

Supporting and integrating RE-Electricity in Italy
The GSE experience
IEA DSM Task XVII
Seoul, Korea, September 2008

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Huge challenges



To cope with:

- Global Climate Change
(facilitating Kyoto targets)
- Security of supply
(restraining high dependence on fuel imports)
- Local environmental issues relief
(waste disposal, landfill reclamation)

in a consistent way with the European Union policy:

- Directive 2001/77/CE targets

$\frac{\text{Gross RE-E generation (kWh)}}{\text{Gross domestic power consumption (kWh)}}$	=	22% as EU (22% as Italy)	@ 2010
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- Directive proposal COM(2008)19 targets

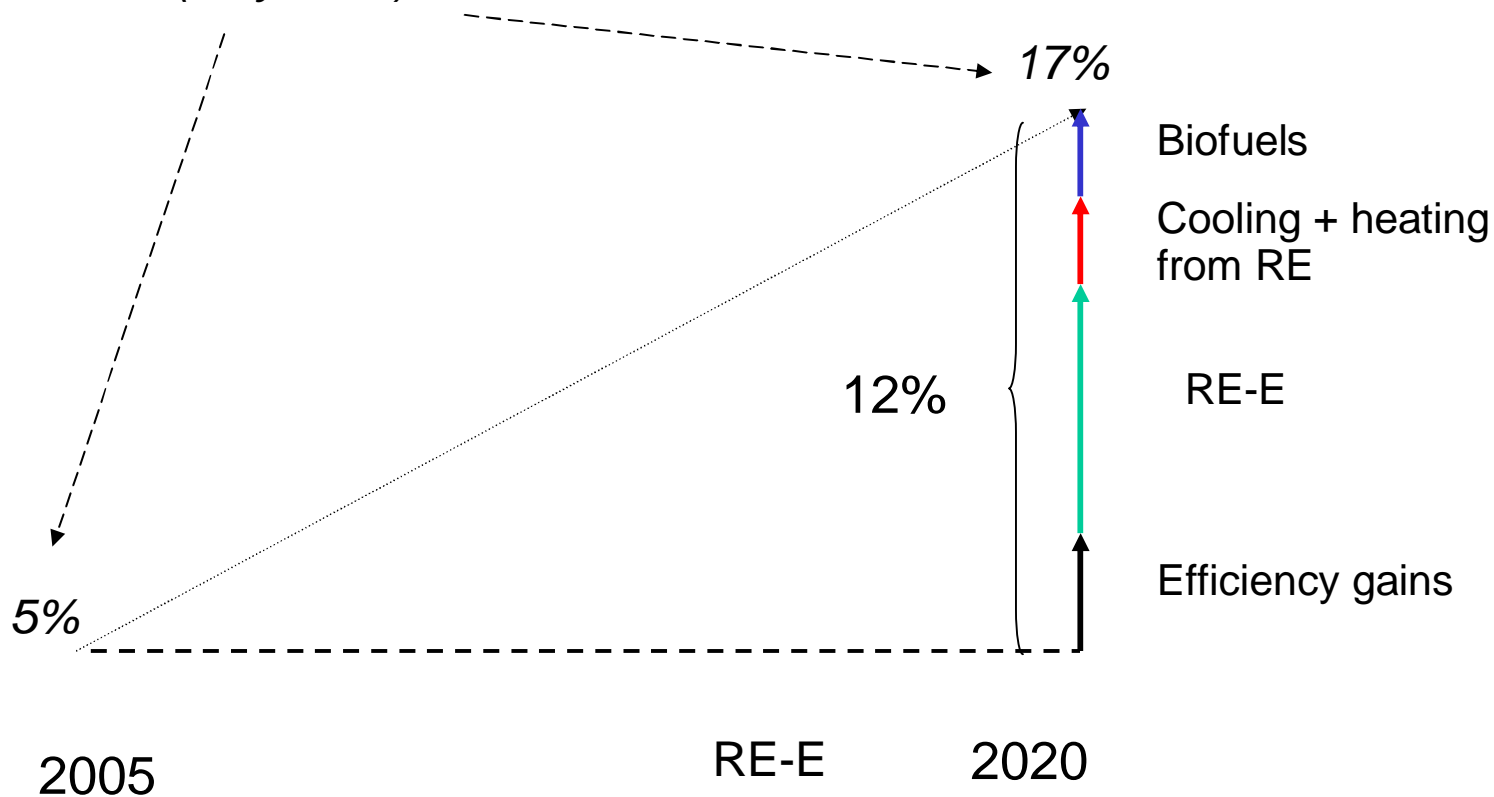
$\frac{\text{Final RE-E consumption (Mtoe)}}{\text{Final energy consumption (Mtoe)}}$	=	20% as EU (17 % as Italy)	@ 2020
		↓	
		about 30% of RE-E as Dir 2001/77/CE targets for memory: 14% recorded in 2007	

when hydro declines and nuke is expected after 2020

Integrated options for the 2020 EU RE target



Renewable share
of final energy consumption
(Italy case)



Legend:



Country main effective policy options



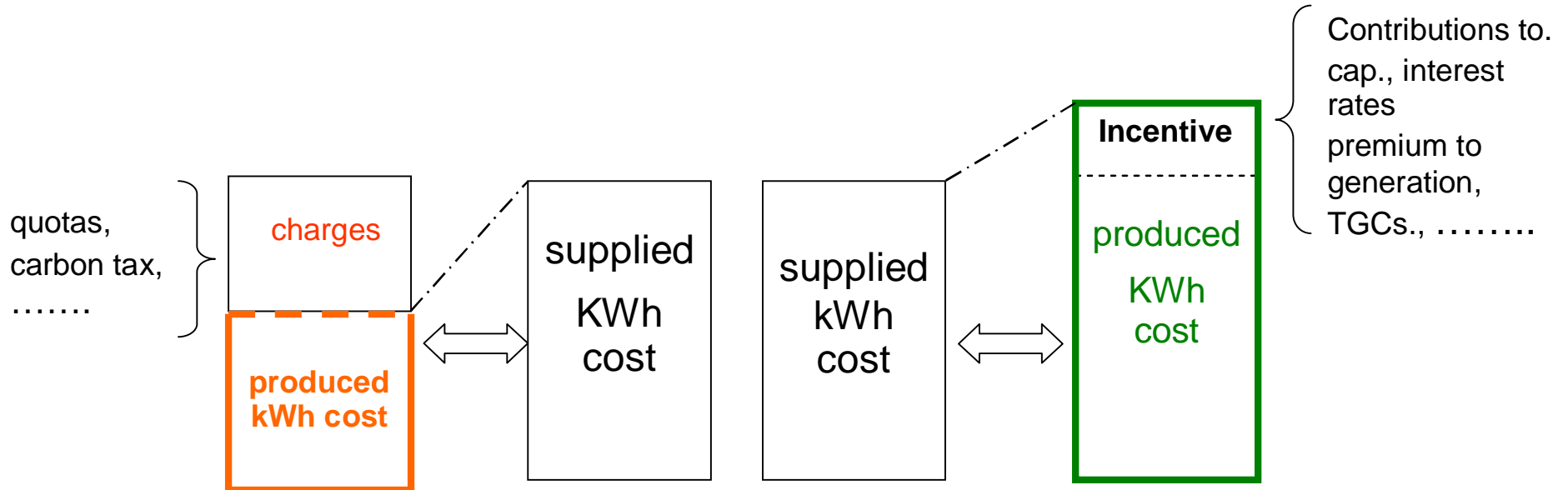
- Liberalization of generation
(everybody free to generate and buy power anywhere)
- Downsizing of the incumbents
(lower power market)
- Implementation of a wide portfolio of regulatory and economic supporting schemes
(facilitation of RE-E, CHP and energy efficiency)
- Establishment of an independent body (GSE) focused on promotion of RE-E and energy efficiency
(really oriented to supporting)

Reconciliation of externalities



Fuel-fired generation costs

Renewable generation costs



Most of experimented supports



	<i>In the building phase</i>	<i>In the operational phase</i>
Regulatory	<ul style="list-style-type: none"> • Grid connection oblig. • Simplified authorization • 	<ul style="list-style-type: none"> • Dispatching priority • Supply disclosure •
Economic		
<i>Administrative</i>	<ul style="list-style-type: none"> • Contribution to capital costs • Contribution to interest rates • 	<ul style="list-style-type: none"> • Feed-in tariffs • Emission taxation • Fuel taxation/ RE-E tax exemption • Net metering •
<i>Market oriented</i>	<ul style="list-style-type: none"> • Bidding of capacity package eligible for incentivizing tariffs • 	<ul style="list-style-type: none"> • Quotas & TGCs • Green pricing (GOs, RECs, labels,.....)

