



**CRES – Centre for Renewable Energy Sources**  
Department of Photovoltaic Systems

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# **Photovoltaic Activities in Greece and Potential for Sustainable Market Development**

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## Utility PV Systems in the '80s

100kWp PV System at Kythnos island



27.5kWp PV System at Arki island



The development of PV systems by PPC through R&D and Demonstration projects resulted in **gaining experience** on the operation of solar power supply systems for the electrification of remote areas using local energy resources. These applications had a strong **social content** and assisted in the development of the local communities in terms of job creation, tourism business etc.



# CREC – Centre for Renewable Energy Sources

## Department of Photovoltaic Systems

Other important PV installations have been developed by,

- **Hellenic Tel. Org.:** ~100kWp for stand-alone telecommunication systems
- **Hellenic Navy:** ~70kWp for some 900 lighthouses in the Aegean and Ionian Sea





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## Department of Photovoltaic Systems

### PV Enlargement – Installation of 40kWp PV at CRES Premises

**5FP Project**

**Participants:** WIP, CRES + another 24 organisations

**Installed:** November 2003





## National Support Schemes

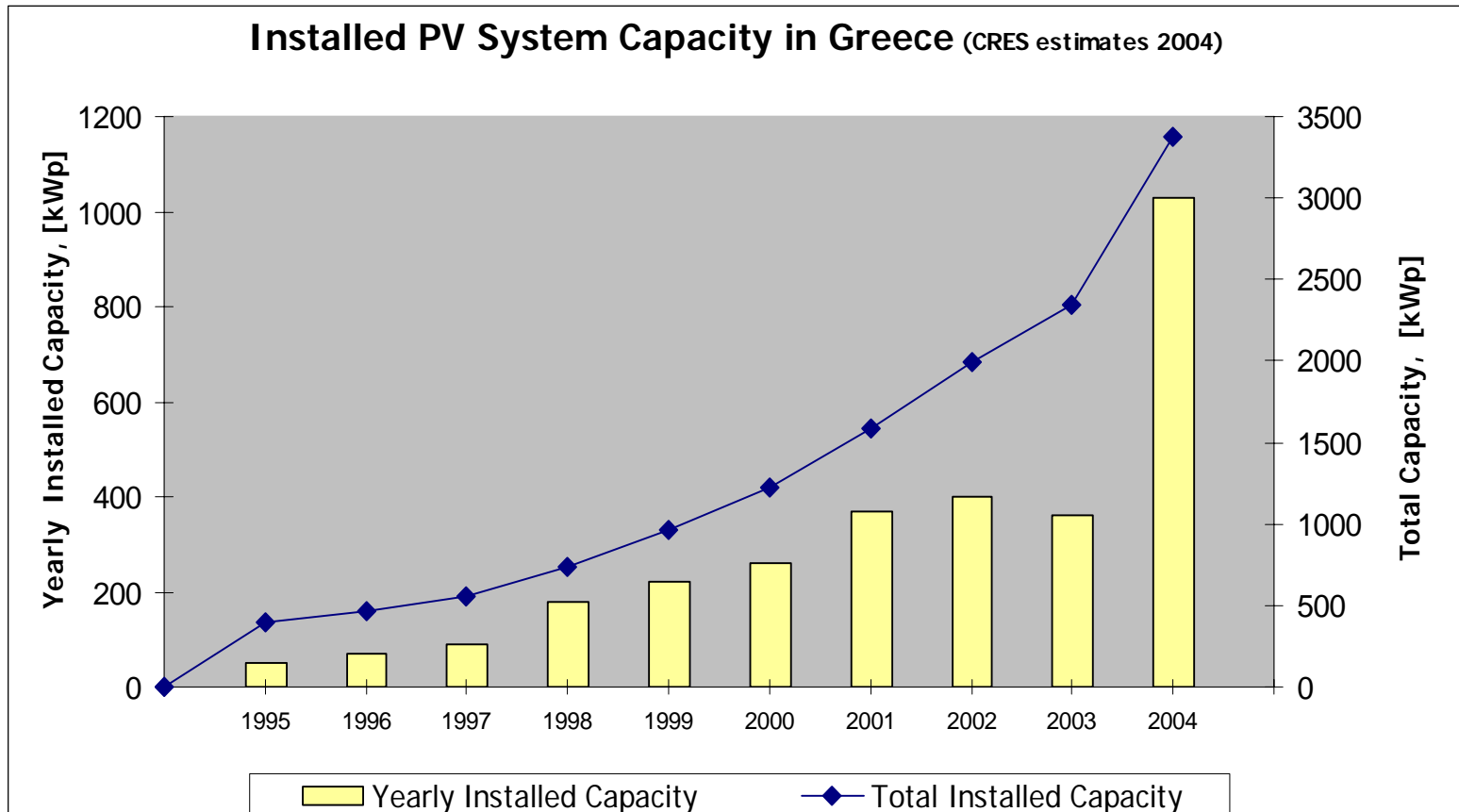
A number of projects have been co-financed through:

- **OPC – Operational Programme for Competitiveness**  
(2001–2006)  
PV subsidy: (40–50)% depending on the location of the application.
- **Development Law** (revised in Dec. 2004)

A total of **1.7MWp PV capacity** was installed during the last 6 years, with subsidies obtained by OPC.



