

# **International Experience: Policy Analysis and Market Development**

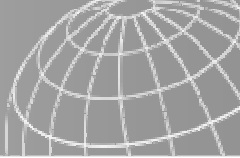
World Bank  
China Renewable Energy Development Project  
PV Forum Jinan/Shandong April 27, 2007

German Technical Cooperation (GTZ)  
Frank Haugwitz



# Overview

- Country Profiles
  - France
  - Germany
  - Greece
  - Italy
  - Japan
  - Spain
- Overview PV Policy
- Outlook



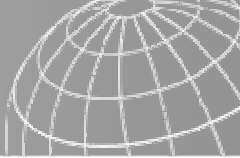
# FRANCE – PV Dev. & Natl. Strategy

- 80s : Rural Electrification / Stand Alone Systems
- 90s : R&D Grid-Connected Systems
- 2002-2004: Feed-in-Tariff plus investment subsidy schemes on both federal and regional level
- At present the mainly subsidy driven scheme will be replaced by tax credits



# FRANCE – Promotion of BIPV

- PV is an integrated part of the construction of the buildings which generates electricity
- BIPV will become cheaper than PV + Building components
- Added-Value of BIPV is higher than PV alone
- Innovation is needed to develop cost-effective products



# FRANCE – BIPV Tariff Structure

## Tax Incentives

- Tax credit for income tax payers : 50 % reimbursement of the equipment cost
- Specific tax incentives on investment in overseas departments (French Territories)

## Feed-In-Tariffs

- Continental France : 0,30 €/kWh + 0,25 €/kWh, if integrated solutions in the building environment
- Overseas departments : 0.40 €/kWh + 0,15 €/kWh, if integrated solutions in the building environment
- Duration 20 years



# FRANCE - Def. of BIPV

## Attached & Roof-Top - are NOT eligible

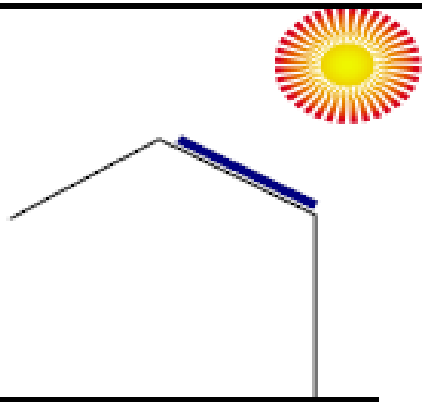


Figure 1 : surimposition toiture: non éligible à la prime I à l'intégration bâti



Exemple de sur imposition en toiture inclinée

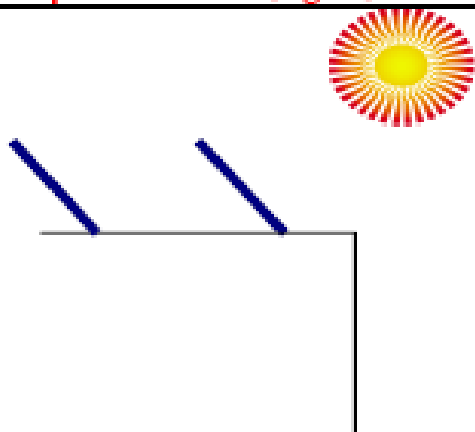
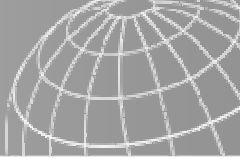


Figure 2 : toiture terrasse: non éligible à la prime I à l'intégration bâti

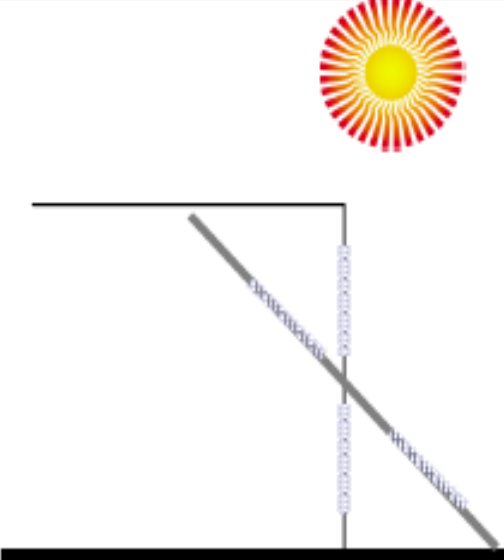


Exemple de sur imposition en toiture terrasse



# FRANCE - Def. of BIPV

## Eligible but not part of the building envelope

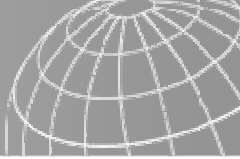


The diagram shows a cross-section of a building facade. At the top, a sun icon with red and yellow rays is positioned. Below it, a horizontal line represents the roofline. A vertical line represents the wall. A diagonal line represents a window frame. A vertical line with a hatched pattern represents a balcony railing. A horizontal line with a hatched pattern represents a window sill. A thick black horizontal bar is at the bottom of the diagram.

**Figure 3: garde corps de fenêtre, garde corps de balcon, allège: éligible à la prime I à l'intégration bâti.**

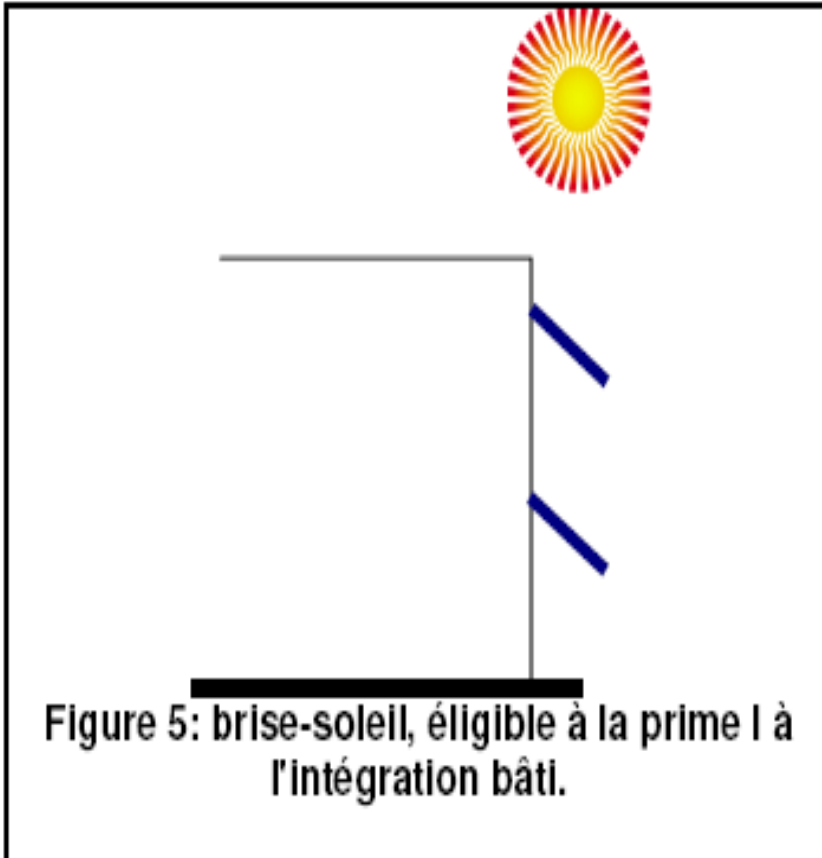


Exemple de garde corps de fenêtre



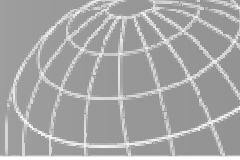
# FRANCE - Def. of BIPV

Eligible but not part of the building envelope  
decreasing air conditioning expenses



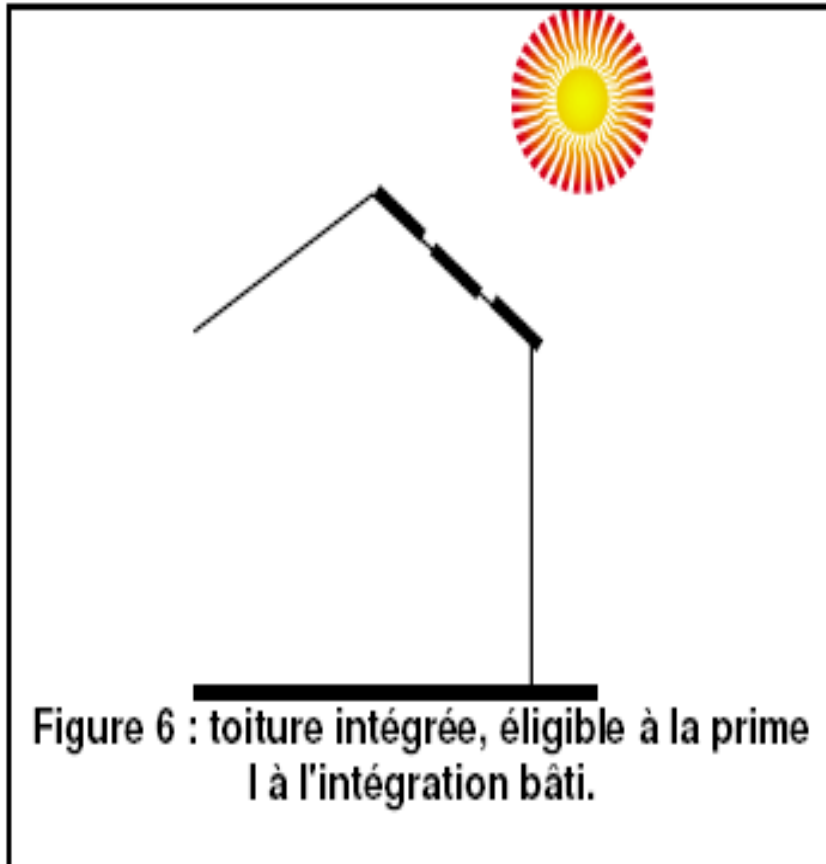
Exemple de brise-soleil (Tecsol)





