

## **PV-NAS Data Base – The Photovoltaic state-of-the-art in the New Member States and Accession States**

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**Abstract** - The Project PV-NAS-NET – the Network of ten Newly Associated States (eight New Member States and two New Accession States) representatives, four EU Member States (the Netherlands, Greece, Austria and Finland) and Switzerland is complementary to the PV-EC-NET. The PV-NAS Data-Base was elaborated using specific questionnaire completed by all partners from the following countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. It could be considered a very useful tool to perform a comparative evaluation of the PV activities in these states.

## **1. INTRODUCTION**

- Photovoltaic Solar Energy (PV) is one of the most promising sources of energy. The world market for PV is now growing rapidly with an average annual growth of approximately 30% over the last 5 years. This success is mainly derived through market stimulation and intensive RTD work during the last 10 years in Japan, USA and Europe, causing a price reduction of a factor 3 since 1990.
- **Demonstration activities are a very important part of the PV strategy in EU states, USA and Japan.**
  - In USA there is a lot of different organizations responsible for PV, but only one institution – Department of Energy, at national level, distribute funds, while in Japan, PV RTD is organized mainly on ministerial level; there are allocated funds within national budgets for R&D, demo programmes and market incentives.
  - In USA and Japan universities and research institutes with strong PV activities are very linked with industry. In EU states the cooperation between the PV sector and industry is not so important.

- However in many EU states public or private utilities take part in financing PV.

- There are **significant differences in the extent of PV RTD among the New Member States and even more in comparison with old EU Member States. There is a need for identifying and overcoming existing barriers to development of PV in these countries.** It is of strategic importance to have up-to-date information, to use the available results, to avoid mistakes made earlier by others, etc., and, if possible, **to orientate ongoing research activities towards the problems which are typical and important for both, the NAS and EU countries.**
- **PV-NAS-NET project aims at creating enhanced networking and coherence among PV RTD activities in NAS and EU countries** in order to advance the above mentioned objectives in a coherent manner focussed on market, social and environmental needs.

## **2. CONCEPTION OF THE PV NAS DATA-BASE**

- **The PV-NAS DataBase was elaborated using specific questionnaire** completed by the partners from the following countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The questionnaire was filled in taking into account the information obtained from credible sources, like representatives of the ministries, research institutes and universities, companies, representatives of NGOs.
- **This PV-NAS DataBase could be considered a very useful tool to perform a comparative evaluation of the PV-NAS activities.** It contains the following information on each NAS country, valid for a period of the last eight years (1996-2004):
  - the information concerning the organizational factors
  - the PV RTD activities
  - the PV policies and support mechanisms
  - the achievements of the PV RTD activities, challenges and needs, problems hindering the progress of the PV RTD activities

- **The DataBase was created in HTML** and was optimised for a resolution of 1024\*768 pixels. By its accession the following sorts of data could be obtained:
  - **The above mentioned sections for each NAS country;**
  - **Information concerning all 10 NAS countries** for each above mentioned section and corresponding subsections; so, a **comparative evaluation of different NAS countries could be done.**

**PV-NAS-NET**  
**"Network for Co-ordination of European and National Programmes  
for Photovoltaic Solar Energy"**  
**PV - NAS - NET**  
Based on the PV-EC-NET Questionnaire  
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**Introduction**  
PV-NAS-NET brings together the institutions from the candidate countries much dedicated to the PV RTD activities. The main goal is to incite

<b>COUNTRY</b>	<b>REVIEW OF PV-NAS-NET QUESTIONNAIRE</b>
<a href="#">Bulgaria</a>	<a href="#">View Entire Review</a>
<a href="#">Czech Republic</a>	<a href="#">View Executive Summary</a>
<a href="#">Estonia</a>	<a href="#">View Introduction</a>
<a href="#">Hungary</a>	<a href="#">View Methodology and Approach</a>
<a href="#">Latvia</a>	<a href="#">View PV Programme Organization</a>
<a href="#">Lithuania</a>	<a href="#">View Review of PV Activities, Aims, Scope and Assessment</a>
<a href="#">Poland</a>	<a href="#">View PV Policies and Support Mechanism</a>
<a href="#">Romania</a>	<a href="#">View Successes and Failures in PV RTD Activities</a>
<a href="#">Slovakia</a>	<a href="#">View Conclusions</a>
<a href="#">Slovenia</a>	