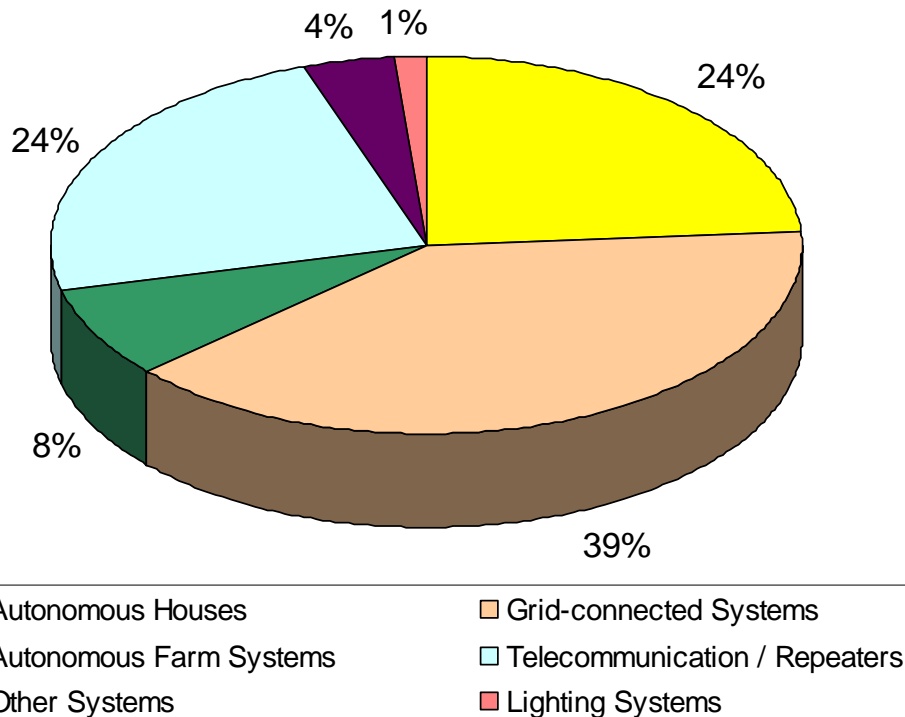
## PV Market in Greece





## PV Market Share and Indicators

**PV System Market shares (CRES estimates 2004)**



### PV Energy Production

- 2002: 2.3GWh
- 2003: 2.7GWh

### PV Industry Turnover 2003

~€3.0M

### PV Industry Workforce

60–70 persons

### Annual National R&D Budget

~€2.2M for PV technologies



## **Legislative / Regulatory Framework**

- L. 2244/94:** Law for RES; PPC is obliged to buy the electricity produced by RE sources at a fixed price.
- L. 2364/95:** Tax exemption incentive; 75% of the investment to be deducted from the taxable income. **This important for PVs incentive was discontinued in 2001.**
- L. 2601/98:** Development Law; provided incentives for industrial activities in the sector of New Technologies. This Law was revised in Dec. 2004.
- L. 2773/99:** Liberalisation of the energy market, establishment of RAE – Regulatory Authority for Energy.
- L. 2773/99:** Special Tariff for RES; since April 2003, PPC charges its customers €60c per MWh, which is rendered to the TSO. **The annual amount is estimated €20M.**





## **PV Industrial Activities in Greece**

### **PV Module Manufacturers**

- **Energy Solutions SA:** production of c-Si modules started in February 2005. Perspectives: 2005 – 1MWp; 2006 – 3MWp
- **Heliodomi:** manufacturing plant for the production of a-Si modules is under way since 2001.

### **Power Electronics**

2–3 manufacturers of inverters and chargers for stand-alone systems and inverters for grid-connected PV applications.

### **Batteries**

2–3 manufacturers of batteries designed for solar PV systems.



## **Professional Activities in the PV Sector**

### **System Designers and Installers**

Approximately 30 companies are involved in the marketing of PV modules and sub-components and the design and installation of PV systems in Greece.

### **PV Research and Technological Development**

Several research activities on material science, components and system level integration are carried out by Research Centres, Universities and Technological Institutions.



## **Perspectives for PV Market Development in Greece**

- The potential for PV applications is huge. **Public awareness** on solar energy is positive and the success of the solar thermal initiative could be repeated, should a consistent **PV roof-top Programme** is effective.
- PV integration in the energy production of **island grids** is several **× 10MWp**. PV electricity is **cost-competitive** on small and medium size islands.
- PV industry is already developing in Greece. Favourable **market conditions** and an **appropriate framework** environment will be the driving force for the industry.



## Strategic Approach – Suggestions

Table 1. Market development targets

	Target 2010		Target 2020	
	Islands	Mainland	Islands	Mainland
Installed Capacity, [MW]	120	80	800	1.600
Electricity Production, [GWh]	168	112	1.120	2.240
PV Penetration	3%	0,2%	15%	3%–5%



## Strategic Approach – Suggestions

Table 2. Suggested Feed-in Tariff Policy

	<b>PV Plant Capacity, [kWp]</b>	<b>Islands, [€/kWh]</b>	<b>Mainland Grid, [€/kWh]</b>
<b>Low Voltage</b>	< 5	0.48	0.45
	5 – 20	0.45	0.40
	20 – 100	0.42	0.36
<b>Medium Voltage</b>	100 – 1000	0.38	0.30
	> 1000	0.30	0.25



## Conclusions

- The conditions in Greece favour the development of PV technology and applications. A **PV National Programme** must be elaborated, including measures for the applications in the household sector.
- Experience gained from early innovative applications shows that electricity production from PVs is **cost effective** in the islands. Large scale PV applications will support the development of **ecological tourism**.
- Apart from the environmental benefits, PV development has a considerable **added value** to affiliated economical activities, creation of SMEs, industrial development etc.