# FRANCE - Def. of BIPV

Eligible and part of the building envelope  
replacing a roof

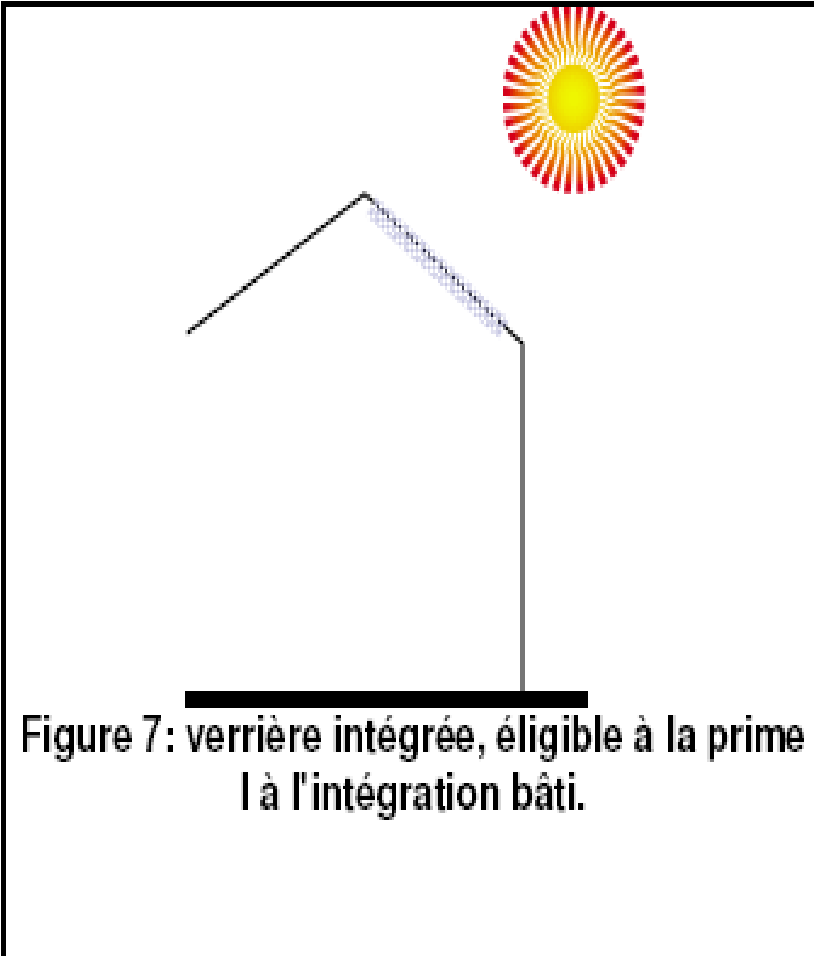


Exemple d'élément de toiture inclinée couverte



# FRANCE - Def. of BIPV

## Eligible and part of the building envelope

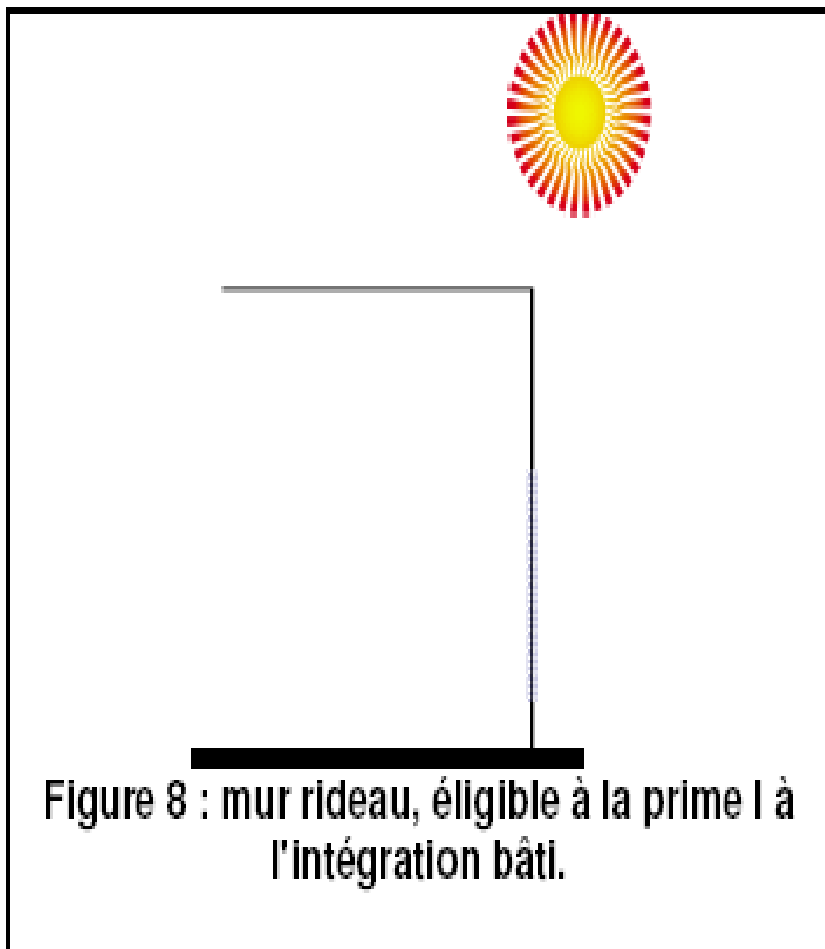


Exemple d'élément de verrière



# FRANCE - Def. of BIPV

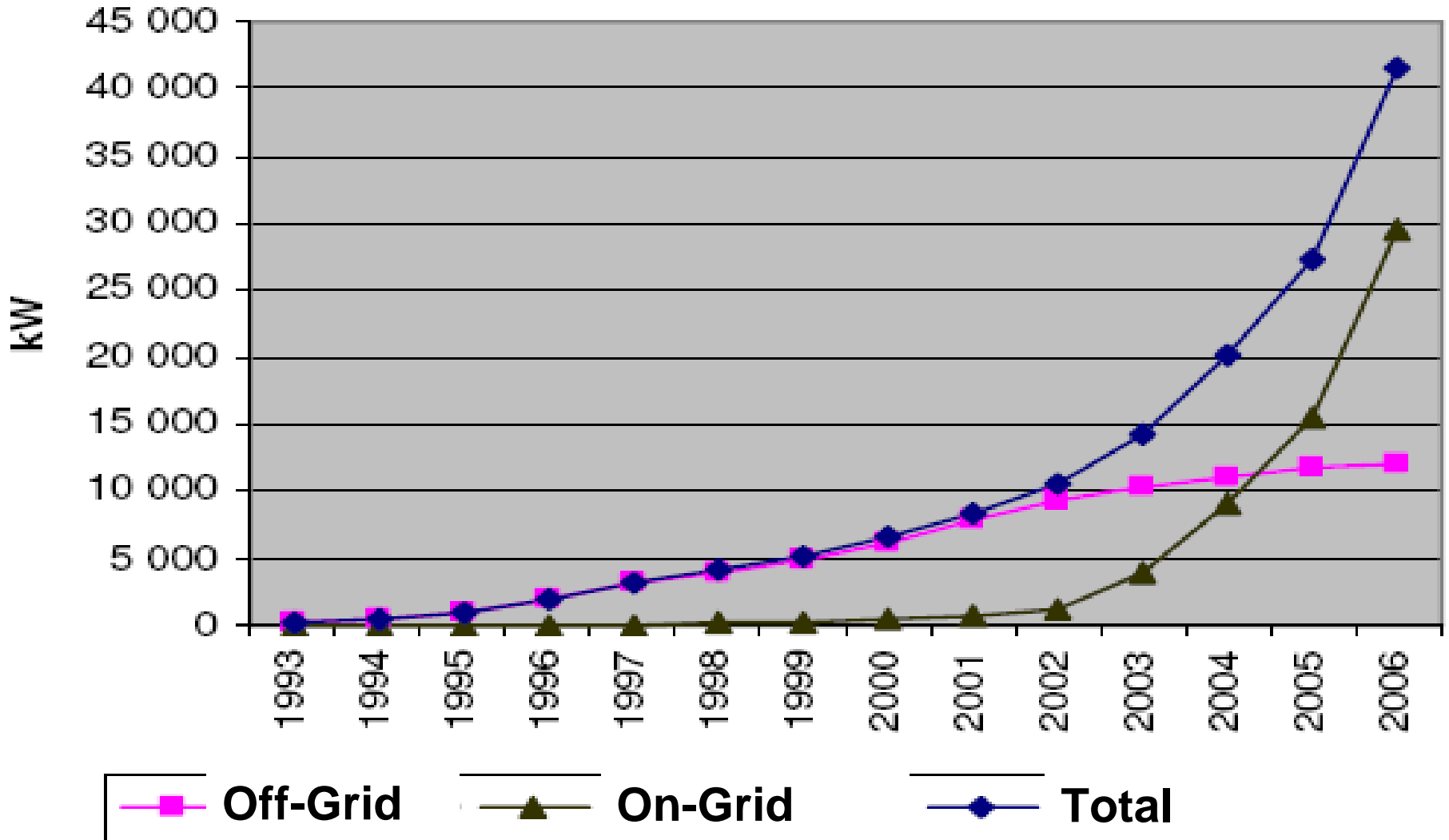
## Eligible and part of the building envelope

