Development of RES in Europe

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Introduction

- The Energy Sector and its contribution to the greenhouse effect plays a major role in the policy for a sustainable environmental development
- In Kyoto in 1997, the targets set for greenhouse gas reductions:
  - European Union : 8%
  - United States of America : 7%
  - Japan : 6%
  - Average industrial world : 5.2%
- Kyoto targets should be reached by 2012
- The main solutions for reaching targets are energy conservation and the use of renewable energy sources (RES)

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Role of RES in Energy Policy

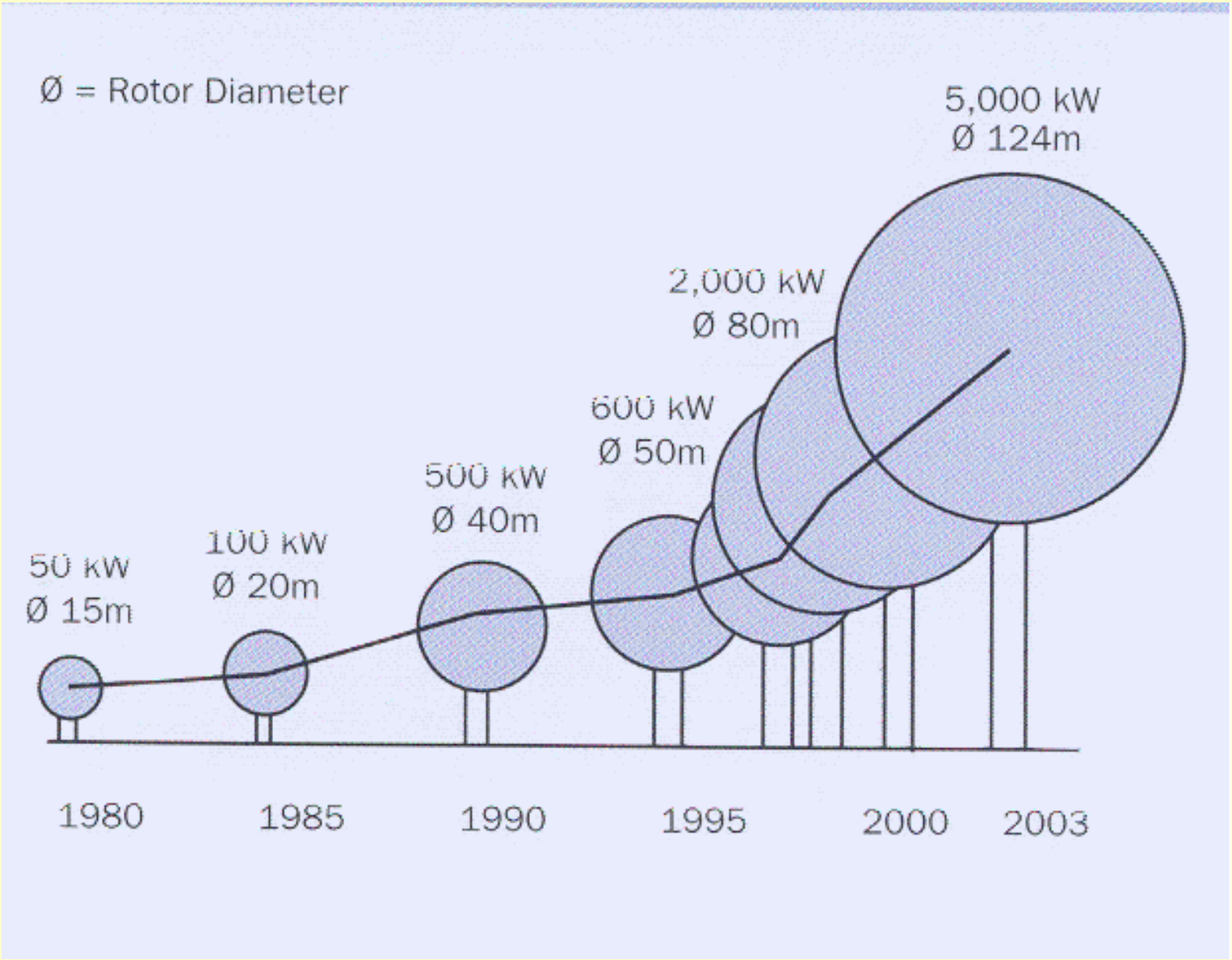
- Contribution to Greenhouse Gas reduction

- Security of supply, i.e. role as alternative source of energy, since:
  - fossil fuels, especially oil and natural gas, will be exhausted before the end of this century at the present rate of consumption and
  - world population is approaching 10 billion people who will all need energy supply

Commercially available and emerging RES technologies

RES technology	Commercially available	Emerging technology
Wind turbines	√	
Photovoltaic systems	√	
Hydropower	√	
Biomass	√	
Geothermal	√	
Fuel cells	√	√
Solar thermal	√	√
Wave energy		√
Tidal energy		√