Support to RE-E & CHP in place



- Feed in-tariffs for RE-E (*and quasi RE-E*) for plants listed eligible within 1 April 1999 (coexisting with TGCs)
- Quotas & TGCs for RE-E plants commissioned after 1 April 1999 (*subjected to frequent upgrading*)
- Fixed premium for PV-E green value in place from end 2005
- Global tariff (*green value + brown value*) for RE-E plants < than 1 MW (*wind farms < than 200 kW; biomasses: only local*) on producer choose from 2008
- Brown value for RE-E paid by GSE on producer choose @ power market prices from 2007
- Net-metering in place for RE-E and CHP up to 200 kW size devices from 2007

Country supports to RE-E in place



Managed by GSE

Feed-in tariffs	Energy purchasing tariffs	CIP6, Global tariff for small generation	
		Micro-generation (Del AEEG n. 280/07)	
	Support to generation	Premium feed-in (Conto Energia PV)	
Market oriented mandatory schemes	Mandatory quotas & TGCs		
Voluntary support to green generation	Guarantee of origin (GO)		
	Renewable Energy Certificate System (RECS)		
	Green Pricing (GP)		
Other economic supports	Support to construction	Monetary contribution to:	Capital Costs
			Interest rates
		Fiscal rebates (depreciation, ...)	

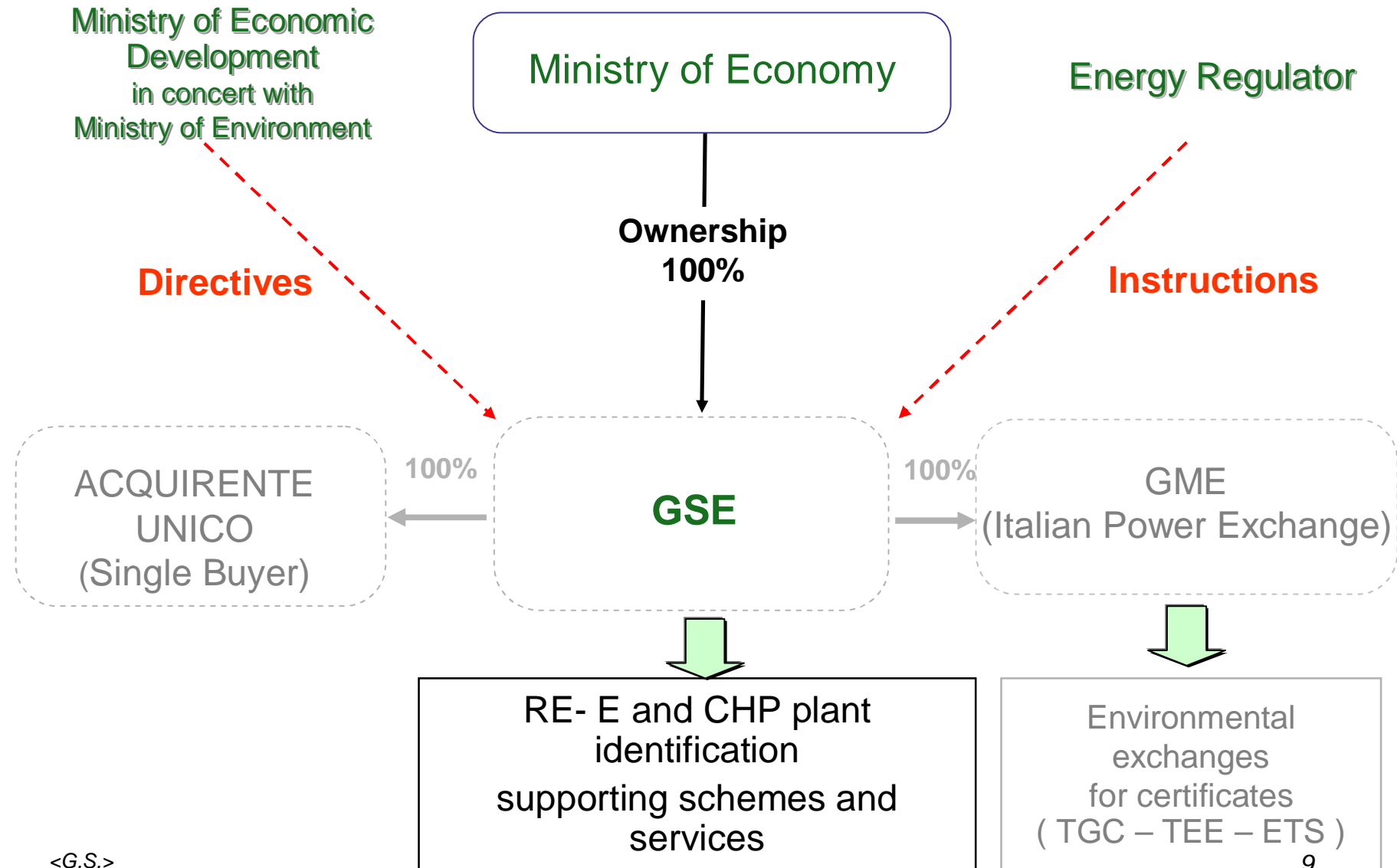
+

Managed by GSE

Favored grid connection, priority dispatching, purchasing services, net-metering (< 200 kW)

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The GSE – a joint-stock public company



GSE business (2007)



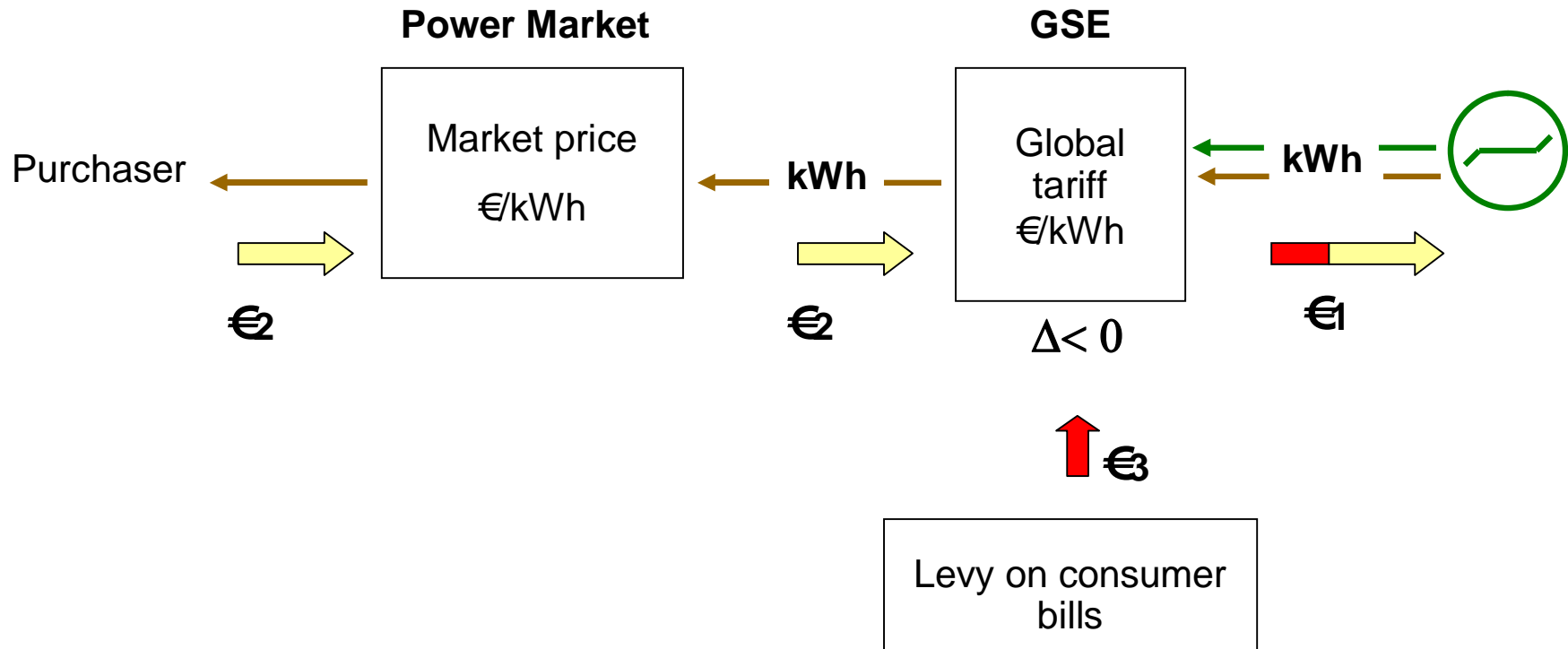
		2007 data		
		Power plants	Capacity (MW)	Power (TWh)
Power purchasing and selling	Feed-in tariffs (CIP 6/92)	386	7.756	46.7
	Voluntary supply from generators	3.005	3.493	7.0
	tot	3.391	11.249	53.7
				→ 17% of country generation
Direct Supporting schemes	Quotas & TGC issuing	1.036	5.525	7.7
	PV sets under premium feed-in	6.057	60	0.04
	tot	7.093	5.585	7.74
Recognizing and certificate issuing	Cogeneration (2006 data)	370	8.600	50.0
	RE-E import ¹	n.d.	n.d.	35.7
	Guarantee of Origin	82	1.547	4.5
	RECS	65	1.025	3.0
tot		517	11.172	93.2