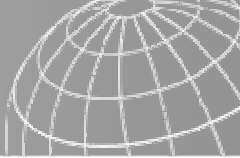


Exemple de mur rideau



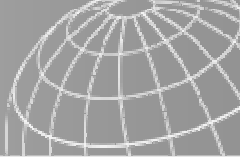
# FRANCE - PV Development





# FRANCE – PV Policy Analysis

<b>Strengths</b>	<b>Weaknesses</b>	<b>Lessons Learned</b>
Feed-in-Tariff has generated growth and hopes	Complex administrative procedure – Permission procedure for < 5 kW Ø 4-12 months > 5 kW Ø 12-24 months	Natl. Support scheme from ADEME has proved effective
Tax Credit System is less bureaucratic than subsidies	Lack of political commitment and stability	Feed-in-Tariff approach has proved as both effective and efficient support mechanism
Fairly efficient monitoring system	Support schemes always depends on budgets, which creates insecurity	



# GERMANY – PV Dev. & Natl. Strategy

## 1991: Electricity Feed-In Act

- Right of (1) of grid access, (2) feed-in of solar electricity and (3) refund payment at fixed prices (approx. €ct8.5 [\$ct11] per kWh)

## 1991 - 1995: 1,000 Roofs Program

- Verification of PV systems' grid compatibility

## 1995 - 1999: Consolidation

- Only regional support programs, demo plants, development of the cost-covering refund payment system

## 1999 - 2003: 100,000 Roofs Program

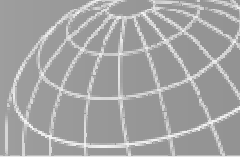
- Low-interest loans for 300 MWp of installed capacity

## 1/4/2000: Renewable Energy Sources Act (EEG)

- Solar electricity feed-in tariff of €ct51 [\$ct64] per kWh

## 1/1/2004: Amendment to EEG

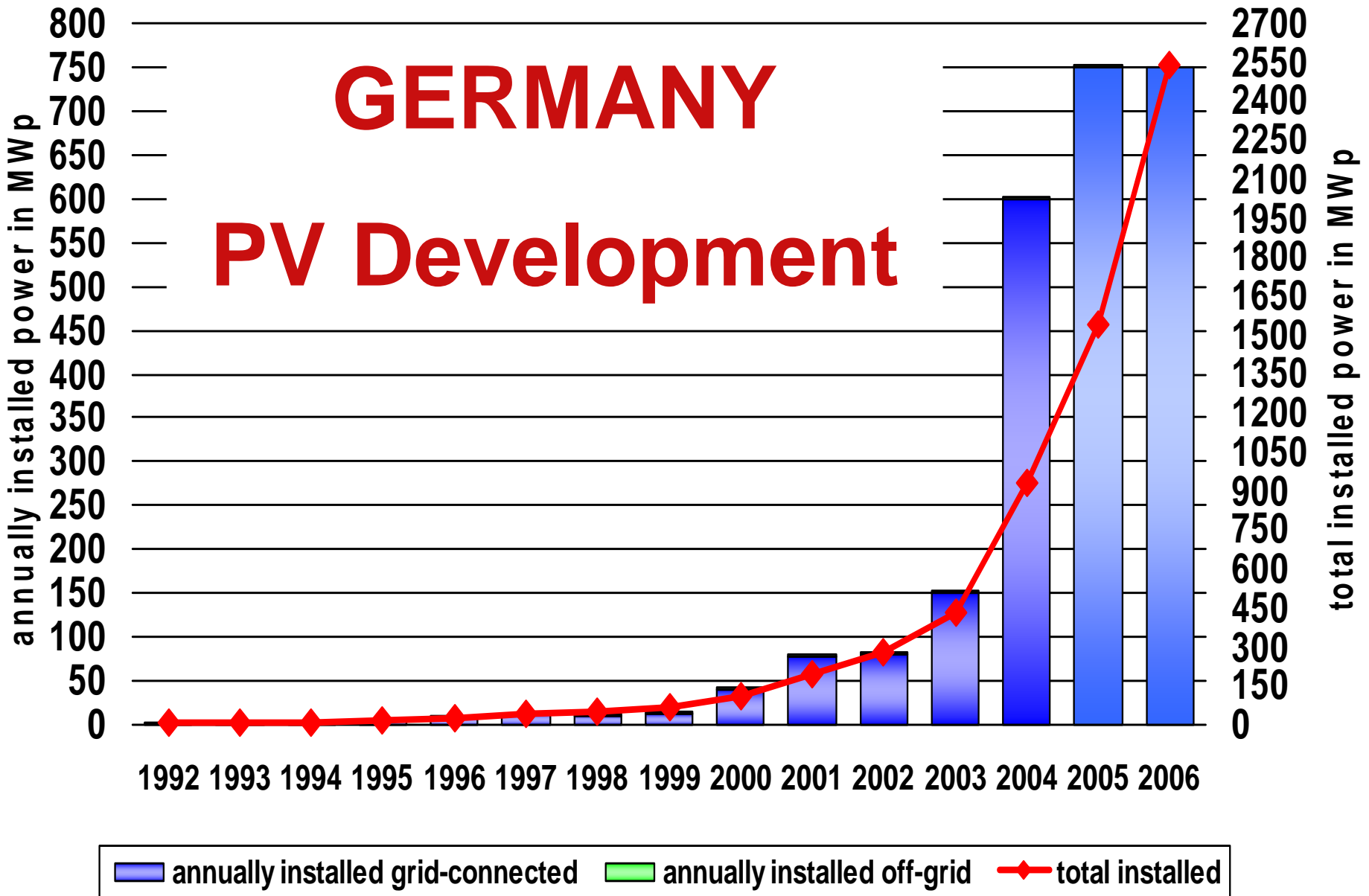
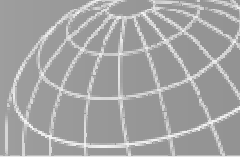
- Feed-in tariff of €ct45.7–62.4 [\$ct57–78] per kWh



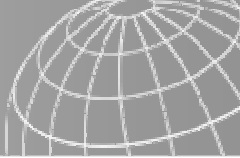
# GERMANY – PV Feed-in-Tariffs

Feed-in tariffs for PV systems installed in 2007, payed over 20 years

Feed-in tariff per kWh	up to 30 kWp	30–100 kWp	from 100 kWp
on buildings and noise protection walls	€ct 49.21	€ct 46.82	€ct 46.30
Façade-integrated	+ €ct 5		
Open land (ground-mounted)	€ct 37.96		

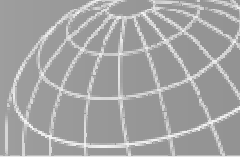






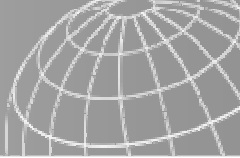
# German PV Market 2006

<b>Newly installed power</b>	<b>750 MWp (el)</b>
<b>Newly installed solar area</b>	<b>6 750 000 m<sup>2</sup></b>
<b>Total installed power</b>	<b>2 540 MWp (el)</b>
<b>Total installed solar area</b>	<b>22.8 Mio m<sup>2</sup></b>
<b>No. of newly installed systems</b>	<b>90 000</b>
<b>No. of total systems installed</b>	<b>300 000</b>
<b>Turnover 2005</b>	<b>3 800 Mio €</b>
<b>Employees</b>	<b>35 000</b>
<b>Market growth 2006</b>	<b>0%</b>



# GERMANY – PV Policy Analysis

<b>Strengths</b>	<b>Weaknesses</b>	<b>Lessons Learned</b>
<p>Feed-in-Tariff Scheme legally guarantees a long-term security of investment</p>	<p>100.000 Roof-Prog. financed by federal budget caused a “Stop and Go” policy</p>	<p>Subsidy based support scheme e.g. 100.000 Roof-Prog. replaced by Feed-in-Tariff Scheme</p>
<p>100.000 Roof-Prog. possibility to finance up to 100% of initial cost helped to overcome investors reluctance</p>	<p>100.000 Roof-Prog. cap created a barrier for market growth</p>	<p>Subsidy Prog. can be effective, but should not be linked to govt. allocation constraints</p>
<p>Feed-in-Tariff avoids administration</p>	<p>Market monitoring is insufficient</p>	<p>Compulsory Market monitoring system</p>



# GREECE – PV Dev. & Natl. Strategy

## Historical Background

- 80s promotion of small off-grid applications in rural areas and islands
- 90s support of industrial applications
- In recent years R&D regarding grid-connected applications

## National Policy and Legislative Framework

- In the past, no consistent policy or regulatory framework for many years, ...
- ... but since June 2006 a Feed-in-Tariff System in place
- National Target of 700 MW by 2020



# GREECE – Legislation for RE

## Legislation: New Law 3468 for Renewables

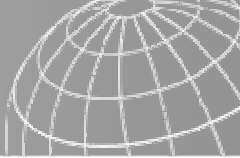
The New **Law 3468 for RES and HE–CHP** was approved by the Hellenic Parliament and is effective since 27 June 2006.