Technology Development - WIND ENERGY



Technology Development - PV

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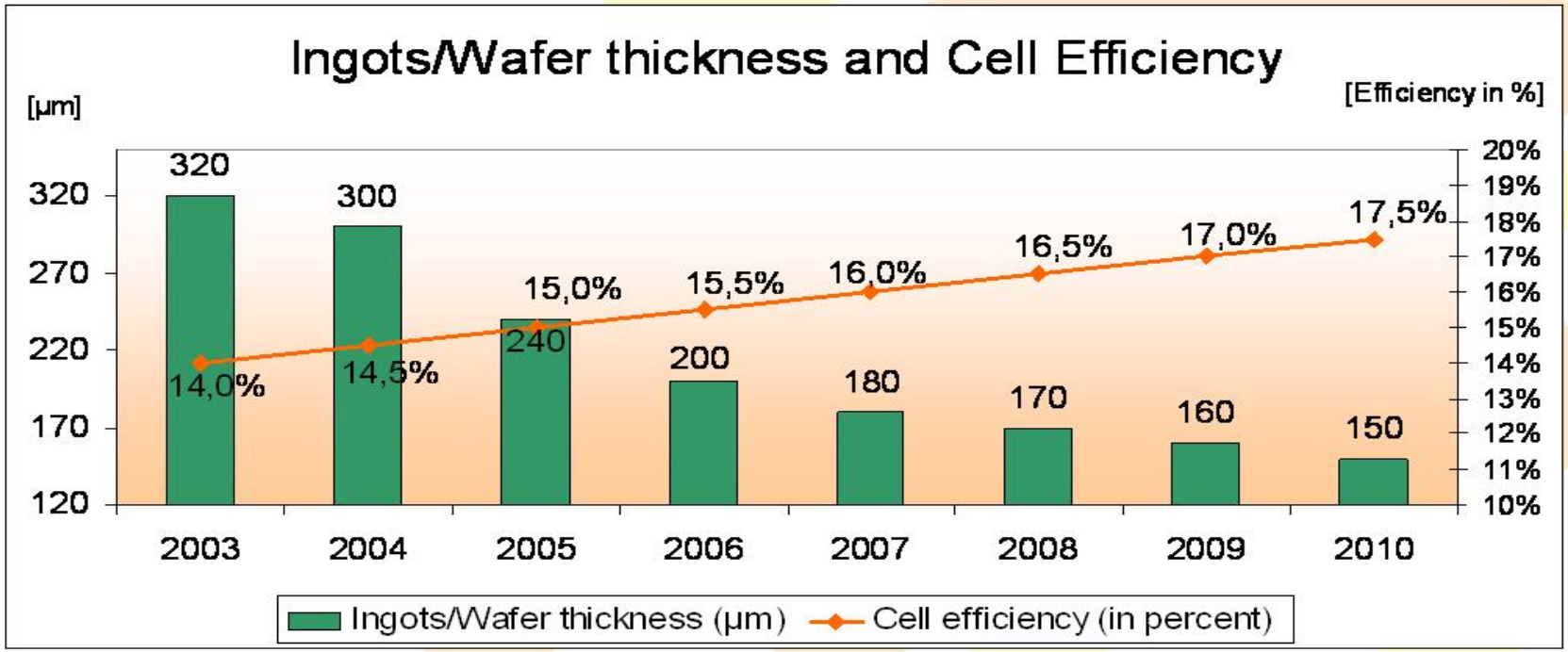
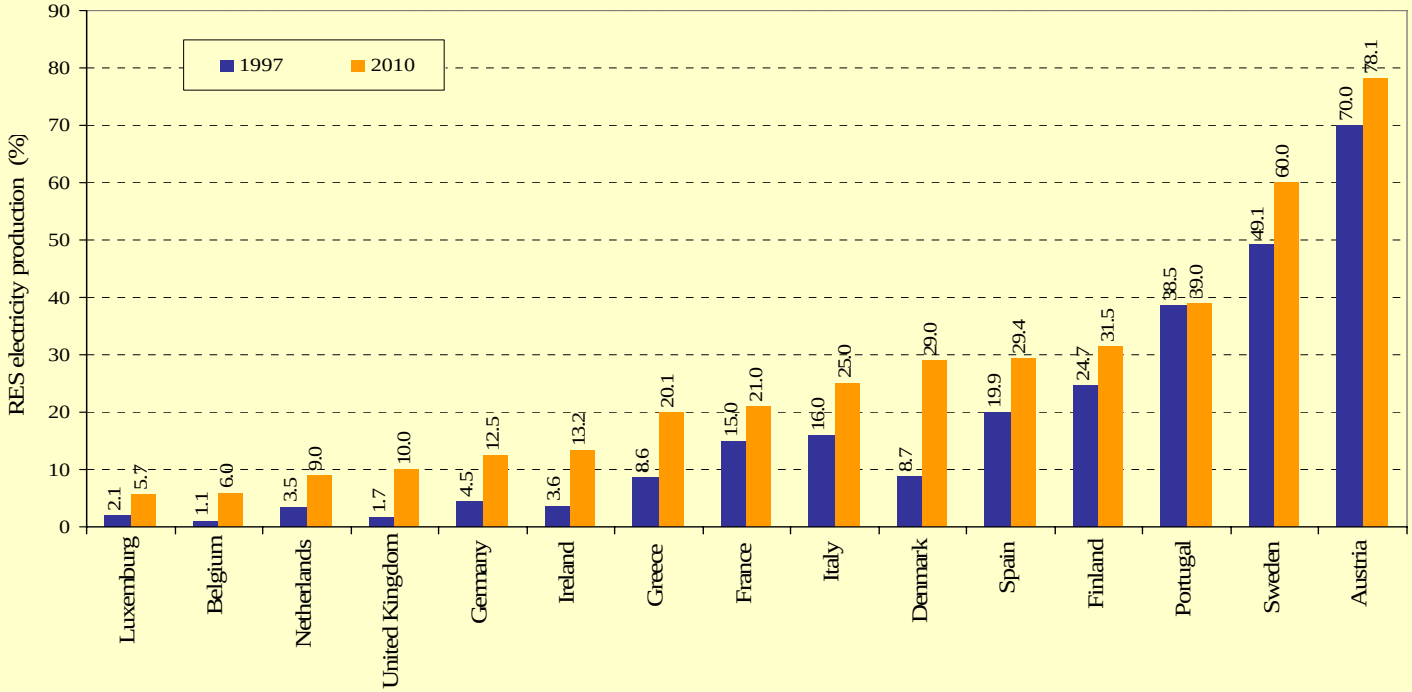
EPIA
European Photovoltaic Industry Association

