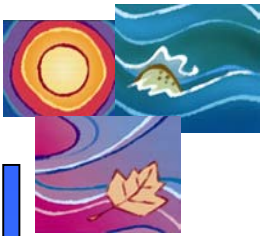# Renewable energies Situation in Portugal

Renewable energies – Situation in Portugal

1 - Current situation

2 - Objectives to meet the EU Directive

3 - Licensing process

4 - Tariff

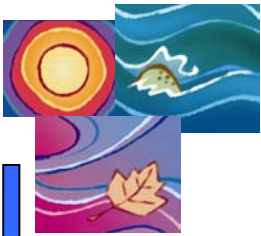# Electric energy produced in Portugal - 2000

Type of energy	Energy (GWh)
Coal	14 578
Oil	8 039
Natural Gas	7 006
Hydro	11 599
Total	41 222

Evolution of electric energy produced in Portugal (GWh)

Type of energy	1 994	1 995	1 996	1 997	1 998	1 999	2 000
Hydro	10 377	7 962	14 199	12 537	12 488	7 088	10 919
Small hydro	325	492	658	638	566	543	680
Thermal	20 628	24 751	19 592	20 942	25 782	35 452	36 000
Wind	17	16	21	38	89	123	220
Geothermic	33	42	49	51	58	80	80
Total	31 380	33 263	34 519	34 206	38 983	43 286	47 899

values estimated

Renewable energies – Situation in Portugal Dec. 2001

Type of Energy	Power (MW)
Wind	125
Small hydro	270
Biomass	10
Other technologies	~0
TOTAL	405
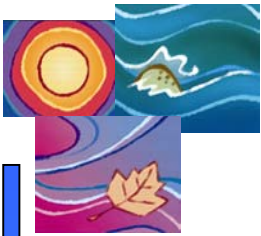
Renewable energies

Estimation of the situation in Portugal 2010

Type of Energy	Power (MW)
Wind	3 000 *
Small hydro	400
Biomass	30
Other technologies	70
TOTAL	3 500

* In Jan. 2002 under the new licensing law there was a demand of ~6 800 MW

Renewable power installed (MW)

Legend:
- Scenario APREN (3 500 MW)
- Business as usual (801 MW)