**General View**  
[Section 1: CONTACT INFORMATION](#)  
[Section 2: GENERAL INFORMATION](#)  
[Section 3: PV-RTD ACTIVITIES, AIMS, SCOPE, METHODOLOGY, and ASSESSMENT](#)  
[Section 4: PV POLICIES AND SUPPORT MECHANISMS](#)  
[Section 5: SUCCESS\(ES\) OF PV RTD ACTIVITY](#)  
[Section 6: References](#)  
[Annex A](#)  
[BACK TO COUNTRIES MENU](#)

Figures 1 a,b,c: Screen-shots from PV-NAS-NET Data-Base

### 3. ORGANIZATIONAL FACTORS

- **In New Member States, dedicated national PV RTD programme does not exist.** There is a strong need for this type of activity. Most of the NAS countries indicate the lack of such programmes as one of the most important factors obstructing PV development. **Photovoltaics RTD is usually placed in general RTD programmes** (Bulgaria, Czech Republic, Poland and Romania) and proposals must compete with others without any preferences. **PV RTD can be also a part of RES programmes** (Lithuania, Czech Republic, Poland and Romania), but it is only a small part of these programmes.
- **There is no central authority to coordinate activities related to solar energy issues.** Usually **responsibility is scattered into several ministries partly responsible for renewable energy development** (Ministry of Science and Technology or Ministry of Environment"). These ministries cooperates with special governmental agencies which are in charge of energy policy, including RES.



- **The important role in PV research in NAS play universities, research institutes and companies, which are mostly concentrated on basic research of materials and solar cells, BOS, PV manufacturing and measuring technical development, education and demonstration activities.**
- There are no special units which work mainly on PV, although there are five exceptions (Poland, Estonia, Bulgaria, Romania, Lithuania), where the **Centers of Excellence dedicated to PV were established**. The number of staff in Universities and Research Institutes in NAS working in PV-RTD is shown in Figure 2.

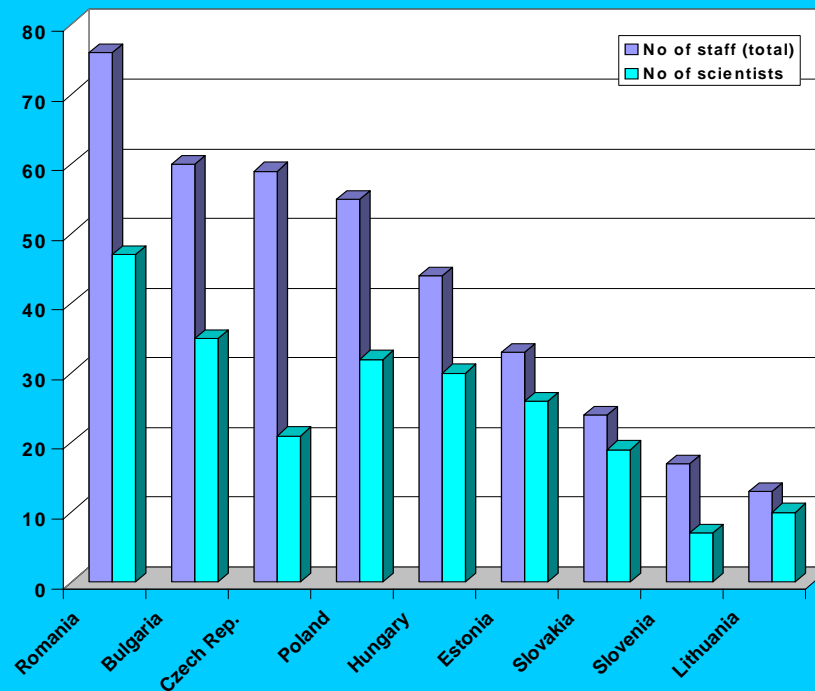


Figure 2: Number of staff in the institutions (universities, research institutions) in NAS working in the field of PV RTD, Demonstration and Dissemination