(HE–CHP: High Efficiency Cogeneration of Heat and Power)

Main scope is to utilise the vast **RES resource** in the country, especially the **wind and solar potential**, by establishing an **adequate legislative and regulatory framework** to support investments in these energy sectors.

Aims to cope with European Directive 2001/77/EC on *"Promotion of Electricity Produced from RES in the Internal Electricity Market"* and the Kyoto protocol environmental targets.

National targets of RES contribution to total electricity production:  
**20.1% by 2010** and **29% by 2020**.



# GREECE – Feed-in-Tariff Scheme

## PV Plant Development Programme

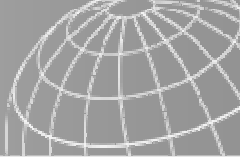
In the New Law 3468, a so-called **Photovoltaic Plant Development Programme** has been incorporated.

RAE is responsible for drafting the Programme; MoD will approve.

Programme Duration: 2006–2020

Minimum Capacity by 2020 for PV: **500MW<sub>p</sub>** grid-connected  
**200MW<sub>p</sub>** on islands

Upper PV Capacity Limit (cup): not specified

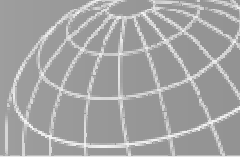


# GREECE – Feed-in-Tariff Scheme

## Timetable of Licenses/Permits Required

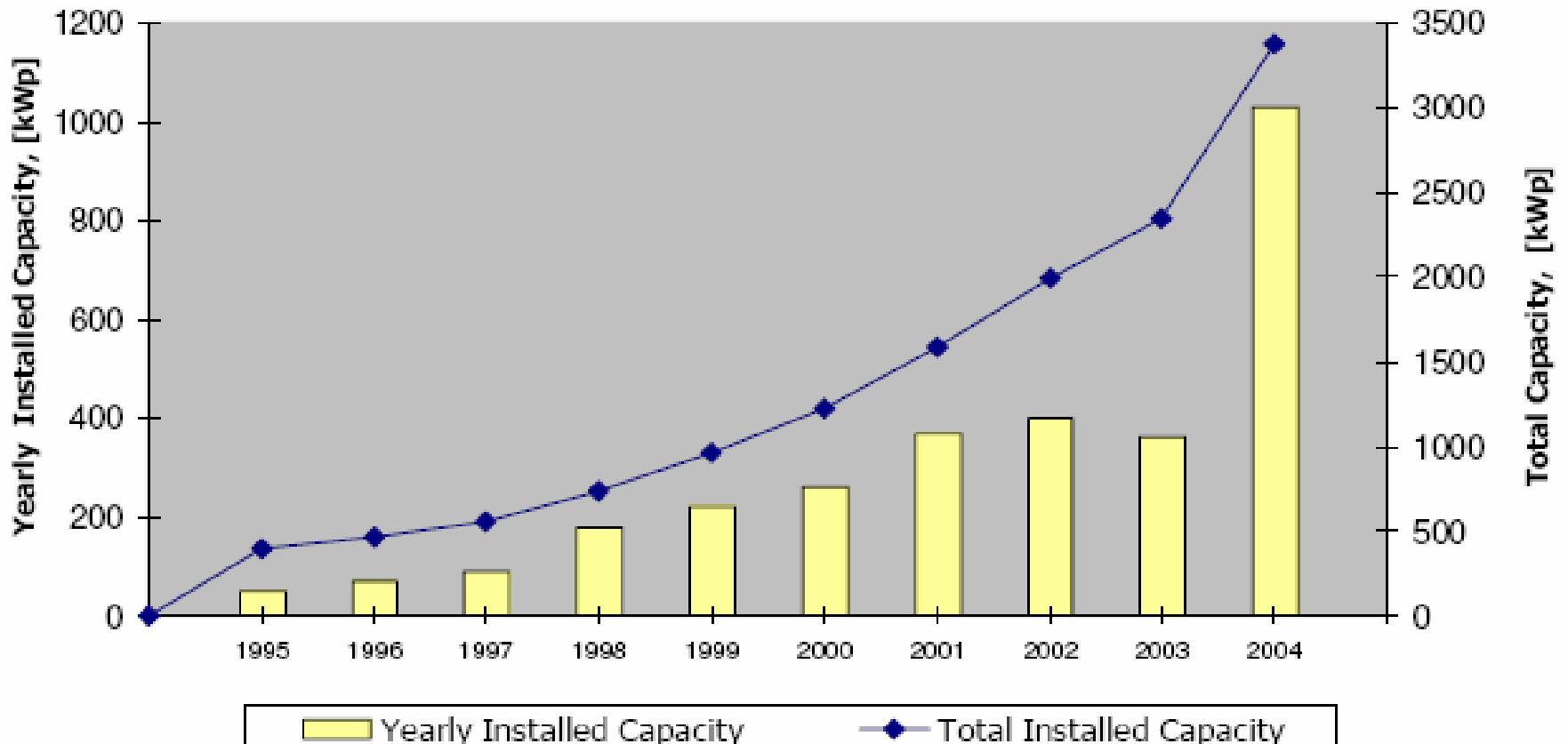
Description of Activity	Days Required	Total Days
Issuing of <b>PEAE</b>	55	55
Issuing of <b>ETA</b>	85	140
RAE opinion to MoD on the <b>EPL</b>	90	230
Decision of the minister of MoD on the <b>EPL</b>	15	245
Issue of the <b>Installation permit</b> from the Prefecture General Secretary	15	260
Issue of the <b>Installation permit</b> from the minister of MoD (if failure above)	30	290
Issue of the <b>Operation permit</b> (same authority as Installation permit)	15	<b>305</b>

- Days indicated are working days; 305wd correspond to **~14 months**
- Table above is indicative for large PV systems of capacity >150kWp; for smaller systems, time 9 required for permits is less.

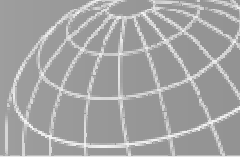


# GREECE - PV Development

Installed PV System Capacity in Greece (CRES estimates 2004)



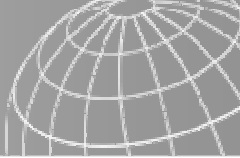
**End of 2006: 5 MW installed capacity**



# GREECE – PV Policy Analysis

<b>Strengths</b>	<b>Weaknesses</b>	<b>Lessons learned</b>
High Subsidy on the capital cost	Lack of a long-term political vision and strategy	Very effective investment support in solar thermal sector could serve as a reference for PV
Utility is obliged to connect to the grid	Feed-in-Tariff is insufficient	
Very high public acceptance	Extremely bureaucratic regulatory framework	





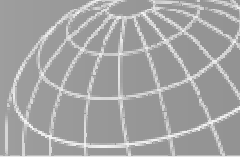
# ITALY – PV Dev. & Natl. Strategy

## National Targets

- 1999: Natl. Target 300 MW by 2008-2012 (White Paper)
- 2002: Natl. Target 100 MW by 2008-2012
- 2005: Natl. Target 1000 MW by 2015
- 2007/02: Natl. Target 2000-3000 MW by 2016  
(current Feed-in-Tariff remains unchanged until 1200 MW reached)

## National Policy and Legislative Framework

- Late 90s discussion: Introduction on Quota System on the basis of green certificates – rejected and never implemented
- 2002 – discussion on introduction on Feed-in-Tariff
- Feed-in-Tariff since July 2005 / 20 years
- Since Feb. 2006 – yearly limit of 85 MW
- Govt. Budget for Feed-in-Tariff is for 500 MW, where 360 MW (<50 kW) and 140 MW >50 kW
- Estimates: 80 MW / annually installed
- Feb. 2007 – Admendment of Feed-in-Tariff Structure