¹ for exemption from quota obligation

Feed-in tariff (CIP 6/92) scheme



Renewable & Quasi-Renewable (CHP, ..) power



Green value of kWh ←

Brown value of kWh ←

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Feed-in data (2007)



- CIP/6
- Premium for 8 years + avoided capital costs + avoided fuel costs → *according to source and technology*

Source	MW	TWh	average tariff (EUR/MWh)
Renewable energy	1977	8.2	180
Quasi-renewable energy	4572	38.3	98
Total	6548	46.5	113

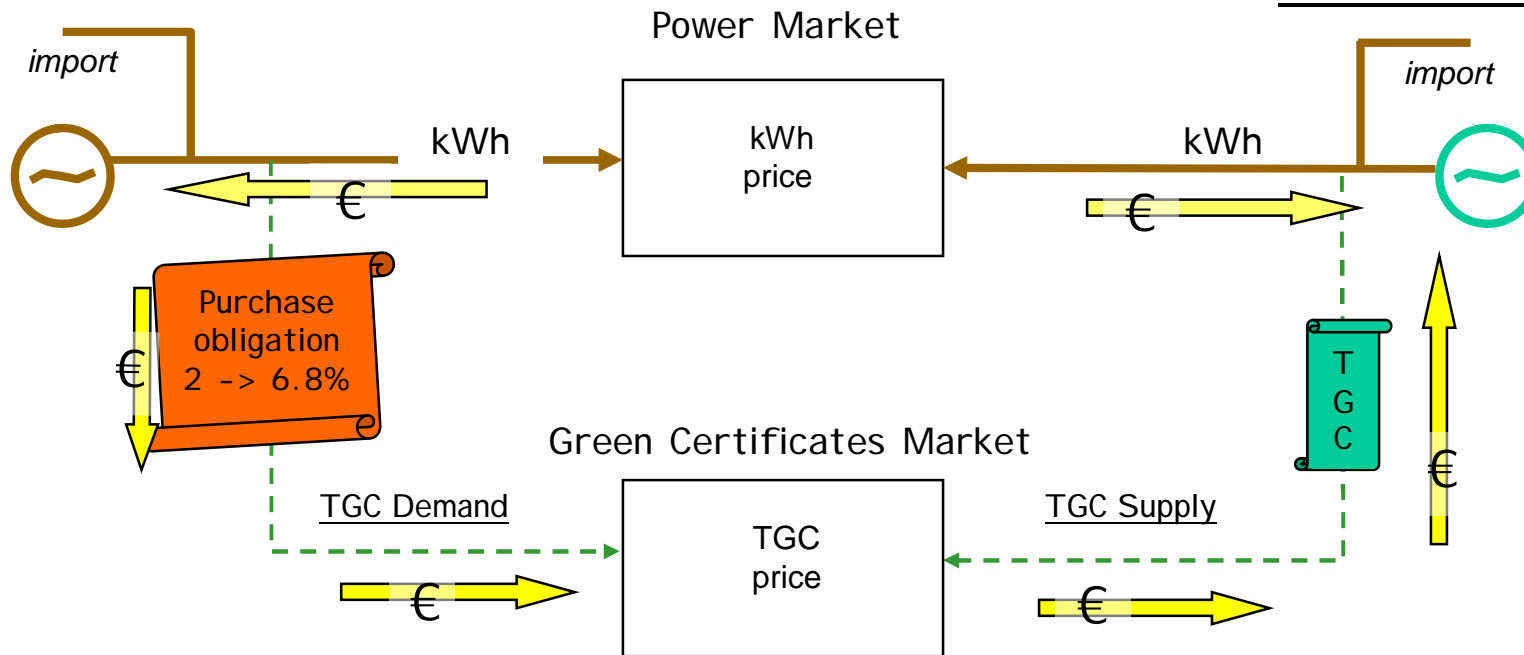
For memory: 2007 wholesale power exchange price averaged 80 EUR/MWh

