambitious target of 45,66 MWp of PV capacity installed by 2020.

Isolated installations can benefit form state support represented by the Fund for Environmental Protection and Energy Efficiency, allocated upon individual request and criteria. Investors might receive preferential loan with Croatian Bank for Reconstruction and Development earmarked for necessary documents preparation (i.e. environmental impact studies). Loan is paid over max. 2-year time period and covers up to 50% (but max. 150 000 USD) of the cost.

The most attractive in Croatia incentive system are certainly its feed-in tariffs. There are three levels: 0,50 EUR/kWh for systems smaller than 10 kWp, 0,45 EUR/kWh for systems bigger than 10 kWp but smaller than 30 kWp and 0,31 EUR/kWh for the rest. FIT rate is guaranteed over 12 years and is adjusted on a yearly basis. The weakness of Croatian RES market lies in its grid accession procedure which is complicated and lengthy.

Turkey

Since 1963, Turkey has been an associated member of European Communities. It started the negotiations to become an EU member in 2005. Although it’s still a question of political decision, Turkey’s attempts to fulfill the Copenhagen criteria is successful in many fields. In some areas, however, are still behind the EU standards. Screening of the Turkish energy sector by the EU started in 2006 and demonstrated important insufficiencies that still require considerable. It is regrettable that Turkey is not a party to the Kyoto Protocol and no limits on gas emissions have been set yet.

Nevertheless energy from renewable sources covers over 10% of total energy consumption. 1650 kWh/kWp of PV electricity output potential characteristic for the majority of its territory places Turkey among the most irradiated European countries. Unfortunately the reliable figures representing PV installed capacity are not available.

In 2005 Turkey adopted a Feed-In Tariff law. The Energy Market Regulatory Authority in Turkey bases the FIT rate on the average of the wholesale price announced in the previous year. In 2008 it was: 0,08 EUR/kWh for industry, 0,09 EUR/kWh for domestic consumption and 0,1 EUR/kW for service sector. But in reality RES producers sell the electric energy the Market Financial Reconciliation Centre guaranteeing the minimum of 0,05 EUR/kWh over 10-year period.

There is also quite interesting incentive scheme featured in the Turkish law on RES. First of all there is a quota system consisting on an obligation of each legal entity, holding a retail sale license, to purchase a specified amount of electrical energy from RES. Certified producers’ installations can not be older than 10 years. The quota is based on a comparison between the amount of energy sold by that retail sale license holder, in the previous calendar year, and the total electric energy offered for sale by all retail sale license holders in Turkey.

All the costs related to state owned properties are subject to 85% discount provided that they are used for renewable energy generation.

Perspective of Croatia and Turkey joining the EU a realistic one and likely to influence far-sighted investors’ decisions. Strategic and growing, Turkish and Croatian markets should not be neglected while analysing European RES sector.

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