

NATIONAL RTD PROGRAMMES FOR RENEWABLES IN GREECE WITH EMPHASIS ON PV TECHNOLOGY AND PROSPECTS FOR HARMONISATION WITH THE ERA

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ABSTRACT: A detailed review of research and technology development Programmes in Greece in the field of Renewables, with emphasis on PV technology is presented in this paper. The work is based on the on-going PV ERA NET project and the structure of the existing Programming tools as well as, the role of the managing bodies and the general National strategy on the Programming level is reported. Budgets allocated per Programme and per thematic priority or technology sector are indicated. Lessons learnt from the execution of past RTD Programmes are summarised and the steps for the harmonisation of the country with the European initiative ERA are described.

Keywords: ERA (European Research Area) – 1; National PV RTD Activities – 2; R&D and Demonstration Programmes – 3

1 INTRODUCTION

PV ERA NET is a European network of Programme coordinators and managers in the field of PV RTD activities. The network comprises major key players in the field of national and regional RTD programmes involving photovoltaics. The mission of PV ERA NET is to carry out activities towards networking and integration of national and regional programmes in the field of PV RTD in the European Research Area (ERA). This paper contains concise information on RTD Programmes in Greece in the field of Renewables, with emphasis on PV technology. The focus of the information is mainly on the Programme level, although indicative data on single RTD projects and relevant activities are also mentioned.

2 STRUCTURE OF RTD IN GREECE

In the last decade, Science and Technology policy in Greece had a triple objective: to develop new research resources, both human and material, to improve the interconnection of research and production and to integrate the country's research priorities into the European and international activities.

The principal operational agent for RTD Programming in Greece is GSRT – General Secretariat for Research and Technology. GSRT belongs to the Ministry of Development (MoD). The role of GSRT is to define the research priorities and to coordinate the Programmes addressed to scientific research institutes, universities, the industry etc., focussing on areas that are important for the national economy and for the improvement of the quality of life. In the energy sector, Programming is done in a so-called “decentralised” structure with GSRT responsible for the first level of the management. Support is provided from its supervised institutions belonging to the public sector. For example, CRES has been appointed by the

government as the principal consultant in energy matters. In terms of Programming in the energy sector, CRES participates in defining the thematic priorities of RTD needs and takes part in the evaluation of proposals and the monitoring of the projects' evolution.

3 PROGRAMME CONTENTS AND BUDGETS

The main financial tools for the implementation of the RTD policy are the annual state budget and the Operational Programme for Competitiveness (OPC), under the European Community Support Framework 2000–2006. OPC covers a broad spectrum of activities for trade, industry, tourism, energy as well as research and technology. The so-called OPC–RTD Programme is managed by GSRT and is the part of OPC focusing on RTD activities.

The total budget of the general OPC for the period 2000–2006 is €6392M of which, €642.5M is dedicated to RTD activities (OPC–RTD). A 64.6% of the total budget, i.e. €415.2M, is supported by the state.

For PV technology in particular, no specific Programme is in place in Greece. PV RTD is actually supported through more generic funding mechanisms, either targeted specifically to RES or even technology development in general. Furthermore, targeted PV market support mechanisms are yet in place and only some motivation for professional applications is subsidised.

The annual total budget dedicated to PV RTD is approximately €2.2M on average. This amount is not explicitly specified in the Programme but rather depends on approved proposals and the continuity of the calls for proposals. The budget dedicated to PV technology for the year 2004 per sector is presented in Table 1 below.

Table 1: Total budget in 2004 for PV RTD in Greece

PV RTD Field	Budget in 2004, k€		
	R&D	Demonstration	Total
Cells / Modules			
Thin-film Si	100	0	100
Other thin-film	50	0	50
Organic cells	50	0	50
Systems			
Stand-alone	150	300	450
Inverters / BoS	200	250	450
BIPV	100	50	150
Total	650	600	1250

3.1 Objectives and Priorities of OPC-RTD

The main objective of the Programme is to bring research organisations closer to the industry through the formation of consortia in order to improve collaboration for the development of innovative products and services in the RES and ES (Energy Saving) sectors. For RES, the Programme aims at the reduction of cost and the improvement of efficiency of relevant technologies. Through its actions, OPC-RTD supports improvement of economic competitiveness, technological upgrading of the production potential and promotion of innovation, creation and development of new enterprises, upgrading of the technological and innovation potential, promotion of collaboration between research and business units, “opening up” of the Greek research system and international cooperation, concentration of funds in priority fields and creation of units or networks of excellence with global recognition and national / regional exploitability, education of researchers, development and expansion of infrastructures etc.