Quotas & Green certificates



Non-renewable energy

Renewable energy

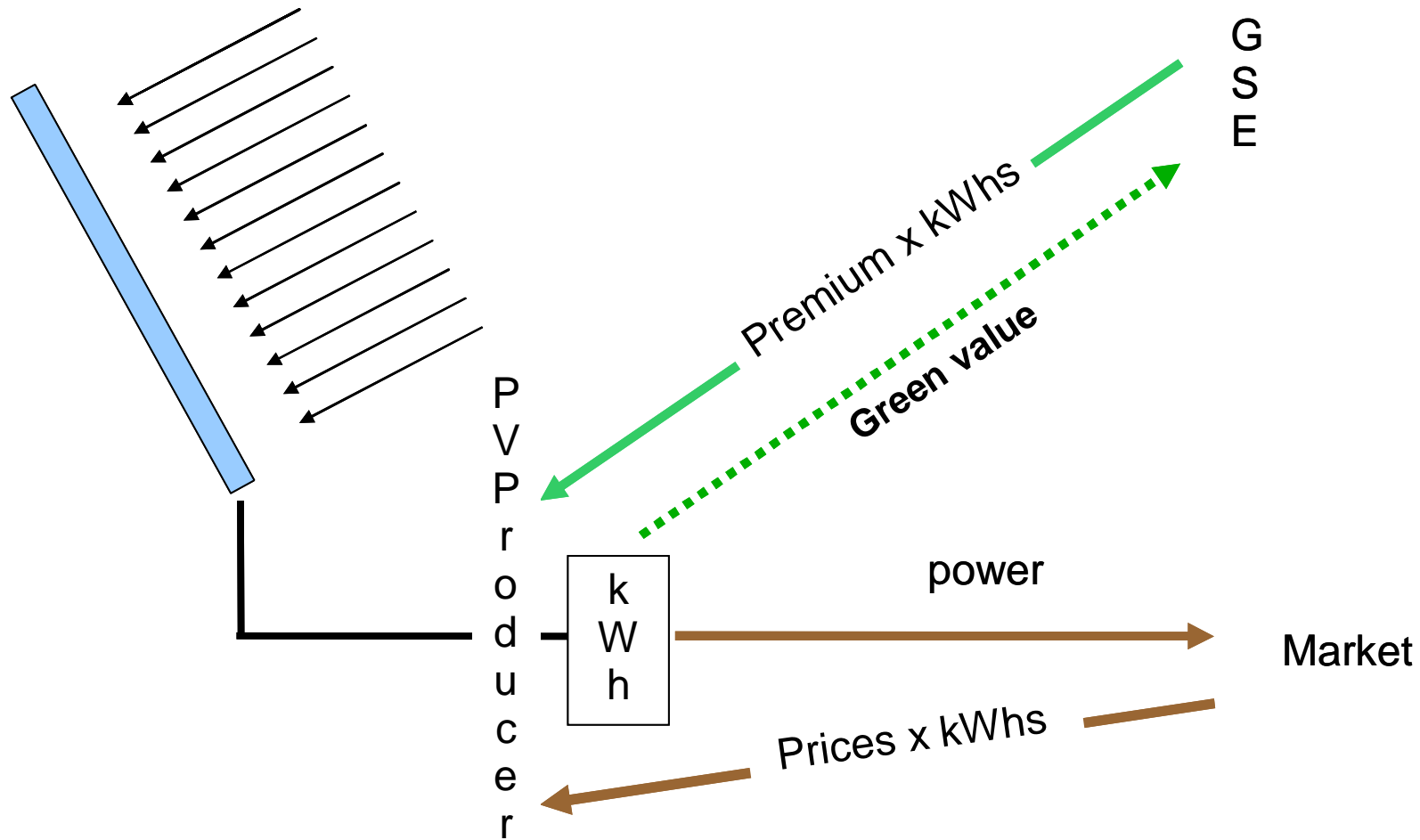


Green value of kWh

Brown value of kWh

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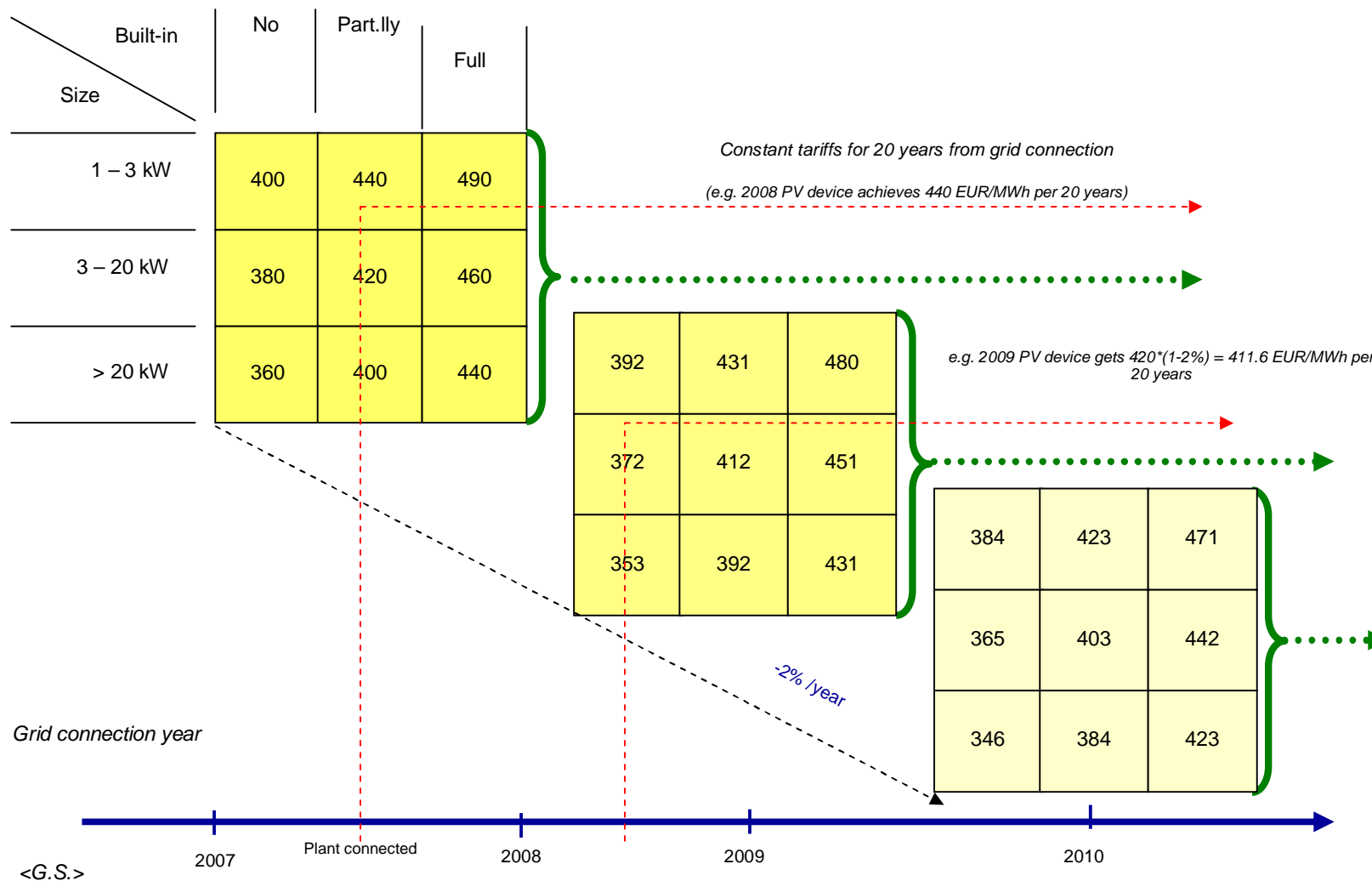
Premium feed-in for PV generation



Base premium tariffs for PV green value



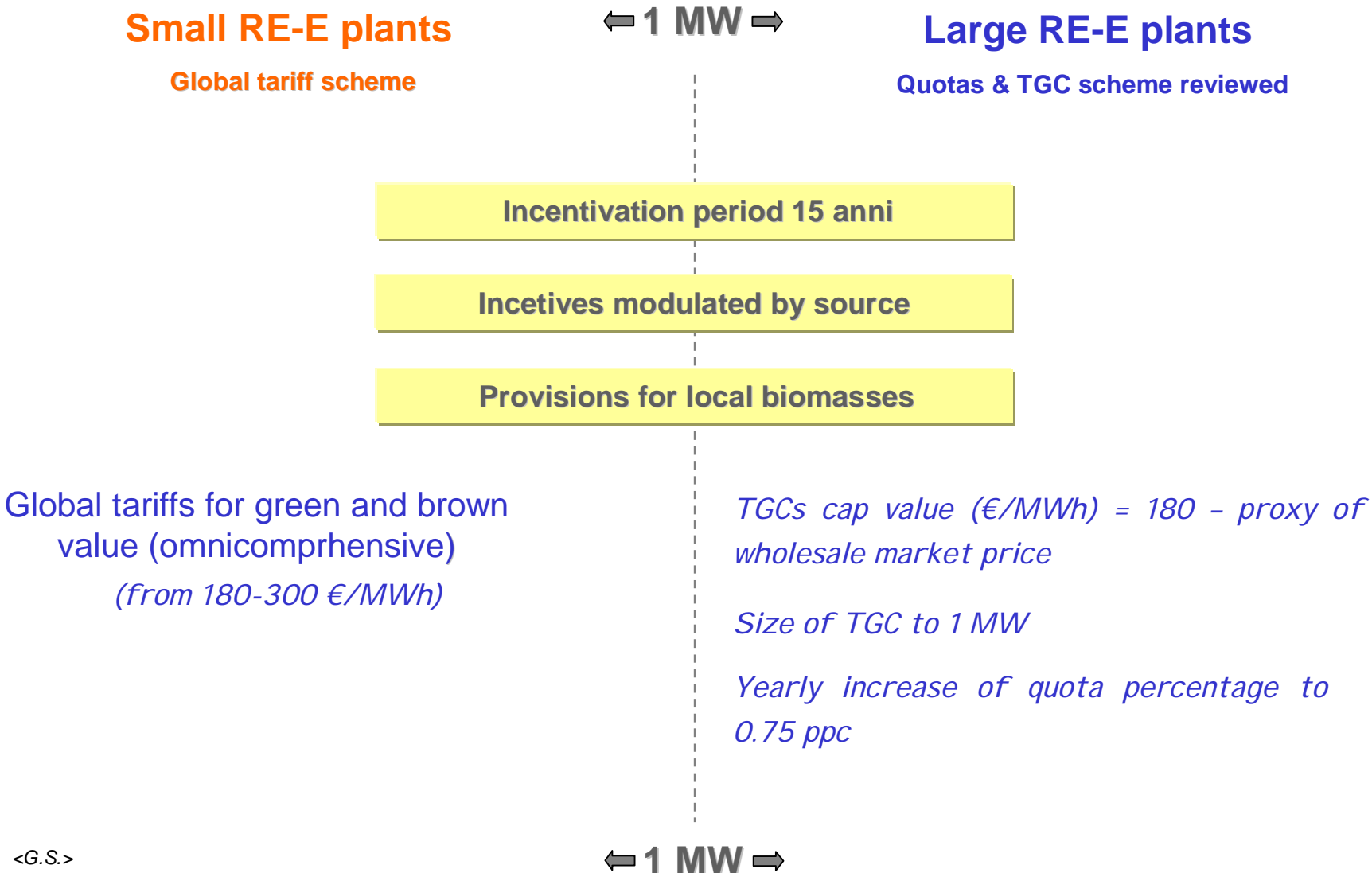
**Base tariffs for grid connection in the 2007- 2010
(EUR/MWh)**