Y-axis: 0, 500, 1000, 1500, 2000, 2500, 3000, 3500, 4000

X-axis: 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010
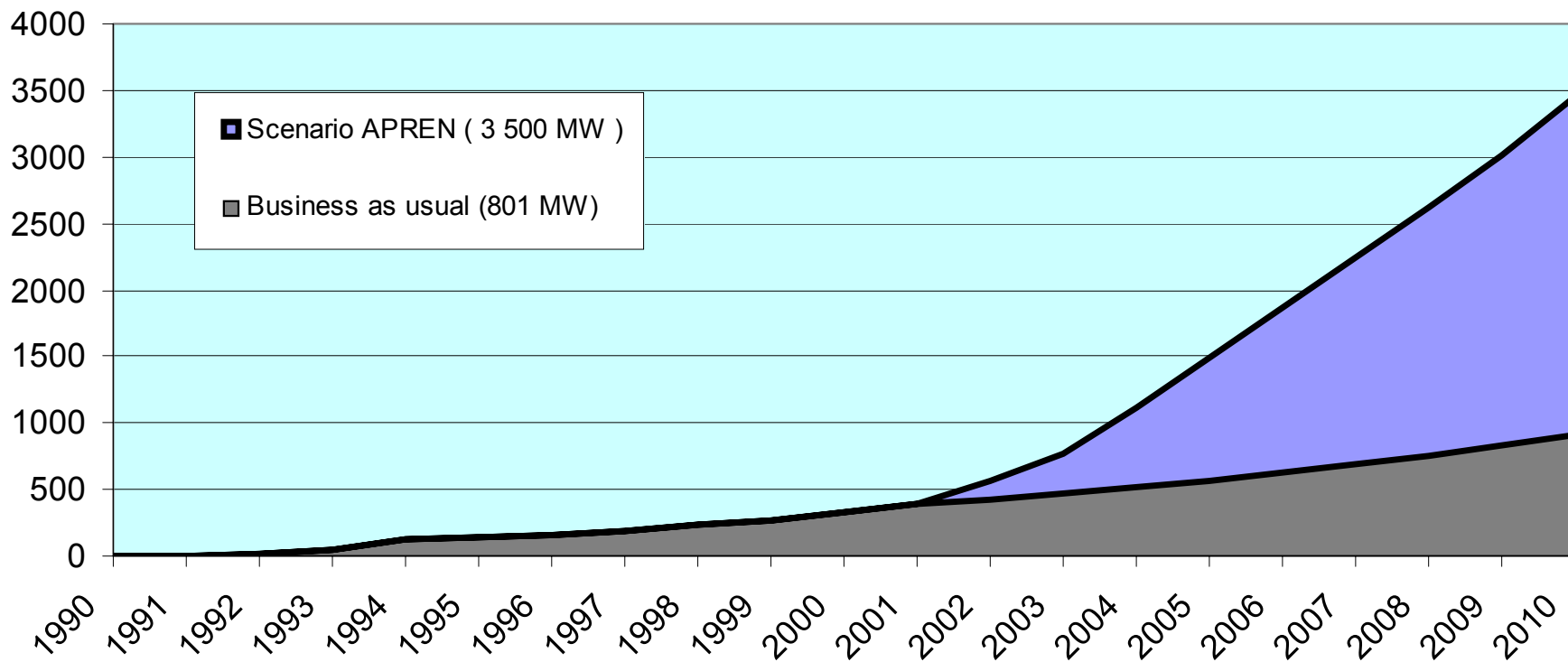
Main figures for the APREN scenario at 2010