# ITALY – Feed-in-Tariff (2007/02)

		1	2	3
	Nominal power plant (kW)	Systems included in art. 2 - 1, b1	Systems included in art. 2 - 1, b2	Systems included in art. 2 - 1, b3
A)	1 to 3	0,40	0,44	0,49
B)	3 to 20	0,38	0,42	0,46
C)	>20	0,36	0,40	0,44

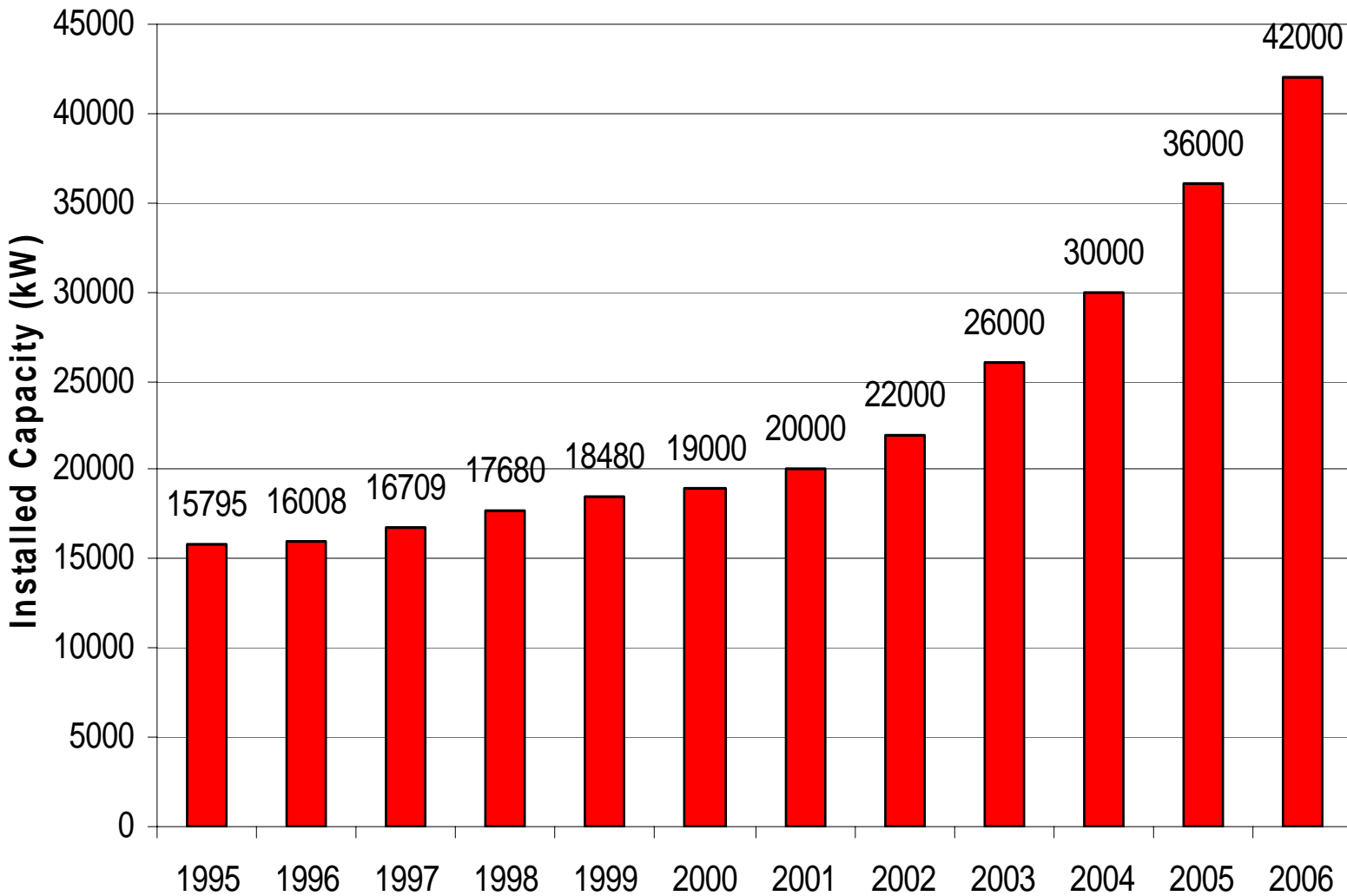
- **b1:** PV system non integrated (ground mounted)
- **b2:** PV system partially integrated (placed on street and iunrbanistic elements)
- **b3:** Building Integrated PV systems (modules integrated on urban, street elements, buildings and building structures)

**Max. ceiling which can benefit from the feed-in tariff is fixed to 1.200 MW**



# ITALY - PV Development

2000 –  
3000 MW



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2016



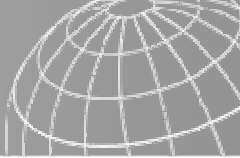
# ITALY – PV Policy Analysis

## Strengths

## Weaknesses

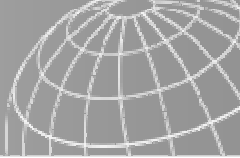
## Lessons Learned

Introduction of Feed-in-Tariff – no Quotas	Centralised permission procedure – long time until installation realized	Too small systems had no impact on reducing system prices
Inclusion of open-land ground mounted sys.	No specific Feed-in-Tariff for BIPV until 2007	Operators made no profit, which could have been re-invested
Increased guaranteed Feed-in-Tarif time from 15 to 20 years and annual decrease of tariff of only 2% instead of 3%	Only small systems promoted, weak leverage effect in the public	Awareness & acceptance was not raised, no pull-effect
Possibility to combine Feed-in-Tariff with regio. investment subsidies	Poor market monitoring and policy performance measurement	Reduce bureaucratic procedures in order to reduce application time

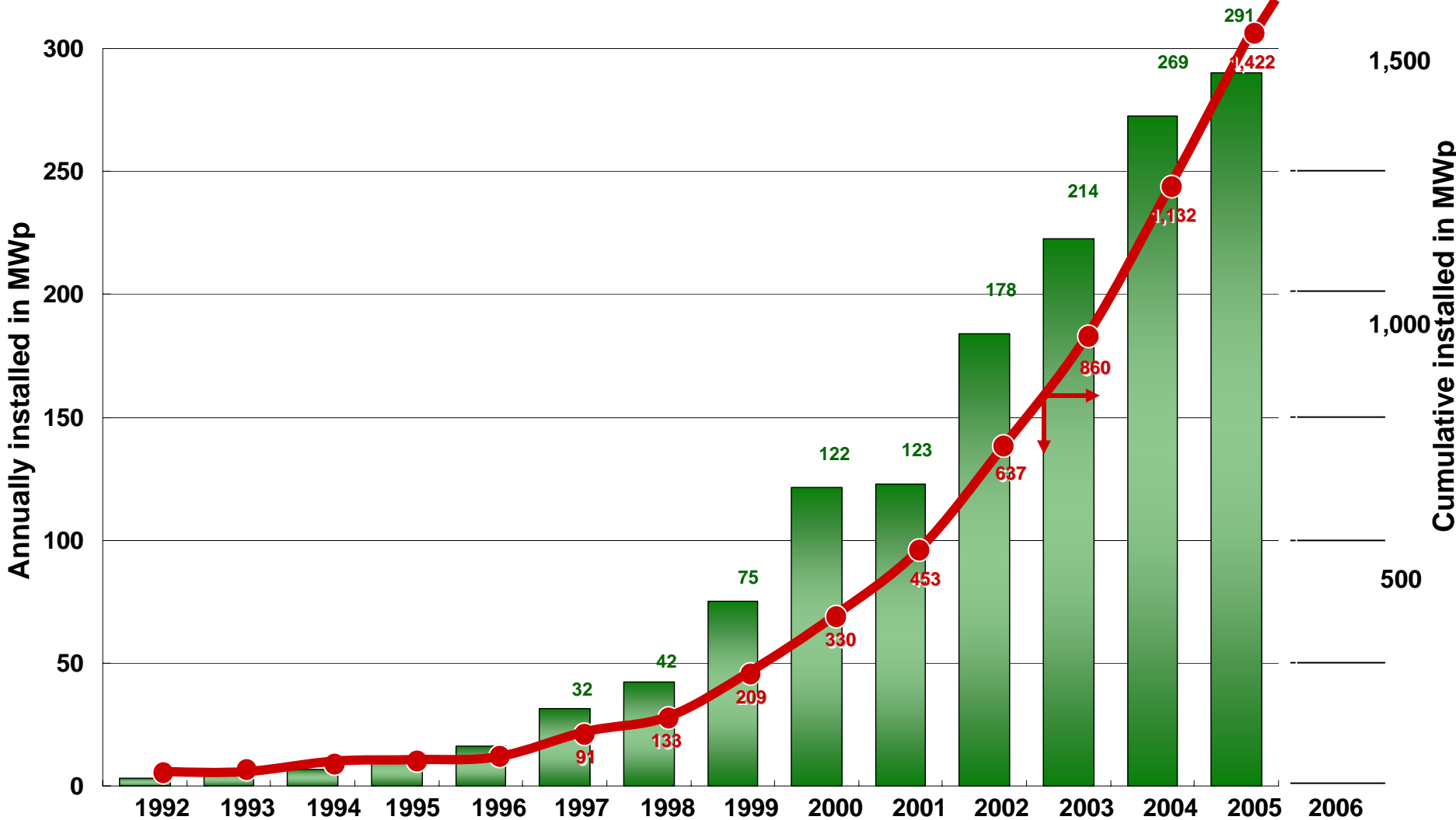


# JAPAN – PV Dev. & Natl. Strategy

- 1992: Sunshine Project launched
- 1993-2001: New Sunshine Project 1<sup>st</sup> Stage
- 1994-2005: Residential PV Sys. Dissemination Program (subsidy driven)  
approx. 256.000 houses equipped (approx. 800 MW capacity installed)
- 1997: New Energy Law came into effect
- 2000: Advanced PV Programm launched
- 2002: RPS regulations for utilities introduced
- 2003: Basic Energy Law came into effect
- 2004: PV Roadmap toward 2030 issued
- 2010: National Target of 4,82 GW
- NO – Feed-in-Tarif, but a  
„Net-Billing“ 24 ¥/kWh residential / 12 ¥/kWh industrial user plus  
fiscal incentives like reduced mortgage for home owners
- A host of technical regulations/ quality standards issued