New stimulus to small generation (2008)



2008 Budget law; Law 29/11/2007



The global tariff



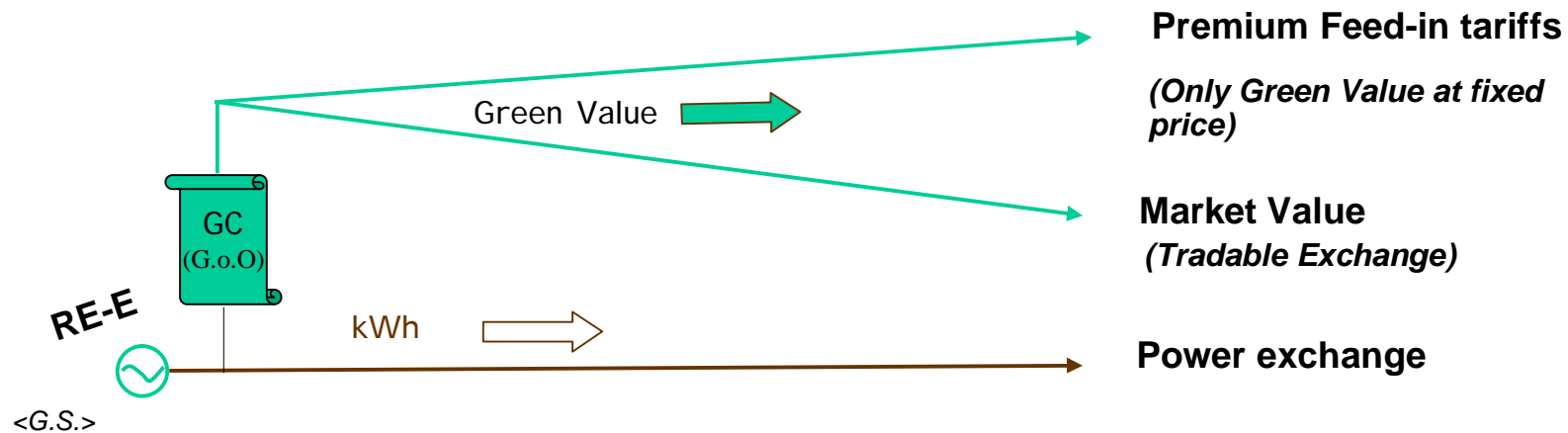
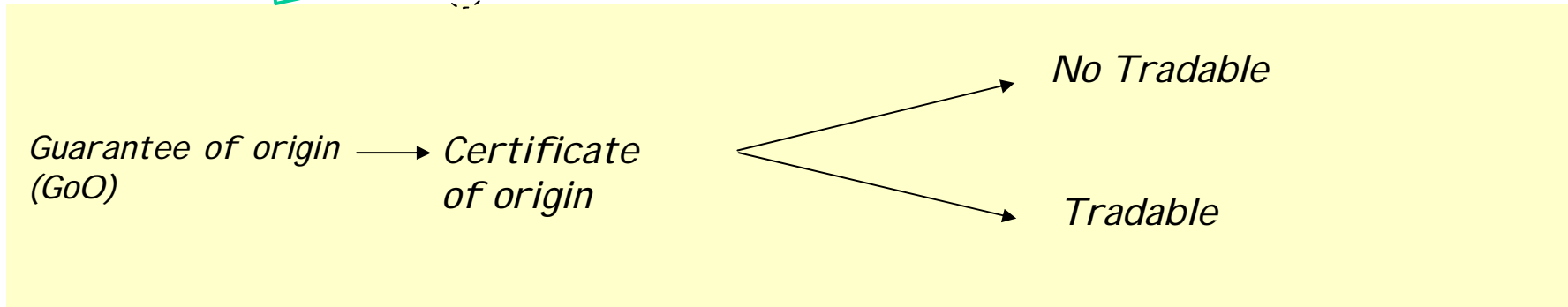
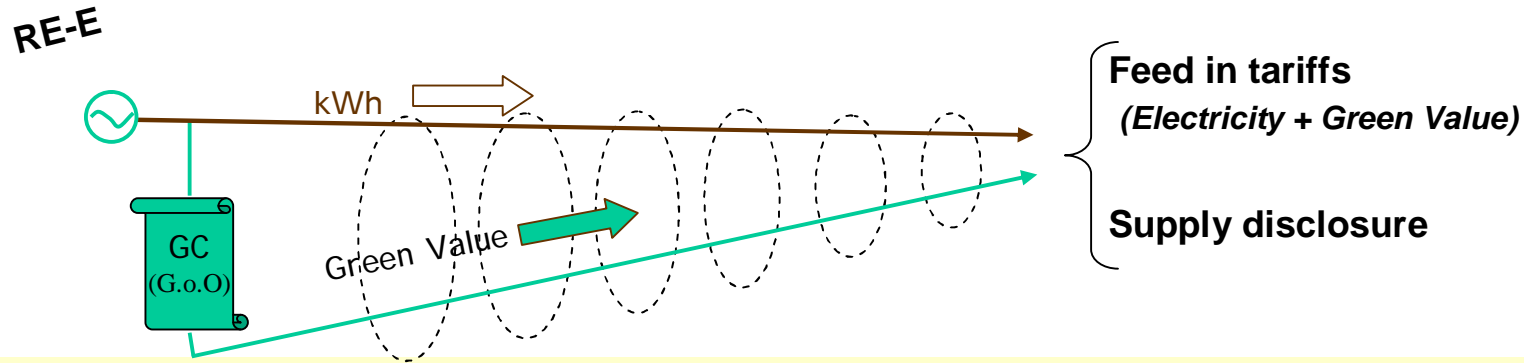
Law 24/12/2007 n.244 ; Law 29/11/2007 n.222

Source	Global tariffs (€/MWh)
Wind genset up to 200 kW	300
Geothermal	200
Wave and tides	340
Other hydro	220
Bioenergy	220
Local agricultural bioenergy (within 70 km)	300
Landfill biogas	180

TGCs granted by source

Source	Source multipliers for granted TGCs (Basis: 1 TGC per MWh)
Wind sets larger than 200 kW	1,00
Off-shore wind	1,10
Geothermal	0,90
Waves and tides	1,80
Hydro	1,00
Bioenergy	1,10
Local agricultural bioenergy (within 70 km)	1,80
Landfill gas	0,80