A list of the main priorities of RTD actions and the implementation tools in OPC-RTD is as follows:

PRIORITY AXIS 3 – Promotion of Excellence in Business Activity

- Measure 3.3: Enhancement of Excellence in Technological Research and Development

PRIORITY AXIS 4 – Technological Innovation and Research

- Measure 4.1: Support Research Units for Standardisation and Commercial Exploitation of Research Results (Spin-Off)
- Measure 4.2: Incubators for New Knowledge Intensive Companies in Science & Technology Parks & Research Centres
- Measure 4.3: Encouragement of Research and the Transfer and Spread of Technology in Companies – Support for Activities of International S&T Cooperation and Technology Transfer
- Measure 4.4: Public Awareness for New Technologies – Support & Formulation of R&T Policy – Management of R&T Information
- Measure 4.5: RTD Consortia in Sectors of National Priority

PRIORITY AXIS 8 – Human Resources

- Measure 8.3: Human Resources in Research and Technology

4 MAIN RTD TOOLS FOR PV TECHNOLOGY

A detailed description of the most important activities for RTD in the RES sector, PV included, is provided below.

4.1 Measure 4.3, Action 4.3.1 PAVET and Action 4.3.2 PAVET-NE

PAVET stands for “Programme for the Development of Industrial Research and Technology”, while PAVET-NE is addressed to New Enterprises which have been operating for less than 5 years. Both programmes aim at encouraging the development of industrial research and the promotion of innovation. The transfer and adaptation of advanced technology to traditional industrial sectors and the development of industrial innovation activities is envisaged. As results, the development of new or improved products or services with high added value and the improvement of business competitiveness and penetration into new markets are expected. In PAVET, subcontracted partners are funded 100% by the principal contactors and in this way, it resembles to the CRAFT Programme of the EC.

In PAVET maximum public funding is 50%. The usual duration of a project is 18–24 months. The budget for the period 2002–2006 is €29.3M, while the average budget per project is €190k. So far, 145 projects have been financed. In PAVET-NE, private support varies between 40% and 55%, depending on the research content. The total budget for the period 2002–2006 is €22.4M and 62 projects have been financed with €12.3M.

Examples of PV projects in this Measure are the projects entitled, “*Design and Development of a PV / wind Autonomous Water Desalination System*” and “*Research and Development on Structural Glass-metal Devices with Integrated PV Cells and Solar Thermal Collectors*”, with total budgets €49.05k and €60.44k respectively.

4.2 Measure 4.3, Action 4.3.3 PEPER

PEPER is the “Programme for the Promotion of Demonstration Projects and Innovation” and focuses on technology demonstration projects, promoting the development of industrial prototypes. Demonstration projects are those aimed at increasing the interest in implementing mature technology tested for the first time on a large scale basis. The proposed technology must refer either to the application of new techniques, procedures or products or to new applications of established techniques or products.

The objective of the programme is to support the introduction of new and advanced technology into enterprises. The proposed technology must have been already tested and must have demonstrated measurable economic results of implementation in enterprises on the international level. Moreover, the proposed technology must have produced adequate results at the laboratory or pre-industrial level and require proof of its operability at industrial level. The projects funded by PEPER should eventually lead to one of the following:

- Design and production of industrial prototype or new/improved products and services.
- Use of new and innovative methods leading to new products or services.

- Development of quality control processes.
- New management or operation processes.
- New processes for the promotion of products and services.

Action 4.3.3 PEPER was initiated towards the end of 2001. The total budget for the period 2001–2006 is €54M and private participation amounts to 50%. The project entitled, “*Demonstration of the Usage of a-Si PV Modules in Buildings and Other Applications*” of total budget €1297k was approved within this Action.