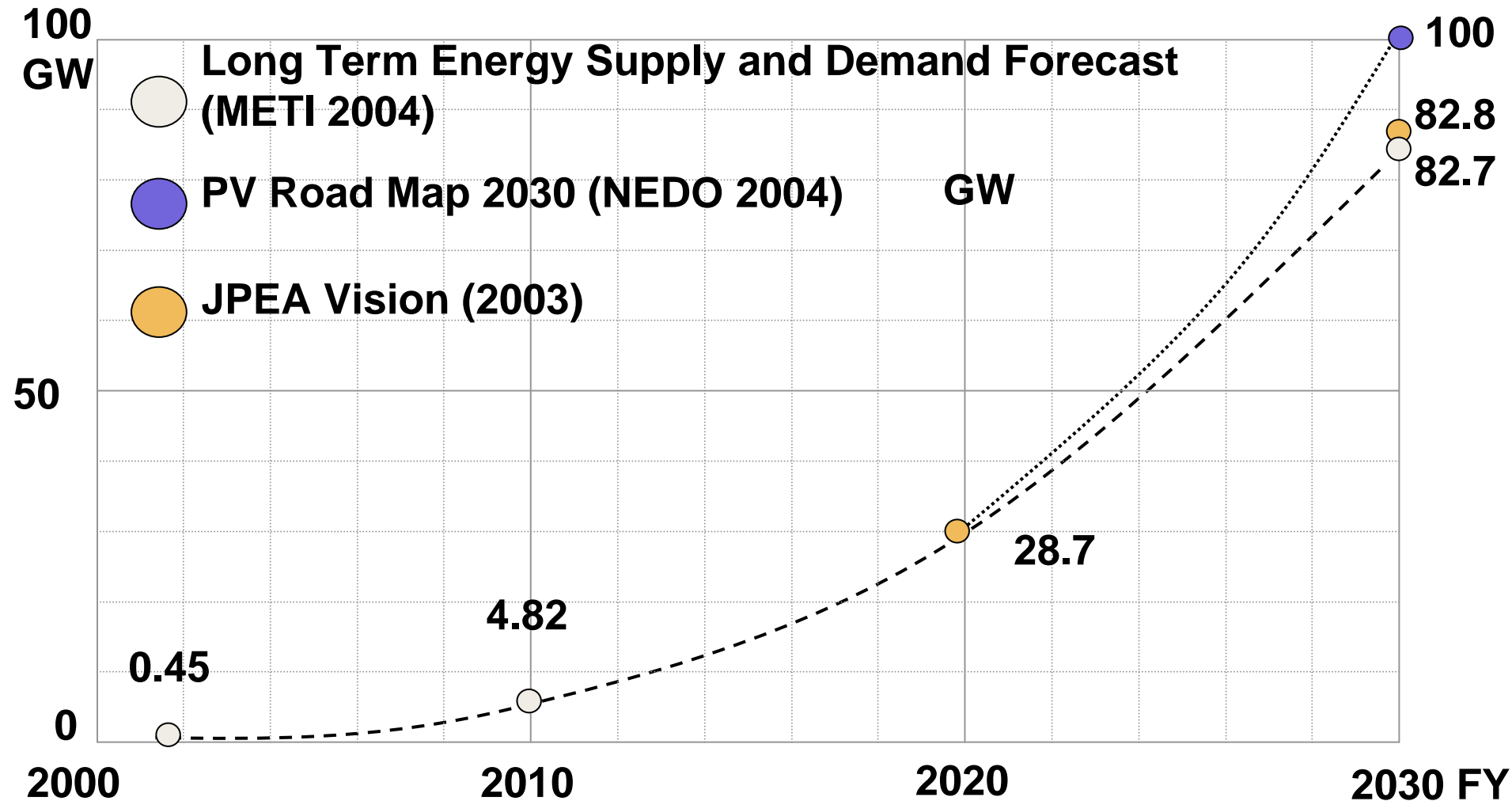


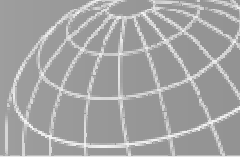
# JAPAN - PV Development





# JAPAN - PV Cumulative Capacity Forecast

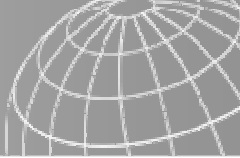




# JAPAN – PV Policy Analysis

Strengths	Weaknesses	Lessons Learned
<p>Market oriented</p> <hr/> <p>Long-term policy and commitment, where the industry can rely on</p> <hr/> <p>Dev. Intl. Standards</p>	<p>Phase-out of subsidies will lead to abolition of support schemes on prefecture level</p>	<p>Combination of different policy instruments facilitated a successful market development, however it needs a good coordination</p>
<p>Housing manufacturer dev. houses which combine PV with energy efficient water supply</p>		<p>Continuity of political support is essential for a long-term market development</p>
<p>Considerable number of Prefectures offer additional subsidies</p>		