Evolution of Ingots/Wafer thickness and Cell Efficiency

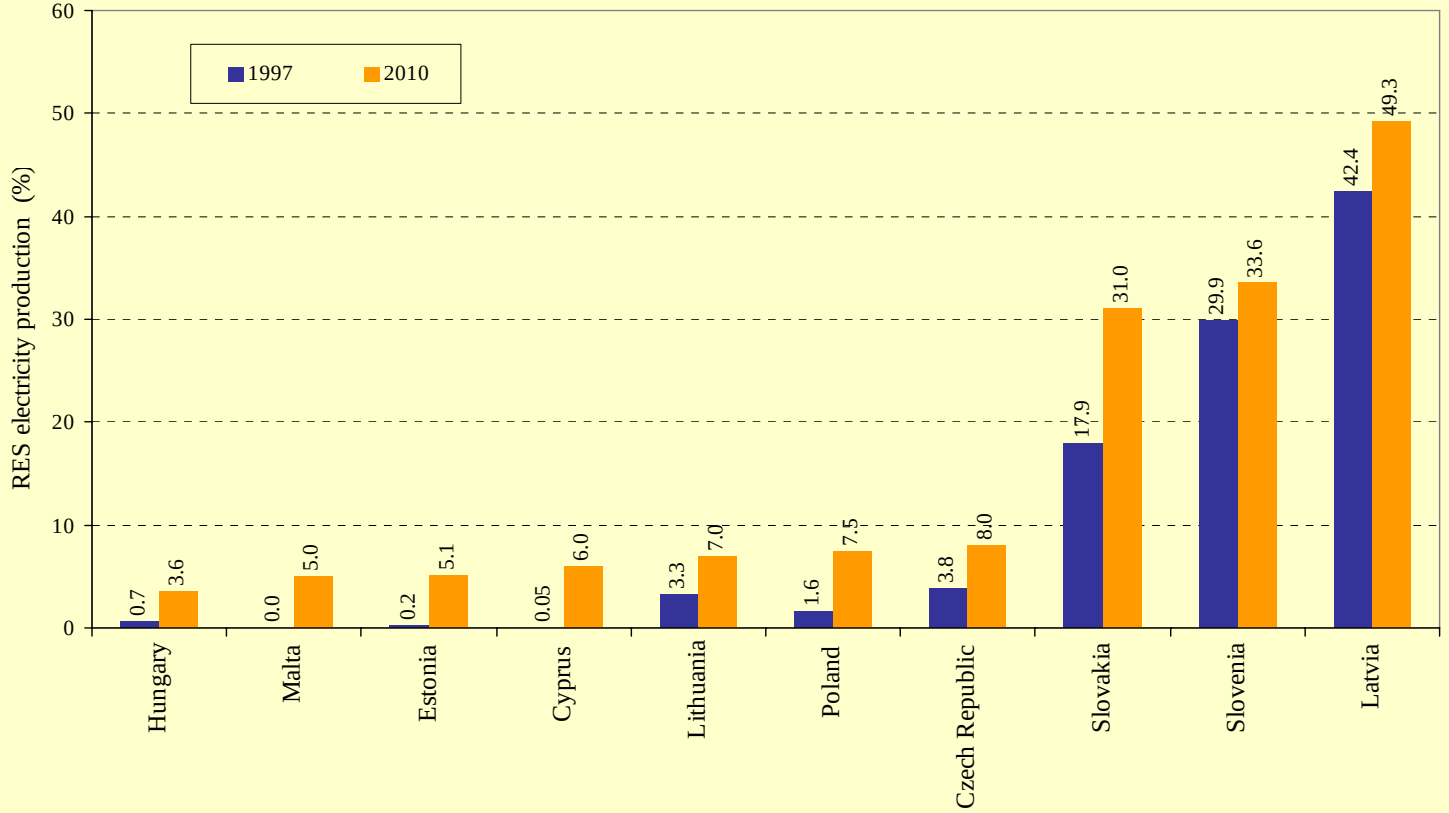


Production capacity towards 2010

EU-15 Targets of RES by year 2010
(including large hydro)



New EU member states: 2010 targets



Renewable Energy Sources – Support Schemes

Necessity for RES Support Schemes

- In a free commercial market, RES still cannot compete with traditional technologies, such as large hydro, combined cycle plants based on natural gas, efficient coal-fired combined heat and power plants or nuclear power plants

- Special support systems are needed for RES until these technologies are commercially competitive

- A number of different schemes have been used by the EU Member States in order to support the development of electricity production systems based on RES

Support schemes for RES-E in EU

Policies and measures established in can be summarised as :

- Feed-in model (FIM)
- Tender system
- Certificates trading model (CTM)
- International trade of green certificates
- Installation cost subsidies

RES Support Schemes: Definitions (1)

- **Feed-in model (FIM)** : a long-term minimum price is guaranteed for electricity obtained from RES
- **Tender system** : calls for tenders in relation to energy supply from RES are made at intermittent intervals. Each RES technology is given a quota and the provider of the lowest asking price is awarded the contract

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RES Support Schemes: Definitions (2)

- **Certificates trading model (CTM)** : it introduces conditions of market competition into the production of green electricity for technologies that are not fully competitive with traditional supply systems
- **International trade of green certificates** : there is an increasing interest in setting up international markets for green certificates

RES Support Schemes: subsidies (3)

- **Installation cost subsidies**: This scheme offers different subsidies for installation cost depending on the installed technology.
- **Subsidy in loans** :Loans for installing RES with reduced interest rate
- **Decrease in taxes** : Decreased taxes for the income of investors in RES

Support schemes for RES-E in EU

Feed-in tariffs (c€/kWh) for wind and PVs in EU25 countries

Country	Wind			Photovoltaics			Note
	General	On-shore	Off-shore	General	Category I	Category II	
Austria	7.80				60.00	47.00	Cat. I <20 kWp, Cat.II >20 kWp
Belgium		5.00	9.00				
Cyprus	9.18				37.4		Cat. I <20 kWp
Czech Republic		9.60		19.20			
Denmark		4.80					
Estonia	5.20			5.20			
Finland	6.90						
France	8.50			30.50			
Germany	9.10			45.70			
Portugal	7.42				41.00	22.40	Cat. I <5 kW, Cat. II >5 kW
Greece		7.30	9.00		45.00	40.00	Cat. I <100 kW, Cat. II >100 kW