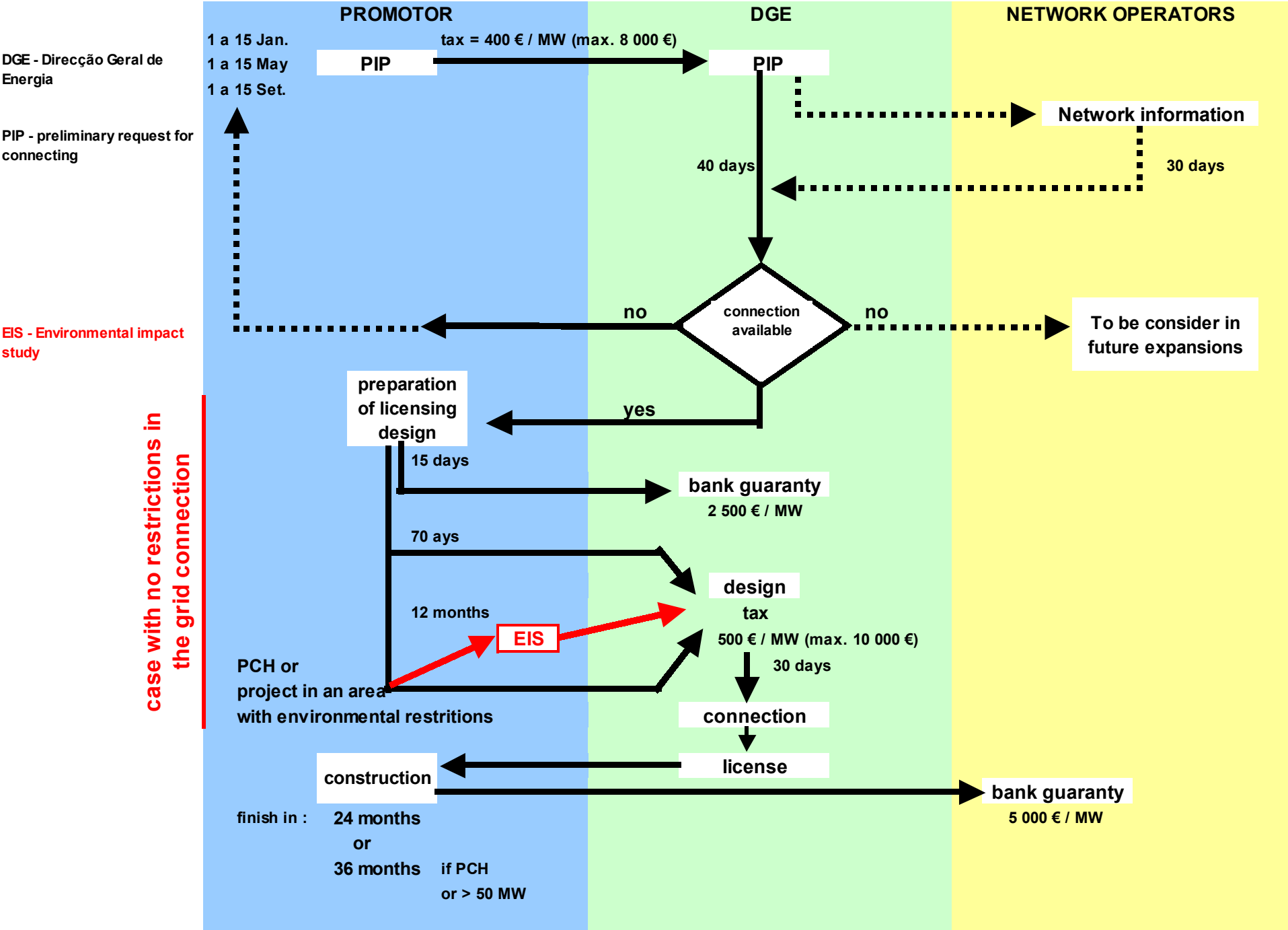|	
Total power installed	3 500 MW
Annual energy	9 100 GWh
Total investment	3 400 M Euros
Avoid CO_2	3.5 Mt/year
Jobs created	500/year