Guarantee of origin concept

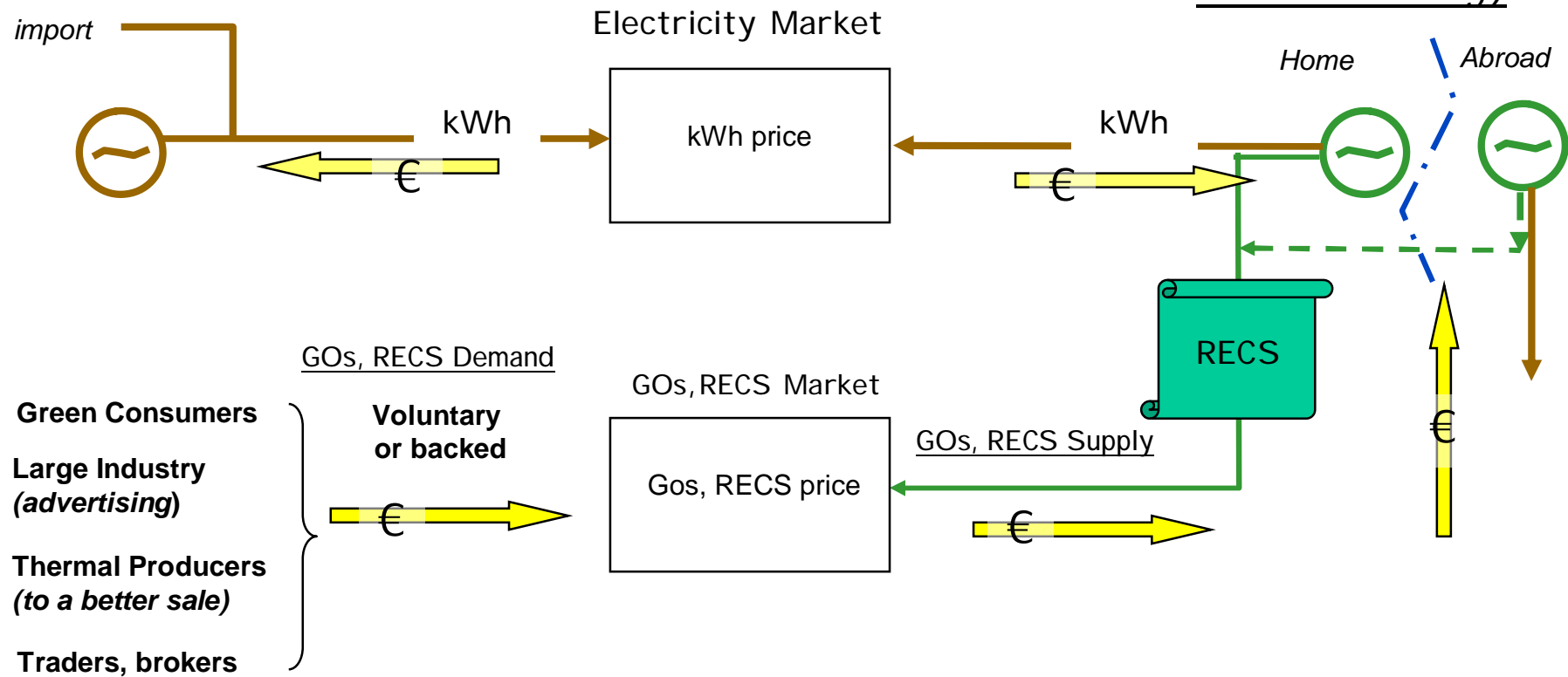


Green pricing via GOs, RECS



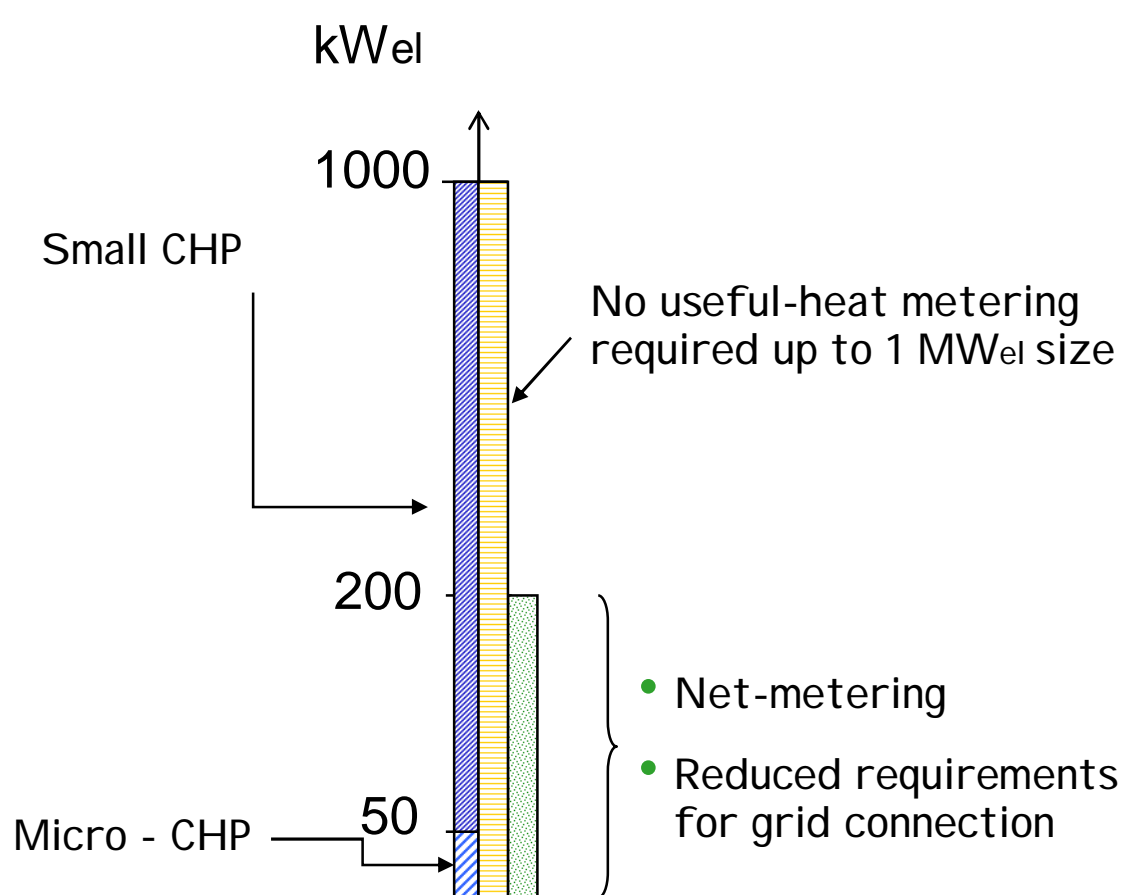
Non-renewable energy

Renewable energy



- No monetary incentives, other than High efficiency sets listed for White Certificates
- Priority of access
- Net metering for CHP plants less than 200 kW

High efficiency CHP facilitation



Facilitation for each size:

- T-D fee rebates
- purchase of reserve or supplemental power

 Eligible for white certificates

Energy efficiency incentives



- White certificates (*reserved to suppliers and ESCOs*)
 - ✓ *Power and gas distributors obliged to get efficiency targets*
 - ✓ *Obligation is fulfilled by tradable white certificates*
 - ✓ *Three types of certificates:*
 - ◆ *Electricity savings by power distributors and ESCOs* (36 €/toe)
 - ◆ *Gas savings by gas distributors and ESCOs* (84 €/toe)
 - ◆ *Primary energy savings by utilities and ESCOs* (5 €/toe)

- *Income tax rebates (reserved to individuals and firms)*

55% of installed costs returned via income tax rebates
(*Applicable to solar heating, condensing boilers, heat pumps, building insulation,*)

- The GSE power plants actual injected output show large unexpected variations versus the scheduled power bid on the day-ahead market, because of their characteristics
- Under the Italian Regulation, the imbalances costs from the quasi-renewable plants (CHP and heat recovery) are passed through the owners, while imbalances costs from the random generation plants (wind farms, solar devices and run of river gensets) are socialized.
- The Regulator has charged GSE to keep those imbalances as low as possible, given the expected increasing penetration

GSE aggregates and sells on the market the power achieved from:

- Purchases under the CIP-6 feed-in tariff scheme
- Purchases from RE-E and CHP generators from small and micro devices under the global tariff scheme
- RE-E and CHP generators asking for selling and bidding services



In this role GSE is Responsible of Balance versus the Independent System Operator for each grid connected plant larger than 10 MVA and for the aggregated generation from the generator sets lower than 10 MVA