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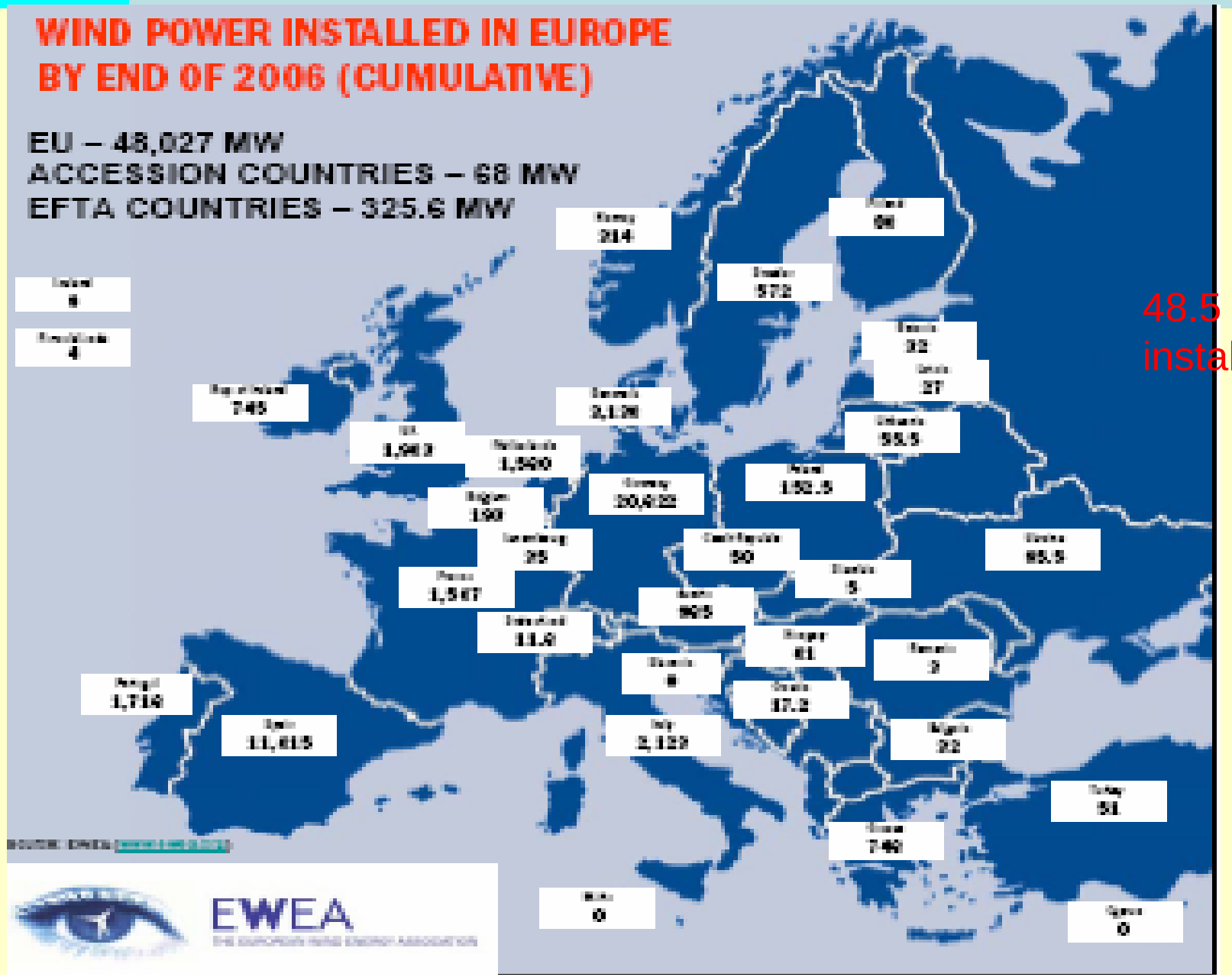
Support schemes for RES-E in EU

Feed-in tariffs (c€/kWh) for wind and PVs in EU25 countries

Country	Wind			Photovoltaics		
	General	On-shore	Off-shore	General	Category I	Category II
Hungary	6.40					
Ireland	5.74					
Italy	10.89				45.50	47.50
Latvia						
Lithuania						
Luxembourg	2.50			50.00		
Malta						
Netherlands		7.70	9.70	9.70		
Poland						
Slovakia						
Slovenia	6.11					
Spain		6.60			42.10	
Sweden						
UK						

Renewable Energy Sources – Installed Capacity

Cumulative Wind Power Installations in EU



48.5 GW now installed

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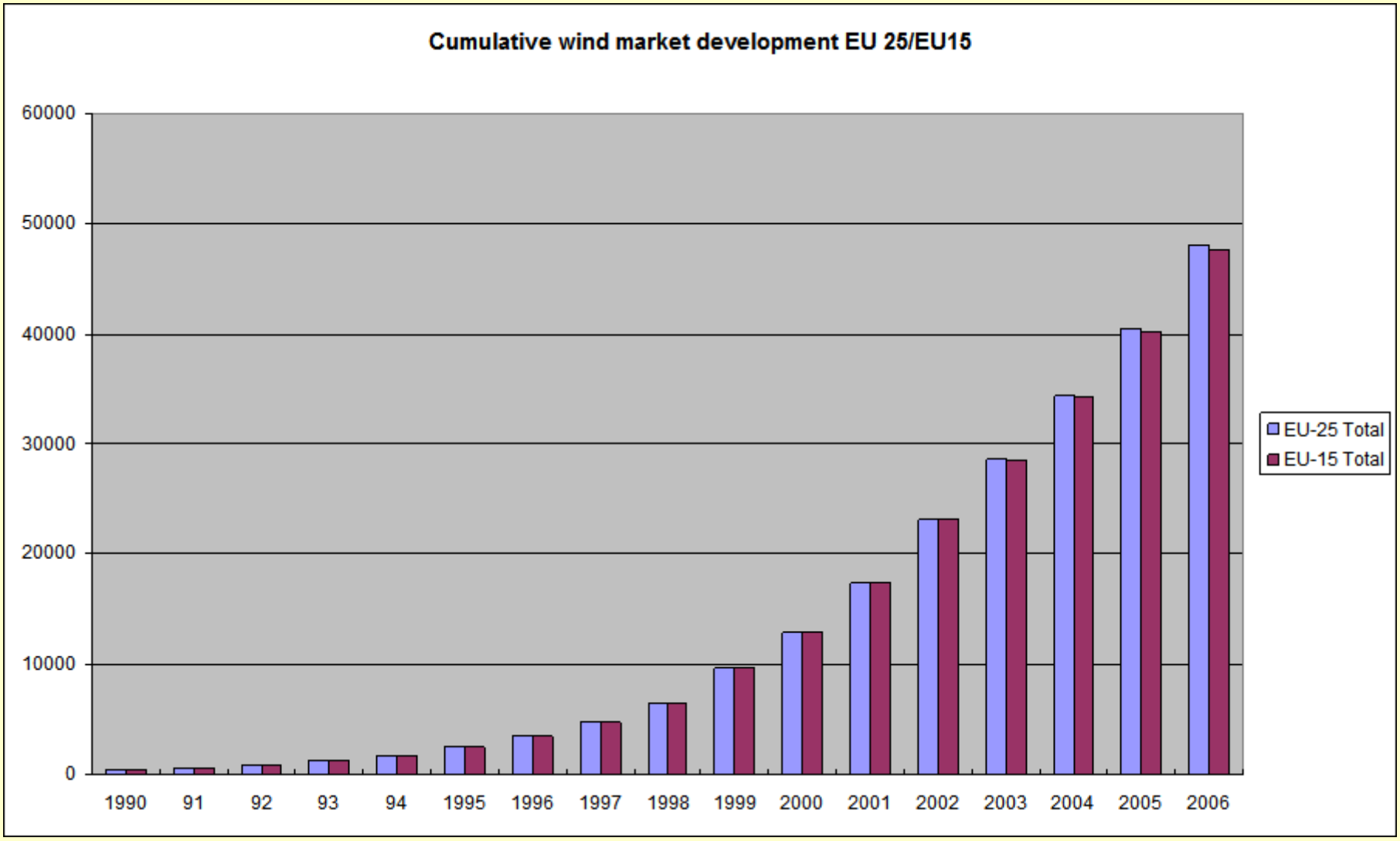
Cumulative Installations of Wind Power In Europe