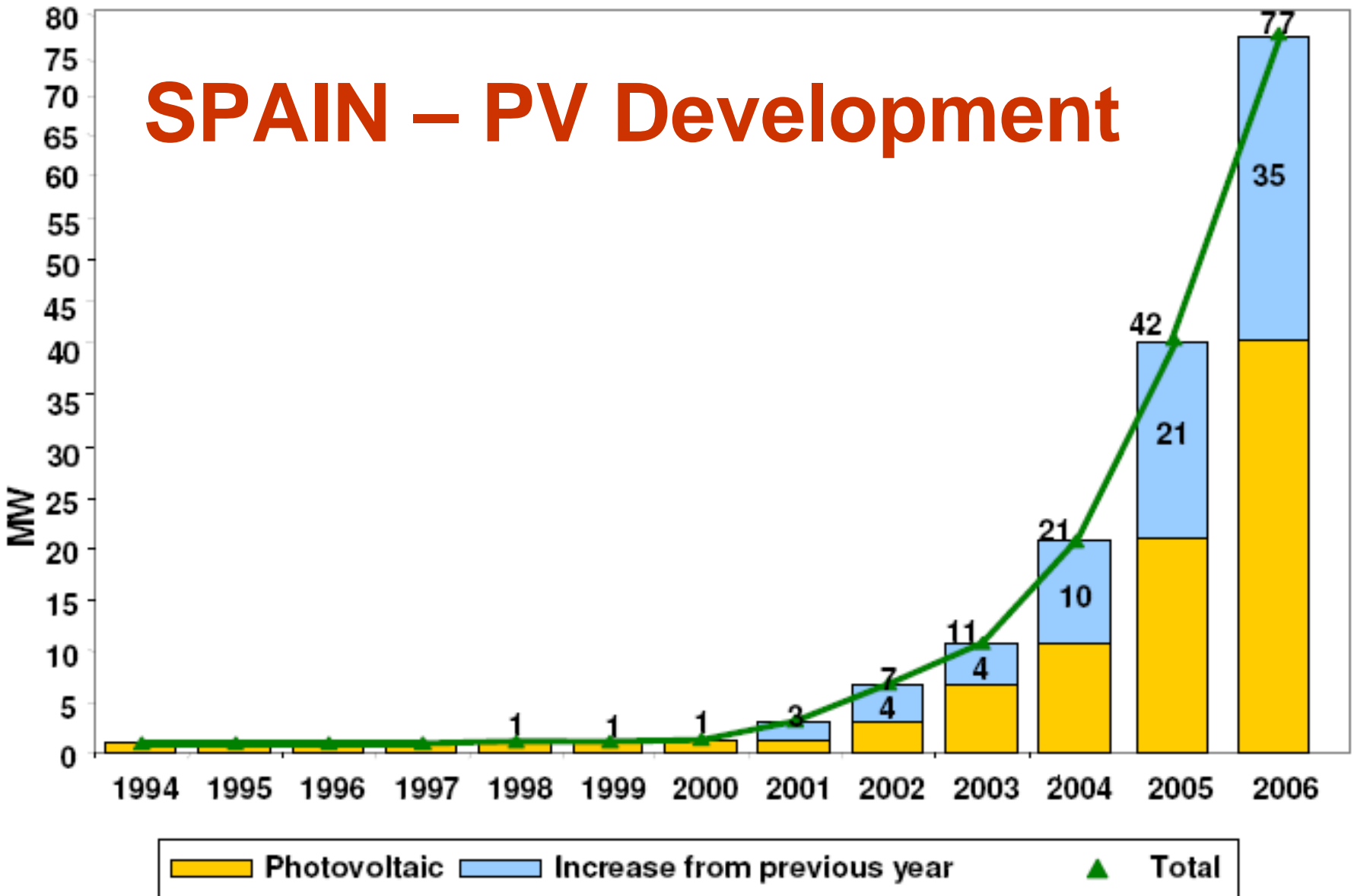


# SPAIN – PV Dev. & Natl. Strategy

- Since 1999 the govt. follows a clear strategy to promote PV
- Royal Decree 436/2004 Feed-in-Tariff Scheme came into effect resulting in both boosting market development and investment climate is one of the best throughout Europe
  - < 100 kWp - 0,414 €/kWh
  - > 100 kWp - 0,22 €/kWh
- Legal Framework created a speculation bubble with 6000 MW of applications submitted to the govt. administration
- 2005-2010 RE Plan: National Target of 400 MW by 2010  
Total Investment est. €500 Mio.



# SPAIN – PV Development





# SPAIN – PV Development



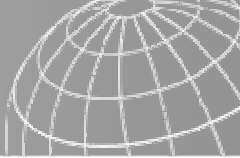
Legend: ● 1 GWh

Source: CNE



# SPAIN – PV Policy Analysis

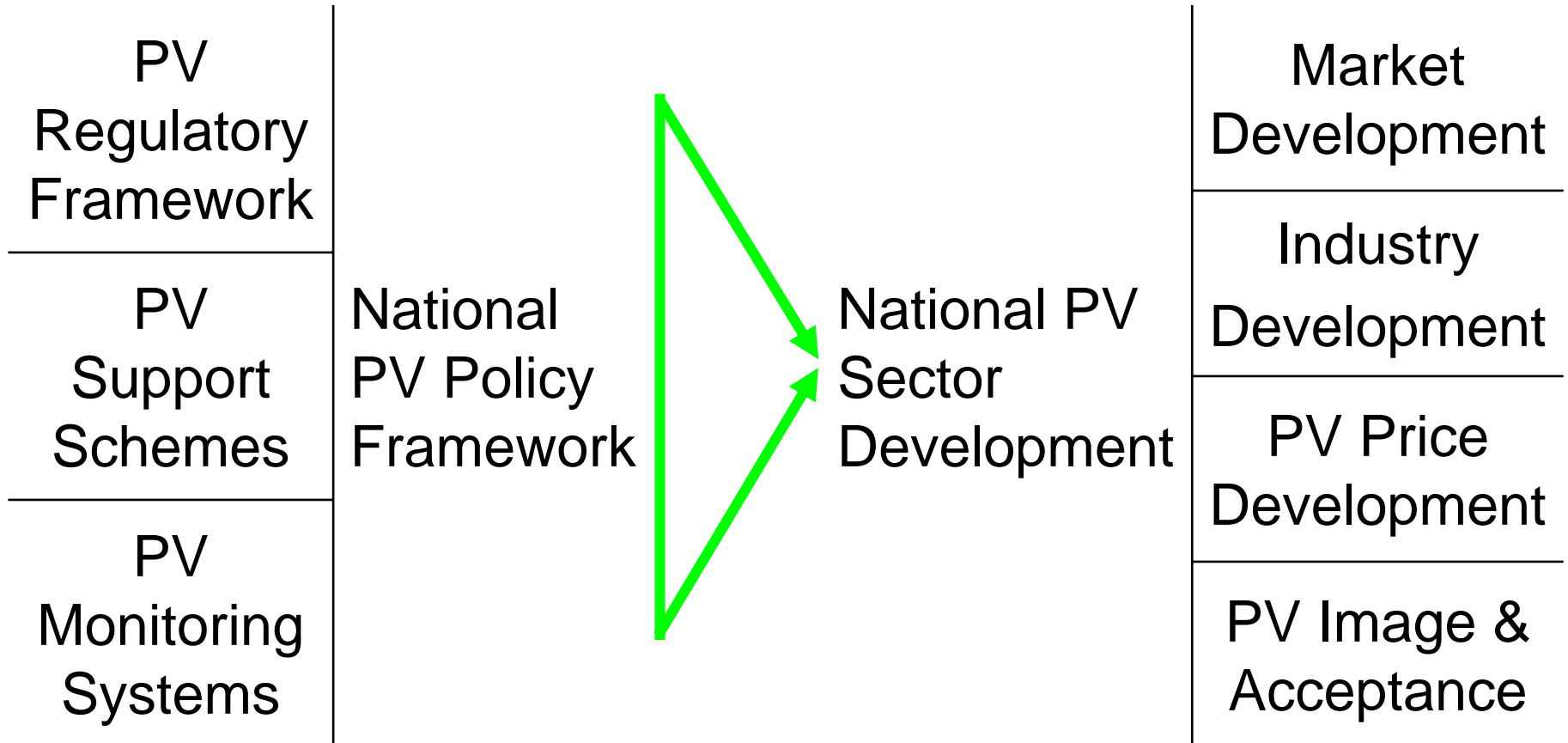
Strengths	Weaknesses	Lessons Learned
<p>Excellent solar yields + feed-in-tariff + loans up to 80% are extremely attractive</p>	<p>Limited budget led to suspension of support program in 2004</p>	<p>Subsidies abolished and Feed-in-Tariff introduced</p>
<p>Very consistent policy and PV strategy, e.g. support schemes, full commitment on natl. and regional level, natl. targets</p>	<p>Most investors focused only on subsidies and public funds, just a few commercial lending / bank credits</p>	<p>Simplification of administrative procedure in order to facilitate the market development</p>
<p>Good market monitoring and policy performance measurement</p>	<p>Bureaucratic application procedures for grants on esp. on regional level</p>	

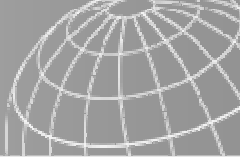


# Measure/Compare the Effectiveness of National PV Policy Framework

## Input = Efficiency

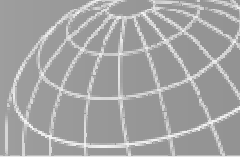
## Output = Effectiveness





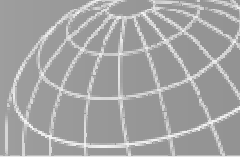
# Admin. Implementation in Practice

Performance Criterion	<u>Complexity of admin. process</u> <i>(Qualitative estimation)</i>	<u>Permissions required / authorities involved</u> <i>(Number)</i>	<u>Duration of planning process</u> <i>(Months)</i>
France	++	5 perm. / 2 author.	4-12 (small) 12-24 (large)
<b>Germany</b>	<b>+++</b>	<b>4 perm. / 2 author.</b>	<b>&lt; 2 (small)</b> <b>8-12 (large)</b>
Greece	+	17 perm. / 3 author.	6-12 (small) indefinite (large)
Italy	+	4 perm. / 3 author.	> 18 (small) 24-26 (large)
Japan	+++	---	---
Spain	++	5 perm. / 3 author.	8-14



# Admin. Implementation in Practice

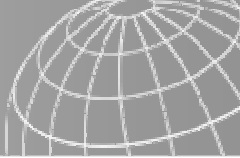
Performance Criterion	<u>Quality of Monitoring</u> (Qualitative estimation)	<u>Quality of Market Survey</u> (Qualitative estimation)	<u>Quality of Natl. Plant Register</u> (Qualitative estimation)
France	++	++	+
Germany	++	++	+
Greece	++	+	+
Italy	+	+	+
Japan	--	--	--
<b>Spain</b>	<b>+++</b>	<b>++</b>	<b>+++</b>



# Admin. Implementation in Practice

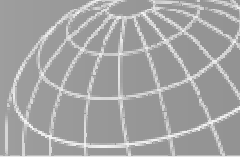
Performance Criterion	<u>Assessment by Prog. Manager</u> <i>(Qualitative estimation based on interviews)</i>	<u>Assessment by PV Industry</u> <i>(Qualitative estimation based on interviews)</i>	<u>General Impact on PV Market</u> <i>(Qualitative estimation based on interviews)</i>
France	++	++	+
<b>Germany</b>	<b>+++</b>	<b>++</b>	<b>++</b>
Greece	+	+	+
Italy	++	+	+
Japan	+++	+++	+++
Spain	++	+	++