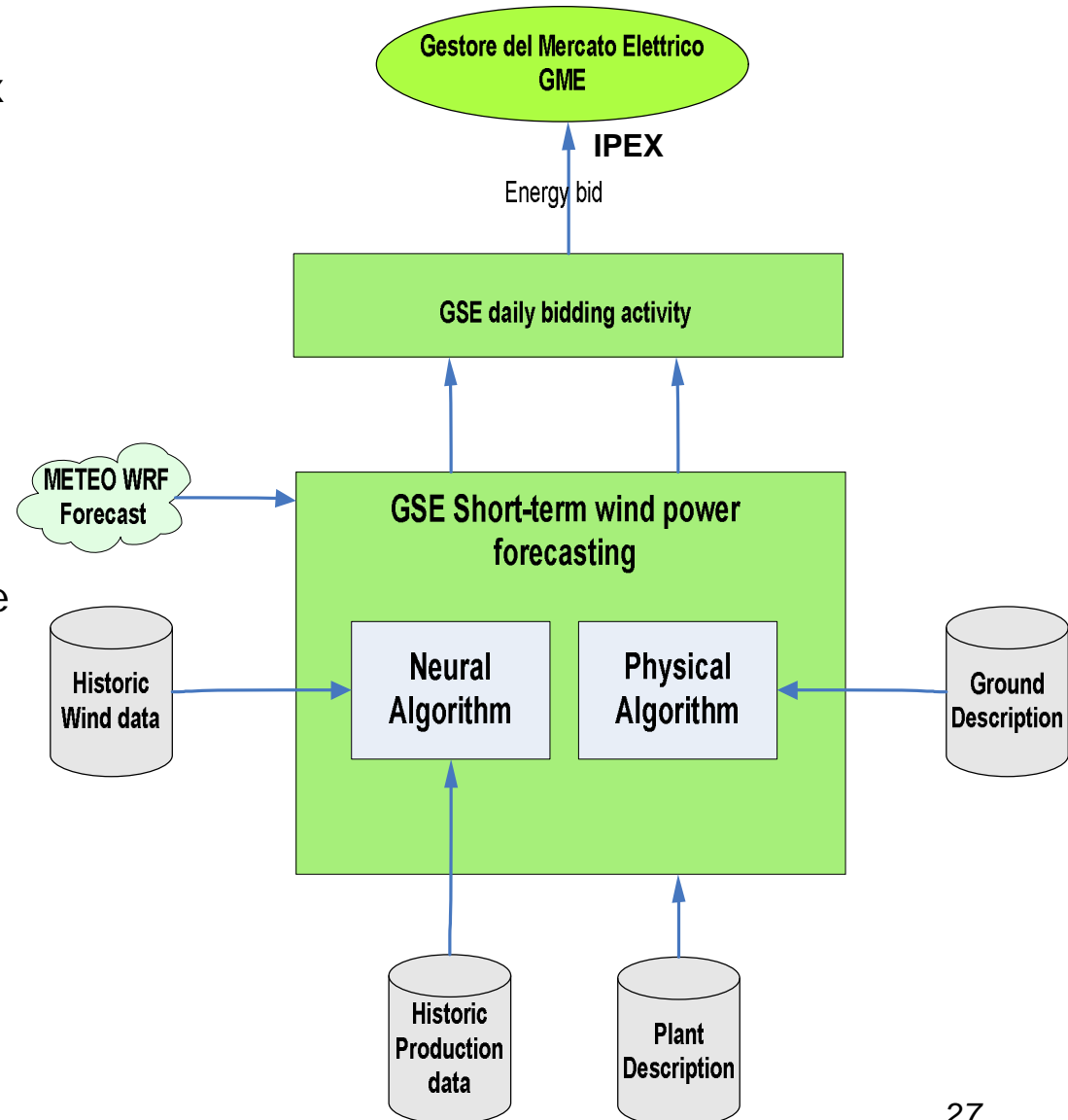
- As virtual producer, GSE puts on the energy market yearly about 60 TWh (Italy: 300 TWh), of which 20 TWh from RE sources (Italy: 50 TWh)
- The wind power short-term forecasting (PrevedoVento) implementation started in 2007.
The forecasting activity for energy bidding from January 2008. At the moment, 1300 MW (40 plants) are scheduled by the GSE forecast models.
Unbalances costs for 40 million Eur avoided from Jan to Jun 2008
- The short term wind power forecasting is part of a large project, aiming at forecasting the random (not programmable) RE-E (wind, solar and run of rivers). The PV solar module (PrevedoSole) is under test, in use in September.
- The run of river module (PrevedoAcqua) is expected ready for use at the end of 2008

The PrevedoVento architecture



Model Characteristics:

- Ground description (complex terrains study of the wind farm)
- Neural Network Model
- Physical Model
- WRF Meteo Model
- Historical data of the wind and production
- Plant description (turbines)
- In house development of the algorithms