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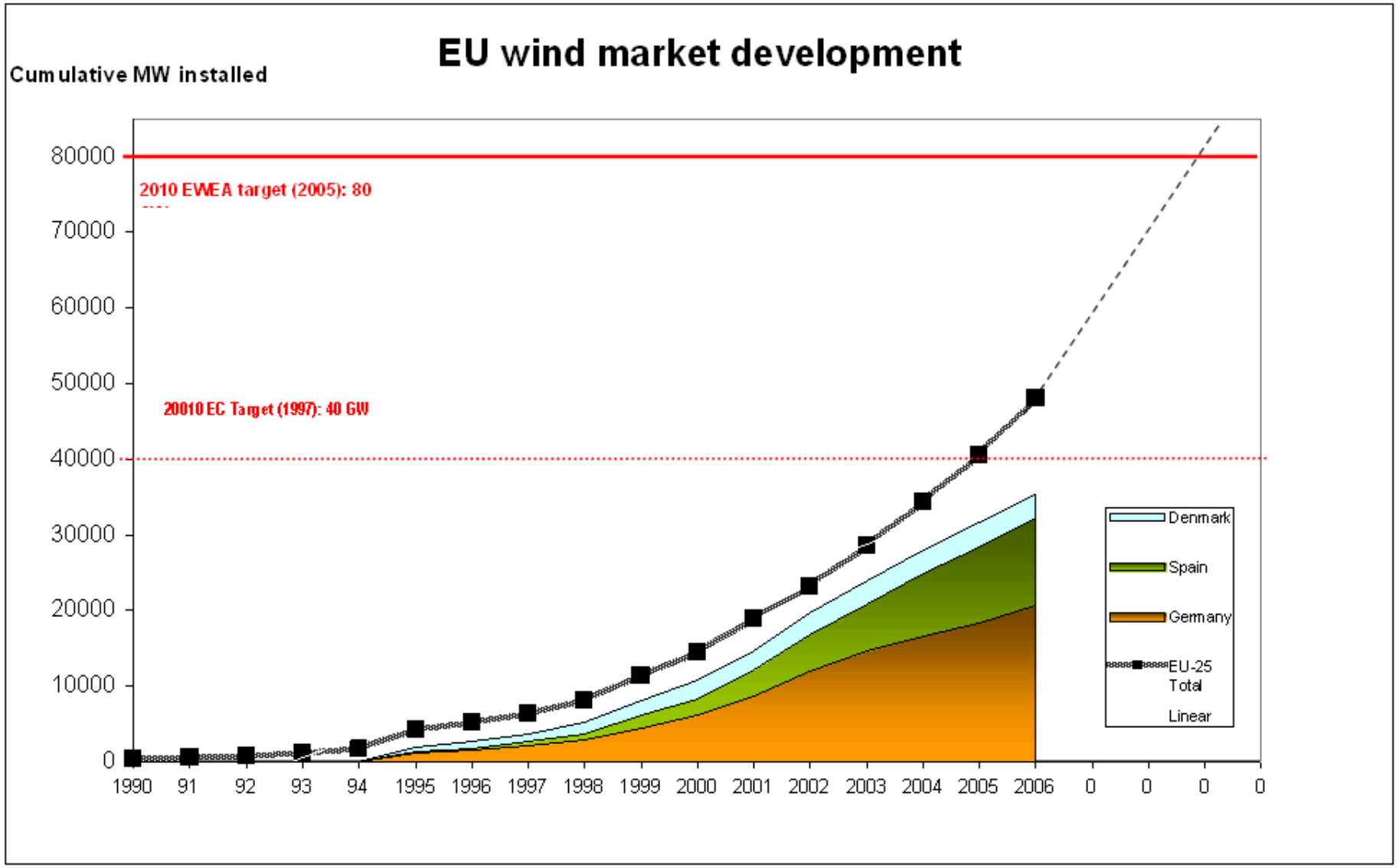
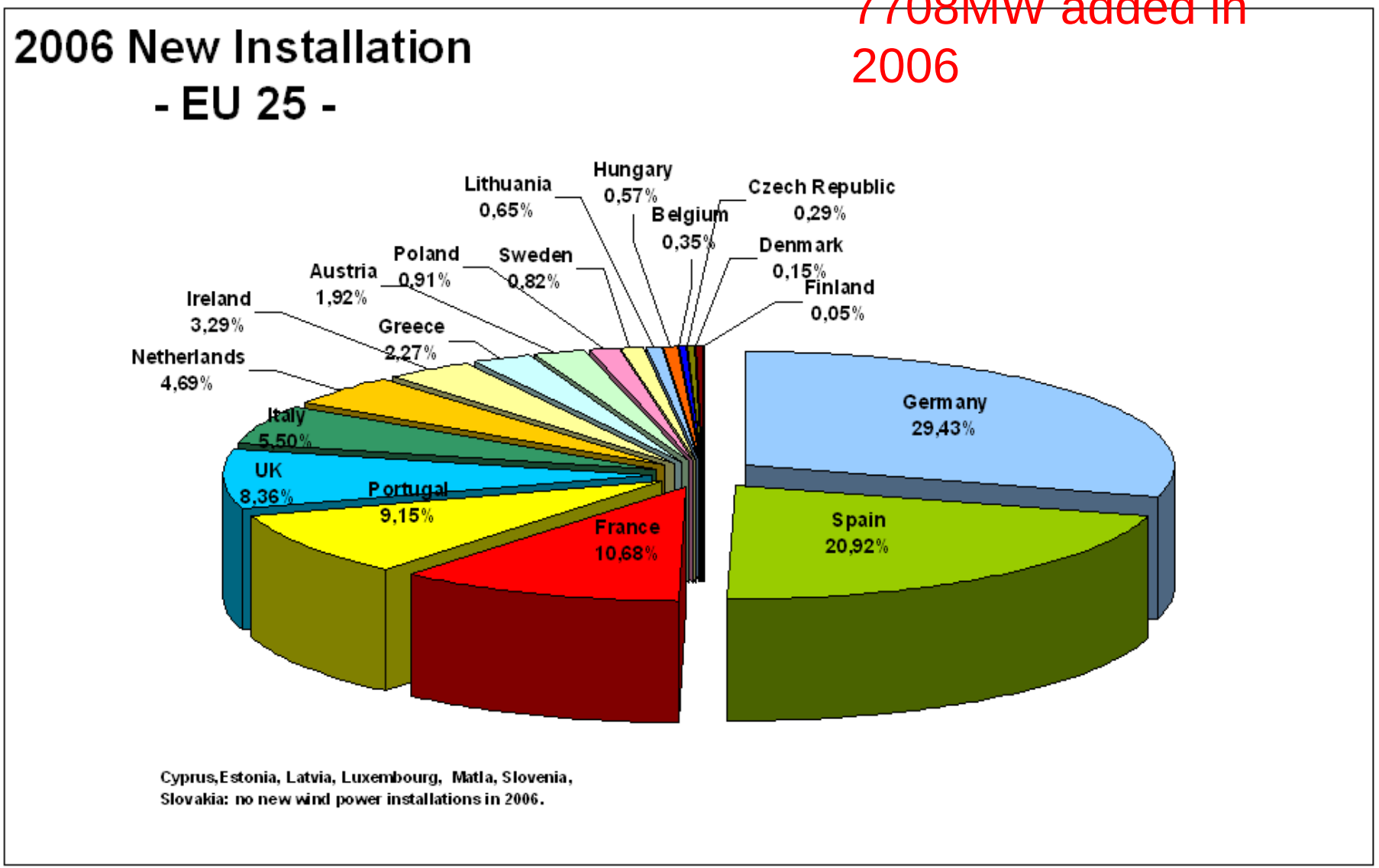
EU Market Development