4.3 Measure 4.5, Action 4.5.2 RES and ES

The general objective of Measure 4.5 “Research and Technological Development Consortia in Sectors of National Priority” is to promote cooperation between productive and research entities in long-term research and technological development projects, in order to produce innovative products or services and confront social and cultural needs that affect positively the competitiveness of the economy. Priority sectors include: natural environment and sustainable development, built environment, RES and ES, culture, health, transport etc.

In particular, Action 4.5.2 refers to RES and ES. The objective of this action is to promote cooperation between enterprises and research entities on a long-term basis for the development of products and services that will contribute to cost reduction and improvement of the effectiveness of RES, optimum integration of RES in the electricity production networks and the development of new technologies and energy saving applications for buildings, industry and transport. The Programme supports both industrial research and initial demonstration (pre-competitive research).

For RES, the thematic areas include wind energy, PV systems, active solar systems, biomass, geothermal energy, fuel cells and hydrogen technologies and integration of RES into energy systems. In the PV field, emphasis is given to RTD areas such as grid inverters, prototype PV modules, small stand-alone systems, PV modules for building components and BIPV applications, thermal photovoltaic (T-PV) systems, etc.

The total budget of Action 4.5.2 for RES and ES is approximately €18M and public support is 50%. The total budget for each project varies between €1.0M and €2.5M and the maximum duration is 36 months. So far, 15 projects have been financed with approximately €18M.

Examples of PV projects in this Action are those entitled, “*Development of Flexible PV Cells*” and, “*PhotoV-ALue – Research, Development and Certification of Large Dimensions Aluminium Structural Devices with Incorporated Modern Technology PV Elements and Innovative Grid-connected Power Inverters, Aiming to Effective Application into Building Constructions*”, with total budgets €1600k and €1000k respectively.

4.4 Measure 8.3, Action 8.3.1 PENED

PENED is the “Reinforcement Programme of Human Research Manpower”. The objective is to train university graduates or post-graduates in cutting-edge sectors. This is done within the framework of research projects which

are planned to render usable results and be completed with a PhD degree being awarded to each participating researcher. Aim of PENED is to support and accelerate the evolution of the economy, from the traditional sectors to a new, knowledge-based economy by promoting related activities through education and training.

As a result of the PENED action, business productivity will increase through a strategic planning and support of the communication between research institutions and enterprises. Additionally, PENED aims at making a significant contribution to reducing unemployment as participating enterprises will eventually employ more researchers. In order a proposal to be approved, the participation of a partner who will contribute at least 10% of the budget is essential. This partner may be a productive unit or service provision unit, from the private or public sector. As the participation of a co-funding body is a prerequisite, the links between academia and industry are encouraged and strengthened.

The total budget for PENED is €59.8M, of which public expenditure in the programme is 90%. The maximum budget for each research proposal is €235k and so far, 170 projects have been financed with a total of €22.6M.

Indicative examples of PV projects in this Action are the projects entitled, “*Nano-structures and gripping of Organic and Inorganic Materials*” and “*Semiconductor Optoelectronic Devices for Emission of UV Light*”, with total budgets €147k and €205k respectively.

4.5 Other PV RTD Activities

Further RTD activities in the PV sector could be assessed through other Measures of the list in section 3.1 above. For example, Action 3.3.1 refers to excellence among research centres supervised by GSRT and a number of institutions involved in PV RTD could be funded. Other possibilities for research in the field of PV technology are the Programmes ELEFTHO and AKMON, Actions 4.2.1 and 4.2.2 respectively. In the latter, the project on “*Certified Testing and Optimisation of RES Products*” was approved, with total budget €452.6.

5 STRATEGY ON THE PROGRAMME LEVEL

In the coming years, RTD policy in Greece is mainly expressed through the Operational Programmes “Competitiveness” and “Information Society”, the 6FP and 7FP of the EC and initiatives for the creation of an ERA, and a series of institutional interventions looking to support various actions and more efficient operation and management of R&T organisations.