- **There are also companies offering products and services being part of PV production chain** (example: production of silicon ingots and wafers, solar module assembling, solar tracker and construction of production equipment as well as BOS - controllers, inverters, etc.). The absence of PV industry is often mentioned as a main problem feature. Some countries, e.g. Lithuania, perceive that in the future the only way to increase the interaction with the industry would be to find contacts with foreign companies that would be interested in RTD work performed by the Lithuanian scientists. Estonia pointed absence of PV local industry as a critical problem factor, but co-operates with industrial partners from EU.
- **Support from the European Commission seems to be crucial for PV development in the NAS.** Due to the relative scarcity of financial support for RTD in NAS (far below 1% of GDP), EU policies have a great influence on the national research agenda, especially influence has by far become the strongest in the renewable energy sectors.

- **The institutions from NAS participate actively in European Programs** (RTD Framework Programmes, TEMPUS, Joule, PHARE, INCO–Copernicus, PECO, Leonardo da Vinci, Altener). In Czech Republic, Inco-Copernicus programme helped to install first facade and gave impetus to gain support from the government for PV activities. The extension of the only such programme in NAS area – Sun to School will be co–financed by PV Enlargement (project in FP6). Thanks to the same project, Poland will install the biggest PV facade in the NAS. Thank to special call in FP5 the PV Centres of Excellence were established in Poland, Estonia, Bulgaria, Romania, Lithuania.
- **The European Commission networking projects are very important to foster collaboration.** Participation in such projects gives access to EU laboratories and results.
- **PV Demo projects have been developed in especially in the last 8 years in the majority of NAS.**

## **4. PV RTD ACTIVITIES**

- **PV research in NAS countries has old traditions and significant experimental and technological basis.** Scientific groups of the region are actively working in all fields of modern PV solar cell research and in some of those fields have reached significant achievements.
- **In general, the range of the PV activities in NAS countries is wide,** covering nearly all most important fields of the PV RTD, from different materials for PV cells to inverters and other components of grid connected PV systems. One could point out a widely developed research infrastructure for investigating main materials used in photovoltaics: all (crystalline, polycrystalline, and amorphous) forms of silicon, chalcopyrite based materials for thin-film cells, and even organic PV materials.

- **There still are numerous research groups in NAS countries that work on the development of advanced concepts of silicon solar cells.**
  - Institute in Bulgaria has developed a technology for producing solar grade silicon ingots;
  - researchers in Hungary develop an advanced low-cost technology of multicrystalline silicon.
  - Research is done on alternative processes of single-crystalline silicon cell technology: ion-implantation (Slovenia) or self-formation processes (Lithuania).
  - In Czech Republic are developed tandem and heterojunction cells based on amorphous Si/ crystalline silicon system.
  - In Estonia and Bulgaria are working in thin-film chalcogenides; new concepts like nanocrystalline absorbers, as well as systems based on chalcogenide solar cells are developed.
  - A3B5 semiconductors (Slovak Republic, Romania), CdTe (Slovak Republic), CIS (Hungary), organic solar cells (Estonia), etc.

- **RTD activities in NAS countries are of a considerable volume, cover a very wide range of topics and are based on research infrastructure and a number of qualified research personnel.**
- **Demonstration projects are usually in the form of small installations.** The amount of installed power ranges from 0,5 to 10 kW. We could mention:
  - 110 kWp of total installed power placed on schools and universities in Czech Republic,
  - 10 kW grid connected system at fuel station in Hungary and four grid-connected PV systems on schools in Poland.
  - Among NAS, Romania is the only country in which several stand-alone hybrid systems, combining PV power mainly with wind, were installed.
  - In Slovenia the stress is being put on developing PV off-grid domestic applications, functioning mainly as a supply of energy in mountain areas.