# Admin. Implementation in Practice

Performance Criterion	<u>Budget for Subsidy schemes in 2004</u> (Mio €)	<u>Installed PV Power Capacity On + Off-Grid</u> (MWe)	<u>Budget per Wp</u> (€/Wp)
France	42,2	5,2	8,11
Germany	--	--	--
Greece	n.a.	1,03	n.a.
Italy	23,2	4,7	4,9
<b>Japan</b>	<b>122,7</b>	<b>272,4</b>	<b>0,45</b>
Spain	--	--	--

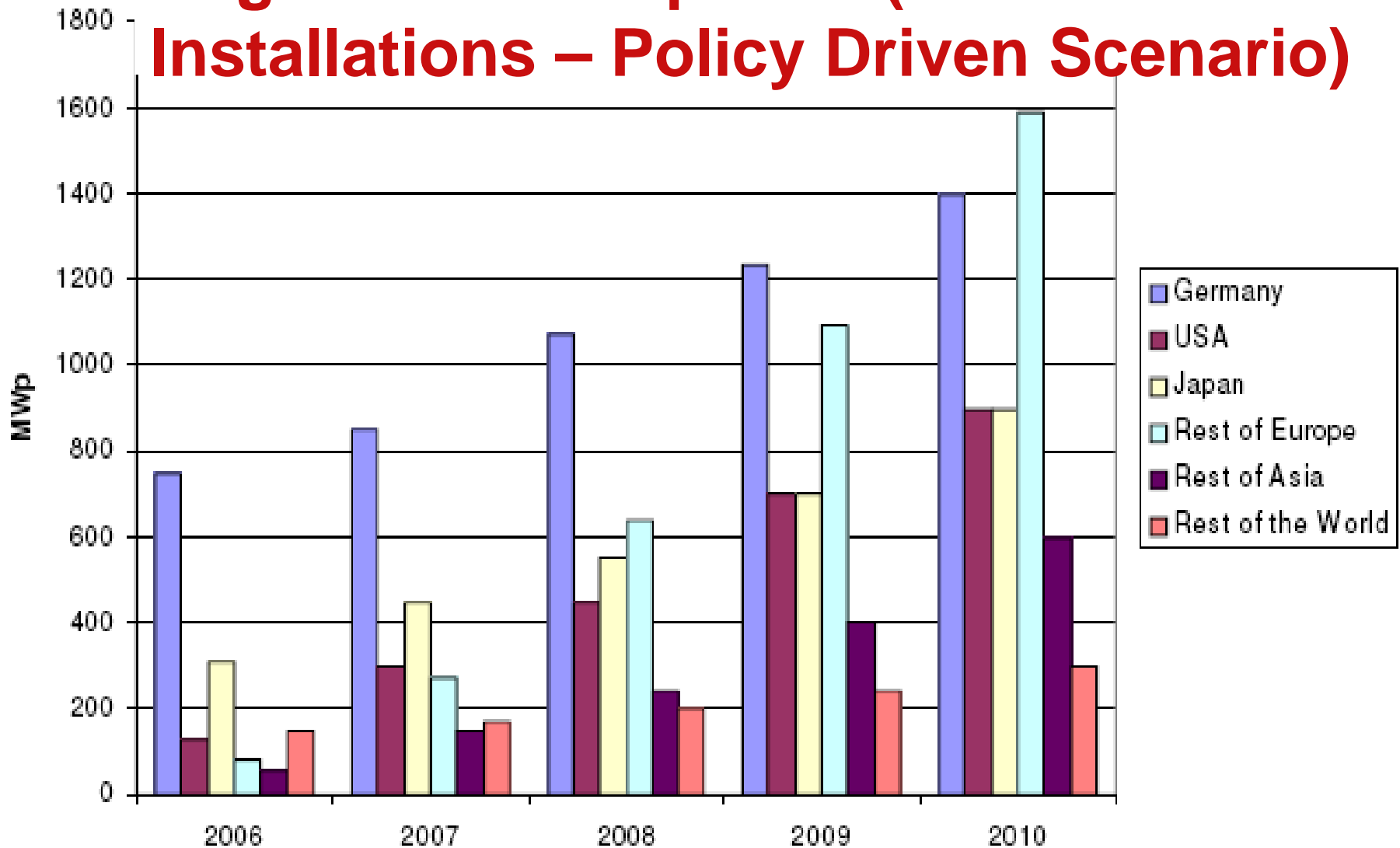


# European Market Support Schemes

Country	Feed-in law			2005	2006 (est.)
	Tariff [€ct/kWh]	Duration [a]	Cap [MW]		
Germany	41 – 52 BIPV + 5ct	20	-	750	750
Italy	44 – 49	20	1,000	10	25
Portugal	22 – 41	lifetime		5	5
Spain	22 – 44	25	400	25	40
France	30 - 40 BIPV + 15- 25	20	-	7	10
Greece	40 – 50	20		3	5
other countries	Feed in Laws: Switzerland (1991); Denmark (1993); Sweden (1997); Norway, Slovenia (1999); Latvia (2001); Austria, Czech Republic, Lithuania (2002); Cyprus, Estonia, Hungary, Slovak Republic (2003); Turkey, Ireland (2005)				

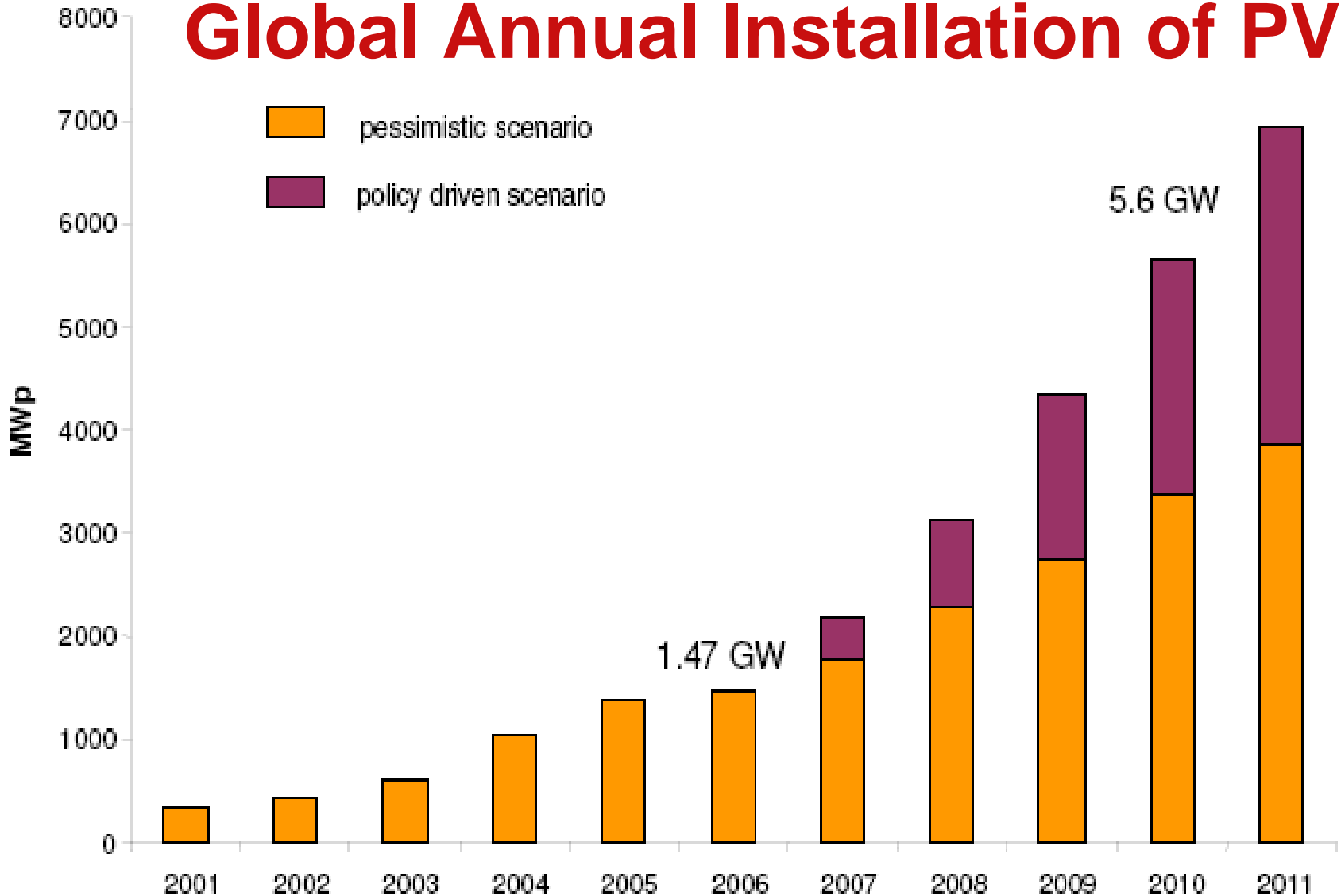


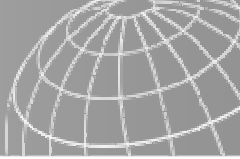
# Regional Development (Annual Installations – Policy Driven Scenario)





# Global Annual Installation of PV





# Thank you for your attention !

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