On the Programme level, the main aims of MoD and GSRT in RTD policy are:

- **Increase in demand for new knowledge and research results in Greece:** increase strategic interest of businesses in technological innovation and the use of new R&T knowledge, creation of new businesses in “knowledge-intensive” sectors, encouragement of businesses involvement through suitable indirect and direct incentives to undertake the implementation of RTD and demonstration

projects, or to hire research staff that will allow to plan and implement such projects, encouragement of researchers to create new business initiatives in cooperation with suitable financial institutions, motivation of regional and local economic and social development bodies to participate actively in incentives for the creation of innovation focal points in direct collaboration with private investors.

- **Re-organisation of research system and knowledge supply in Greece:** reorientation of research institutes in directions regarding developmental, financial and social policy and differentiation of the research mission of institutions supervised by GSRT from that of the universities, reinforcement of academic research primarily for supporting the learning process, training of new researchers and the creation of reference points for international research and improvement of the managerial effectiveness of research institutes.
- **“Liberalisation” of the research system and opening to the international Forum:** increase of cooperation between Greek research teams from public research institutes and businesses and similar organisations abroad, improvement in the participation of Greek institutions in EU FP projects, and increased participation in European and international scientific and technological organisations’ programmes (ESA, ESF, etc.).

6 INTERNATIONAL ORIENTATION

Action 4.3.6 of the OPC–RTD Programme refers to “International Scientific and Technological Cooperation”. This activity is divided into 3 parts namely, bilateral cooperation, international cooperation in industrial research and pre-competitive activity and cooperation with international scientific organisations.

7 GOOD PRACTICE AND LESSONS LEARNT

Although a specific RTD Programme for the PV technology sector is not in place in Greece, a number of opportunities for RTD are offered to the scientific community through OPC–RTD. Calls for proposals of particular Actions are usually announced every 3 years, repeatedly over the last 8 years, giving a possibility to the research community in the field of PV technology to plan follow-up activities of on-going projects. However, there is ample space for further improvement in Programming which would lead to the creation of a sustainable PV research activity in Greece, with considerable contributions in specific fields from materials science to system technology. Experiences gathered from previous RTD Programmes in Greece are summarised as follows:

- **Programme continuity:** although the calls for proposals are quite frequent, the research community often criticises lack of overall planning and reasonable timing between the activities. Political circumstances usually affect negatively Programme announcements, thus continuation.
- **Market support mechanisms:** an effort is done to link RTD in research institutions with the industrial

manufacturing and marketed products. However, meticulous planning to bring closer the research community with the industry is needed in order to be competitive on the international level.

- **Broadness of actions and financial potential:** the structure of OPC–RTD does not allow for specific thematic activities in selected technologies, e.g. PV. Research activities from virtually any field of interest are eligible for financing through a large number of actions, resulting in low average budget per project for a given financial potential of the government. More flexibility is required for targeted actions, together with a new, less complicated Programme planning aiming in specific calls for proposals in fields of National interest.
- **Programme evaluation:** a systematic evaluation on the Programme level should be undertaken by MoD.
- **Interaction with EC Programmes:** Programming in Greece does not necessarily comply with the EC RTD activities within e.g. the 4FP, 5FP and 6FP. Research priorities of interest in Greece should be in line with the state-of-art in Europe.

8 HARMONISATION WITH ERA

Based on the existing infrastructure of RTD Programming in Greece, a focused thematic priority for RTD activities on PV technology could be a future initiative of GSRT, as a result of the networking and integration of national and regional programmes seeking within the PV ERA NET project. The expected results are summarised as follows:

- Adapt future PV RTD National Programmes in Greece with the PV-ERA-NET findings.
- Develop closer collaboration with European institutions and increase international collaboration.
- Create closer links between GSRT and CRES in terms of Programme management, with specific calls, budget and timetable in the field of PV technology.
- A well-structured RTD environment in Greece with harmonised joint forces from institutions and the industry will create a sustainable market.

9 CONCLUSIONS

The structure of the RTD Programme in Greece has been highlighted in this paper and the main financial tools for carrying out research in the PV technology were mentioned. Reference to the role of the managing bodies was made and past experiences were analysed. The participation of Greece in the PV ERA NET project will create an opportunity for further improvement in the Programme structure, with particular measures addressed to PV technology.

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