New Installations of Wind Power In Europe

7708MW added in 2006



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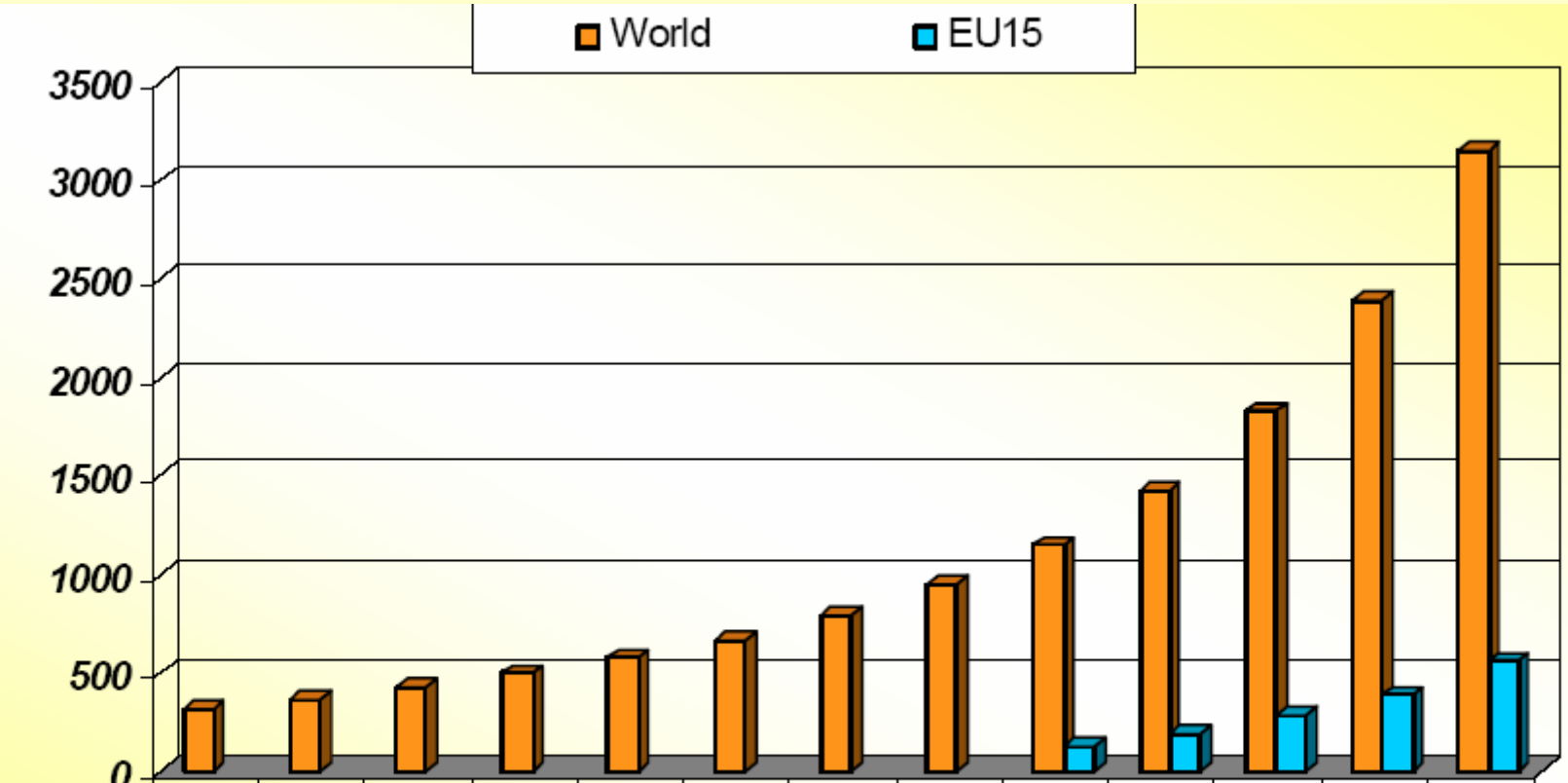
PV installations