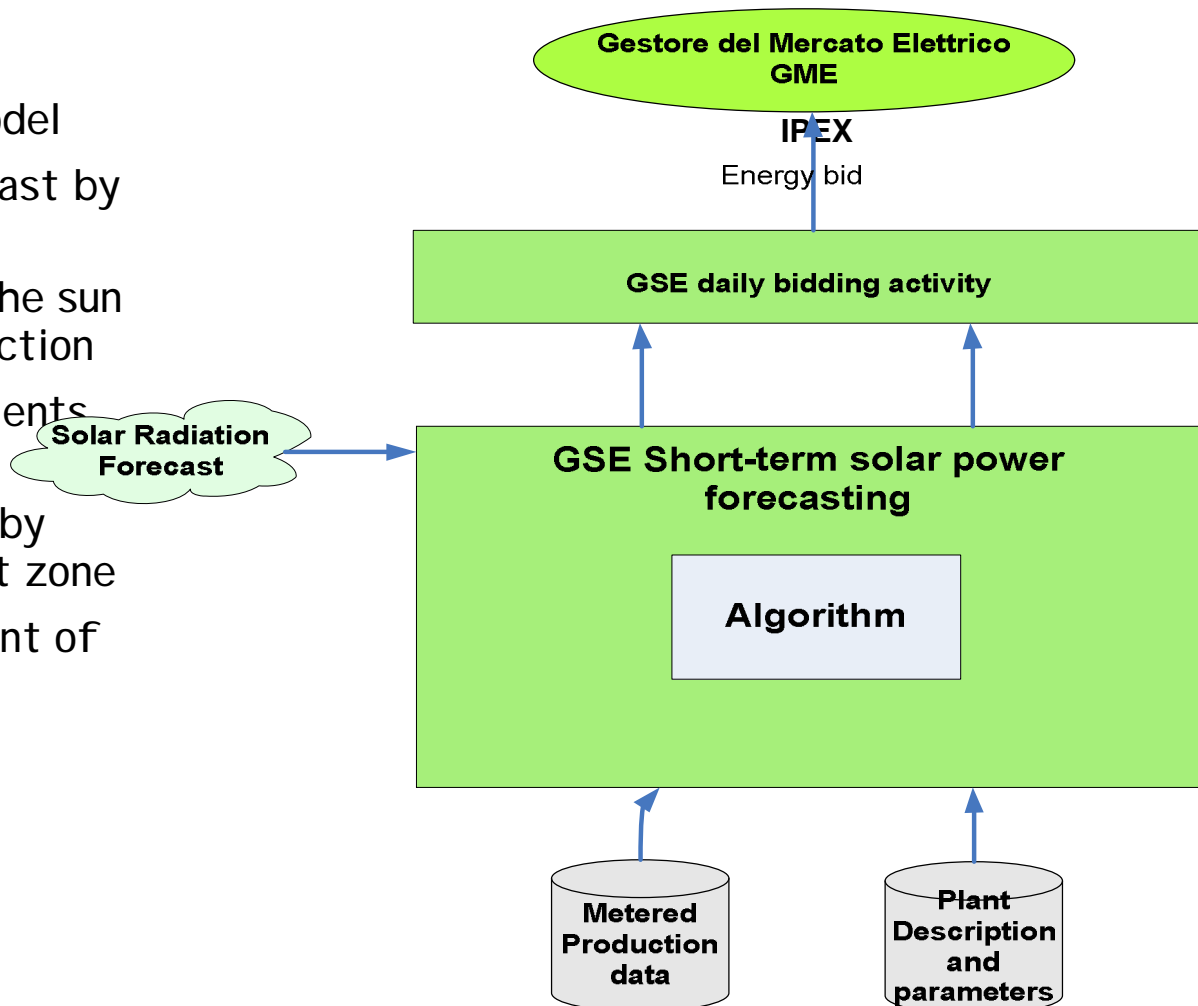


The PrevedoSole architecture



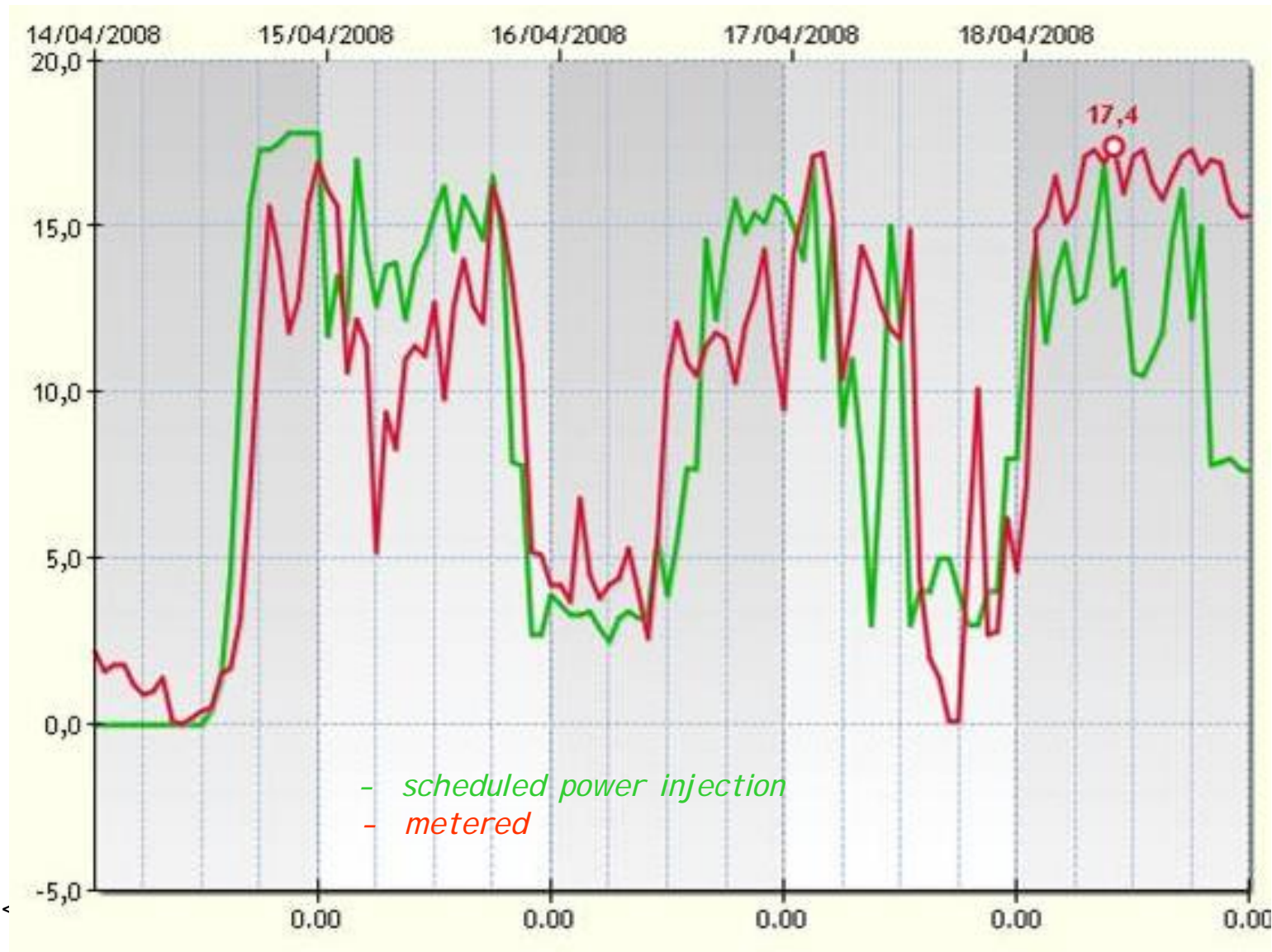
Model Characteristics:

- Plant description
- Neural Network Model
- Sun radiation forecast by province
- Historical data of the sun radiation and production
- Correlation coefficients for single sun field
- Aggregated output by province and market zone
- In house development of the algorithms



PrevedoVento: a week sample

A 20 MW wind park output (14/04/2008 - 18/04/2008)



PrevedoSole: a 24 hour prediction sample



1 MW PV device output forecast

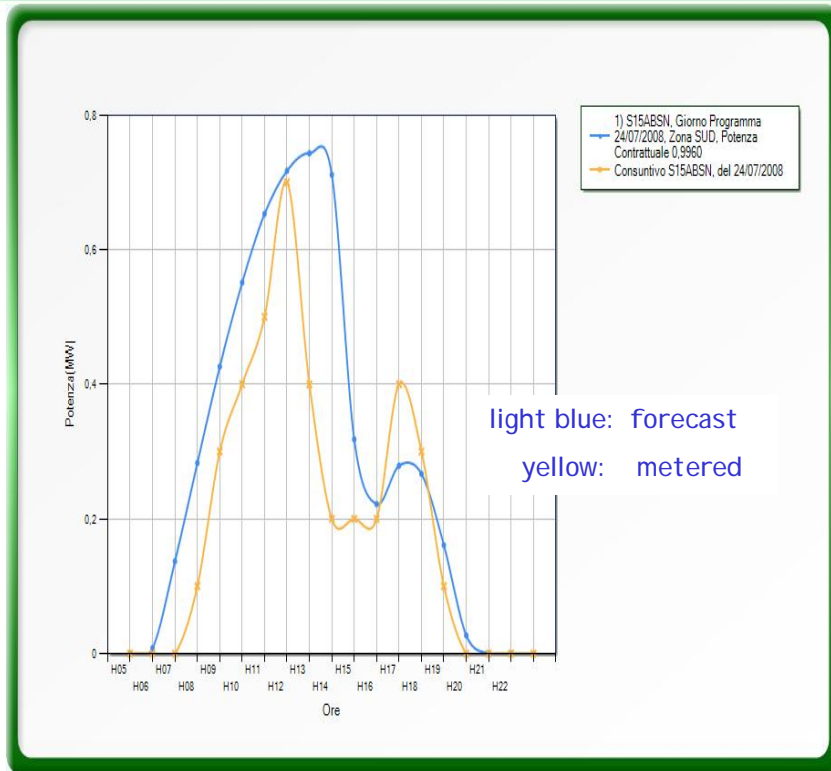
Sintetico Impianto

Potenza Contrattuale: 0,9960 Potenza Min. Contrattuale: 0
 Potenza Massima: 0,9960 Potenza Minima: 0
 Proprietario: SOLUXIA SRL Coefficiente:

Programma Impianto

Codice Impianto	Potenza	Giorno	H05	H06	H07	H08	H09	H10	H11	H12	H13	H14	H15	H16	H17	H18	H19	H20	H21	H22
S15ABSN	0,9960	24/07/2008	0	0,008	0,137	0,283	0,426	0,551	0,653	0,717	0,743	0,711	0,318	0,222	0,279	0,267	0,161	0,027	0	0

Grafico



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SUN POWER GESTIONE PROGRAMMA FOTOVOLTAICO v.1.0

venerdì 25 luglio 2008

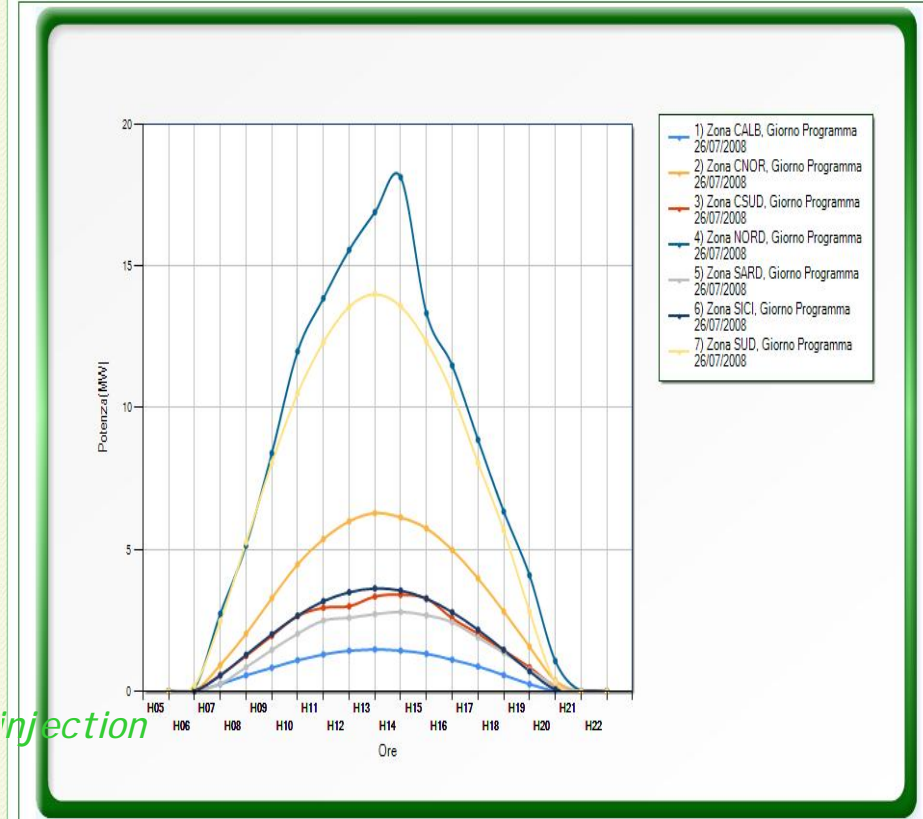
Buonasera Gennaro Niglio

Gestione Coefficienti Gestione Programmi GPP

Output forecast by market zone

Mostra Dati Consuntivo Esporta Imprimi

Grafico



injection

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