- **Promotion of PV energy in the NAS countries is quite active.** Public awareness on the benefits of PV is rising, however it is still not sufficient to affect the NAS countries decision makers.
- By presenting the amount of funds devoted to RTD and demo/diss programmes and the sources of financing the relation between input of public or international funds into various activities in particular countries could be understood. The Figure 3 covers activities from 1996 to 2003; the amount of money were defined at the level of at least 10000 €.



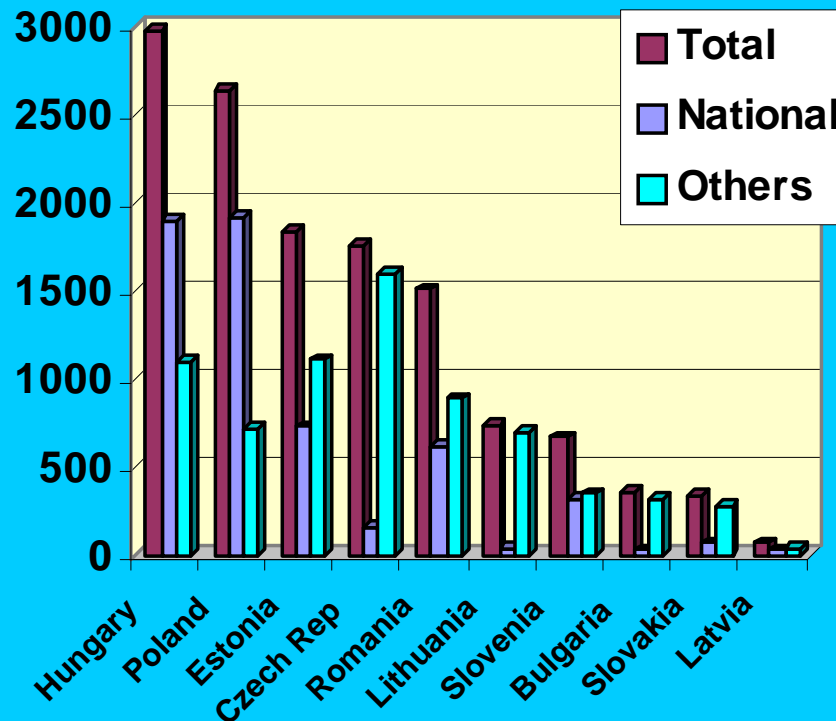


Figure 3: Amount and origin of the funds for PV RTD and demo/diss (in 1000 €)

## 5. PV POLICIES AND SUPPORT MECHANISMS

- **All countries have their own strategy for development of RES** that put obligation to achieve certain share of RES on whole energy source mix till reference year (2005 and/or 2010). Existing strategies for development of RES in majority of NAS countries should create the support arrangement to motivate potential investors.
- **The main incentives for PV in NAS countries are as follows:**
  - **Feed-in-tariff** already established by decisions or Governmental decrees in Slovenia, Hungary, Estonia, Czech Republic, Lithuania and Bulgaria. The level of support is very small in all cases.
  - **Green tariffs** introduced only in Estonia and Czech Republic.
  - **Green certificates** exist only in Estonia and Romania.
  - **Tax incentives** applied by VAT reduction in Czech Republic and Poland, or by CO2 tax on fossil fuels
  - **Soft loans / subsidies** introduced only in Slovenia, Hungary, Poland and Romania. Very good examples are in Slovenia and Poland

Graphic presentation of installed power in NAS countries is shown in the Figure 4.