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
World	314	371	432	502	580	669	795	948	1150	1428	1829	2387	3151
EU15									128	188	284	392	562

PV installations-On/Off Grid applications

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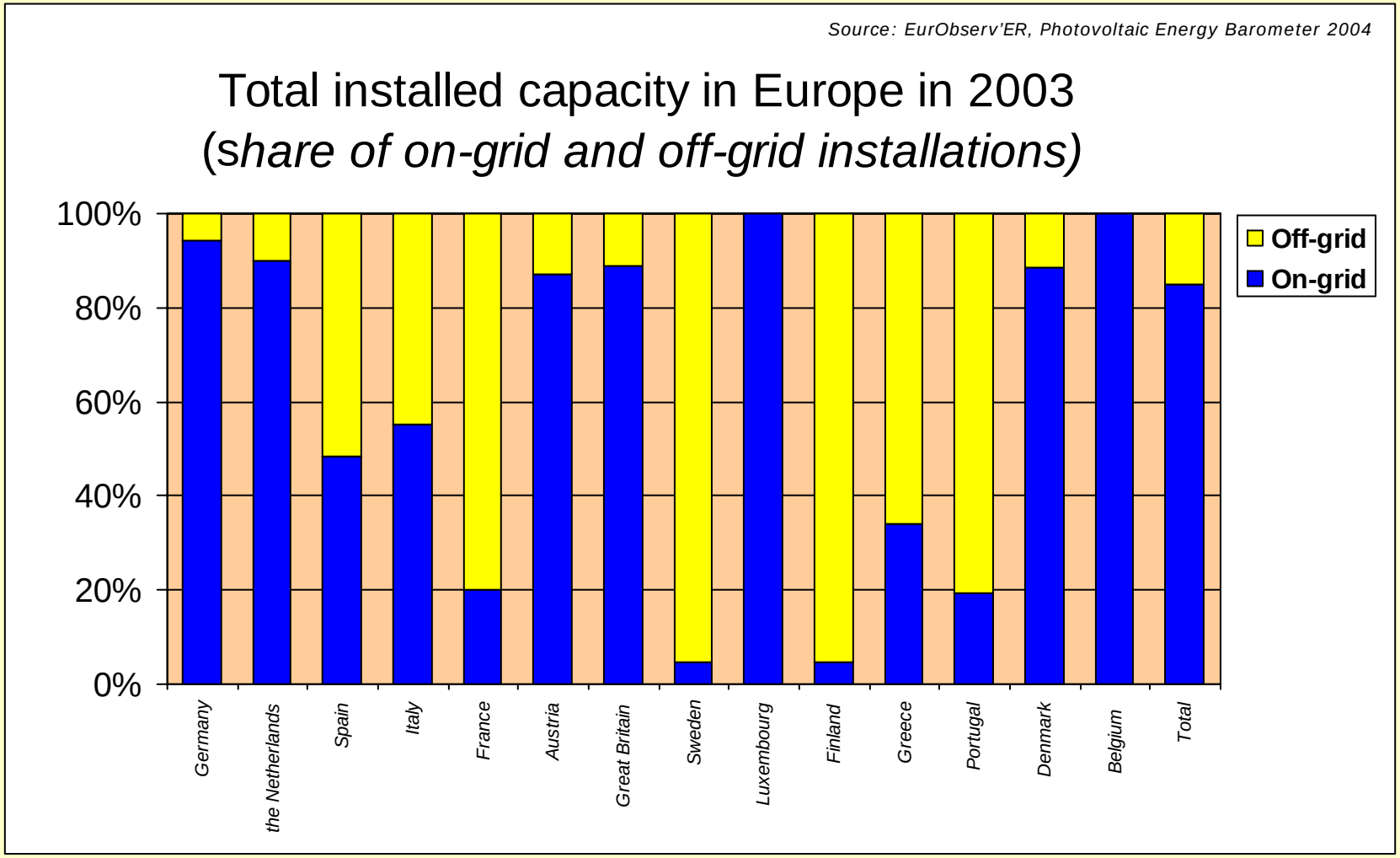
Mainly for off-grid Applications



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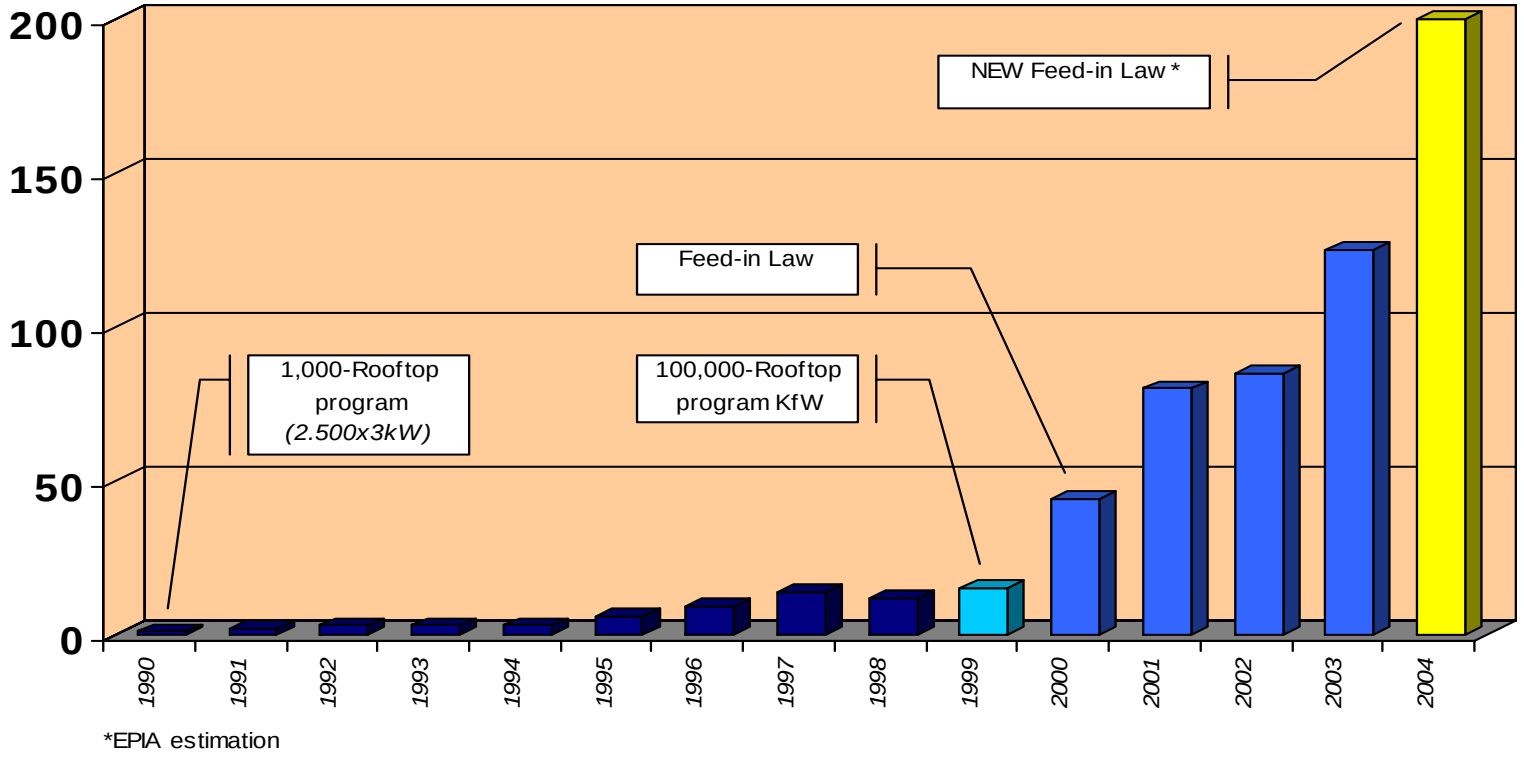
Importance of Support schemes-Germany

Source: @ RWE SCHOTT Solar GmbH and EPIA estimation

Annual PV installation in Germany (MWp)
(impact of Feed-in Law)



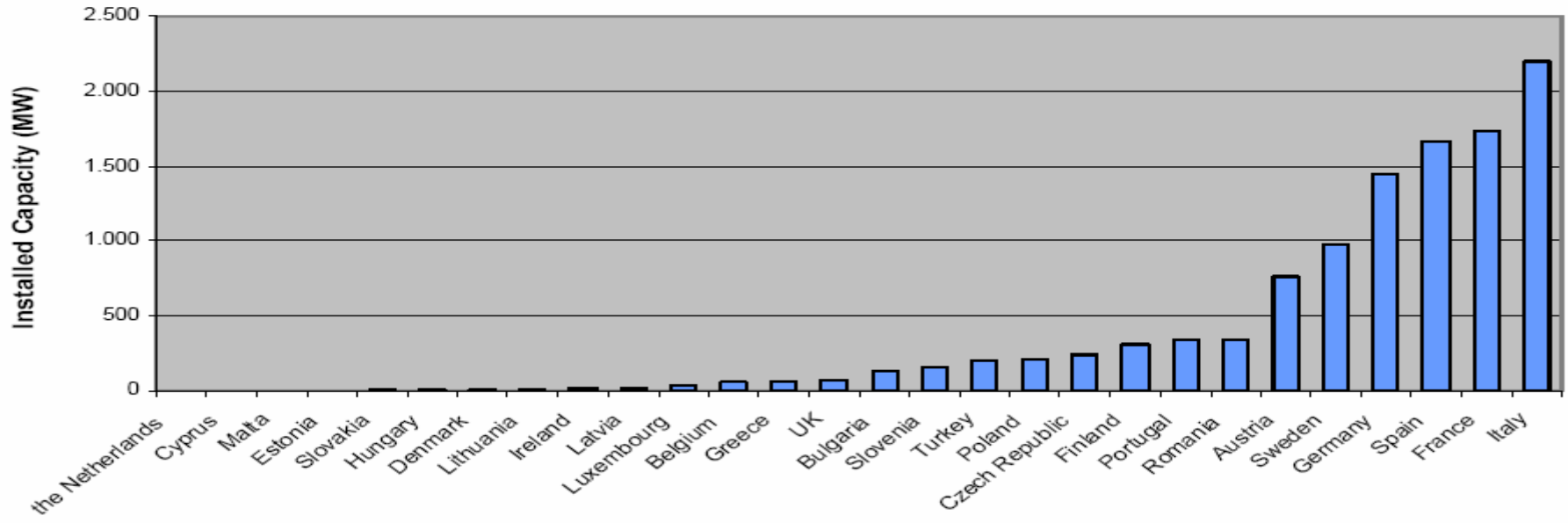
*EPIA estimation

Small Hydro installations

In EU-25 about 16,800 SHP plants are in operation, total installed capacity 11 GW

. SHP champions: Italy (21%), France (17%) and Spain (16%)

. New EU Member States: Poland and Czech Republic both with 2% of the total EU-25 SHP capacity



Source: ESHA (2004)

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Installed RES and Future installations in Greece

Current	Wind (MW)	Small Hydro (MW)	Biomass (MW)	PV (kW)
Interconnected System	592	105.5	37.4	105
Island Networks	192.6	0.6	0.4	803
Total	**784.6**	**106.1**	**37.8**	**908**

Future	Wind (MW)	Small Hydro (MW)	Biomass (MW)	PV (kW)
Interconnected System	3039.4	348.59	40.5	760
Island Networks	204.3	3.8	8.5	590
Total	**3243.7**	**352.39**	**49**	**1350**

Main barriers to RES development

- Most important is the complexity of the legal framework and particularly the authorization procedure, frustrating for many small investors.
- The often inhibitive cost for the interconnection to the grid (mostly reinforcement or construction of new network lines).
- For larger stations (more than ~20 MW) and in certain areas with very high wind potential, lack of sufficient HV system capacity. Due to environmental restrictions and local community protests, expansion of the HV system is in some cases completely blocked.
- In the case of wind farms, public acceptability also an issue in certain cases, basically due to visual impact or other reasons.

Best practices in GREECE

- Places with high RES penetration in Greece (above 10% in electricity):
  - Crete Island : instantaneous 38%
  - Lesvos Island: instantaneous 42%
  - Kythnos Island: above 40% for 1000 hours, 100% for few hours a year

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Lessons learned

- Need for speeding up licence procedures
- Licence procedure should be differentiated according to the RES type of installation
- Effective co-operation of the local authorities with the investors was the key for speeding up the licence procedure (Crete and Thrace)
- Increase of feed-in tariffs for some RES will speed up penetration

Thank you for your Attention

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