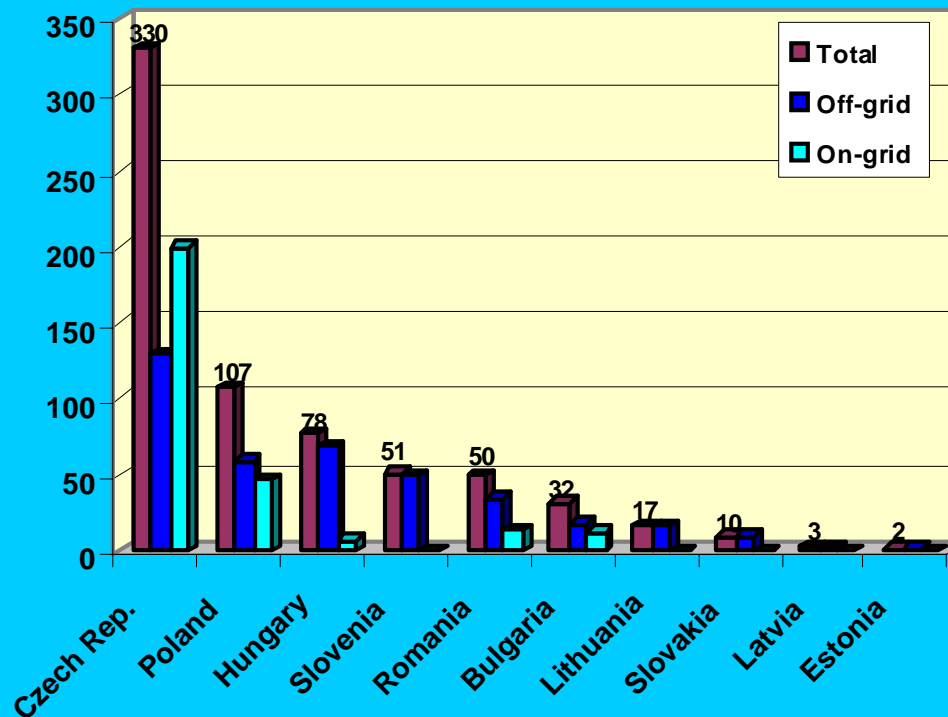


Figure 4: Installed power in the NAS

## 6. ACHIEVEMENTS AND CHALLENGES

- **The great intellectual potential capacity can be – and already is - used and interconnected by the European Commission, putting stress on the establishment of European networks co-operating in RTD projects.** All NAS countries state that the co-operation with the EC programmes should be considerably intensified in order to fully take advantage of their potential and capability.
- **The interaction between the governmental institutions, research centres, universities and the industry has already been fostered and resulted in major achievements and some success stories.** Some partners perceive the very important role of the PV industry. Increased awareness and interest in society and private sector would stimulate the demand for PV installations and would trigger further production and the technological development.

## **7. CONCLUSIONS**

- **The photovoltaic activities are slowly emerging and markets are already being created in the NAS.** Further success stories are needed in order to convince decision makers to create favourable legal environment, to attract more potential investors and convince will-be customers to invest their funds in the PV installations. A clear commitment and stable framework are necessary in order to make different stakeholders invest in NAS (PV RTD), not only to create new wealth but also to prevent further losses (brain drain).
- **There are significant differences in the extent of the PV RTD among the New Member States and even bigger differences when compared with those in the EU Member States.** There is a need for overcoming the existing barriers for the PV development in NAS countries. The new enlarged European PV industry and the energy market require a very deliberate emphasis on the technology transfer and dissemination, if new and improved energy technologies are to be successfully developed. It is also of strategic importance to have information updated and exchanged and to use the latest results available.

- To sum up, photovoltaics may develop in NAS. For this, there are still many opportunities to be effectively exploited and some barriers to be overcome. A pool of highly skilled PV researchers, appropriate infrastructure and external funds constitute the prerequisite for a strong PV RTD in NAS. In order PV to become also a powerful technology and industry, awareness should be increased in society and among the key decision makers. Especially the legal and market framework should be developed and strengthened in order to make key stakeholders invest in PV in NAS countries.

## **ACKNOWLEDGEMENTS**

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