The new law for licensing (Dec.Law 312/2001) is applicable to the elctroproducer centres of the SEI (Independent Electric System)
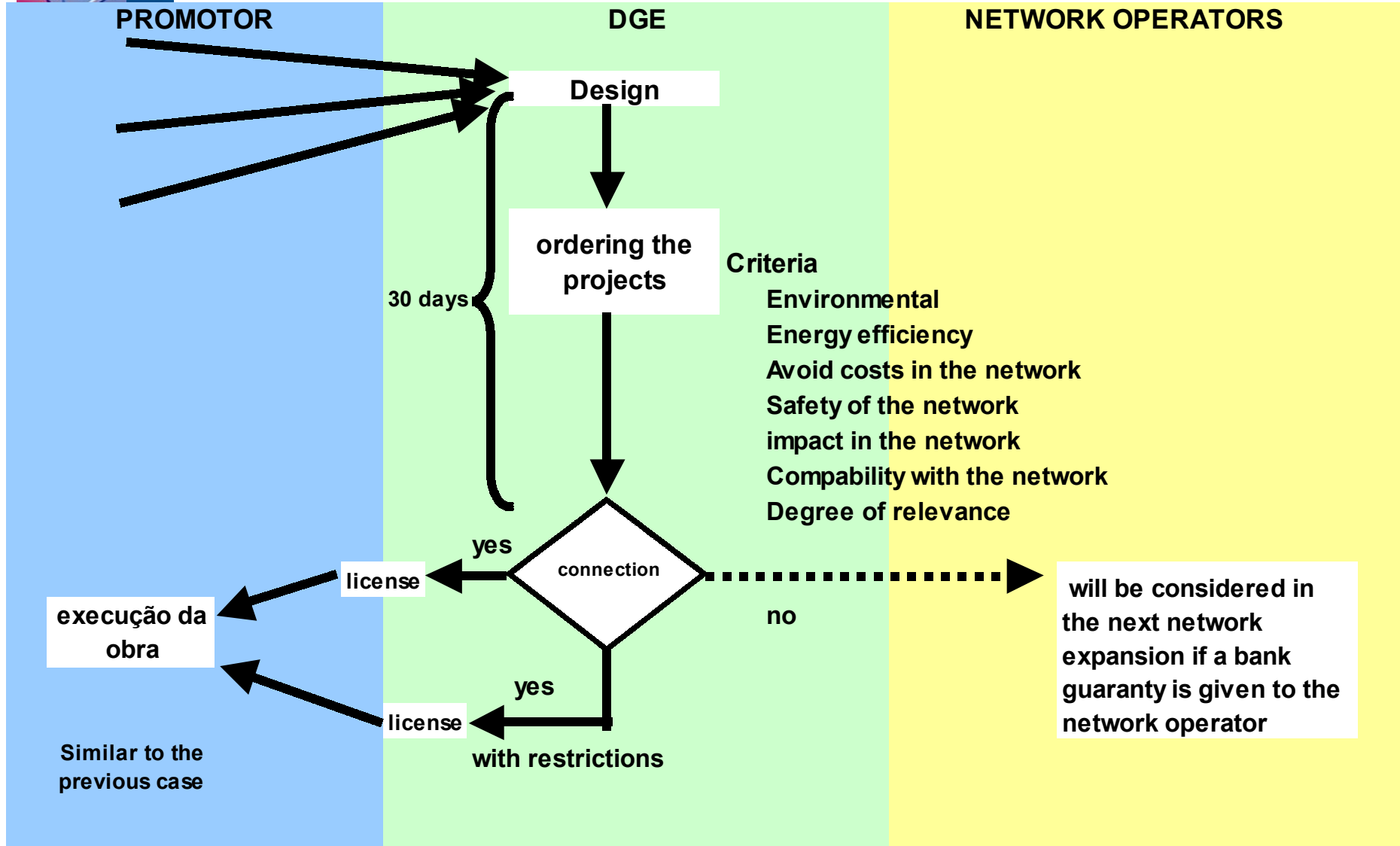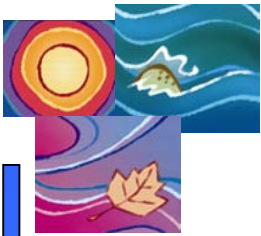
1 – Small Hydro up to 10 MVA

2 – Other forms of renewable energy including biomass without limitation of capacity

3 –Cogeneration

Centres up to 100 kVA can connect directly to the LT without the procedures for higher powers.

PROMOTOR **DGE** **NETWORK OPERATORS**

DGE - Direcção Geral de Energia

PIP - preliminary request for connecting

EIS - Environmental impact study

1 a 15 Jan.
1 a 15 May
1 a 15 Set.

tax = 400 € / MW (max. 8 000 €)

PIP → **PIP**

Network information

40 days

30 days

connection available

no → (to PROMOTOR)

no → **To be consider in future expansions**

yes

preparation of licensing design

15 days

→ **bank guaranty**
2 500 € / MW

70 ays

12 months

EIS

design tax
500 € / MW (max. 10 000 €)

30 days

PCH or project in an area with environmental restritions

connection

license → **construction**

→ **bank guaranty**
5 000 € / MW

finish in : **24 months**
or
36 months if PCH
or > 50 MW

case with no restrictions in the grid connection

APREN - Associação Portuguesa de Energias Renováveis

PROMOTOR **DGE** **NETWORK OPERATORS**

Design

ordering the projects

Criteria
- **Environmental**
- **Energy efficiency**
- **Avoid costs in the network**
- **Safety of the network**
- **impact in the network**
- **Compability with the network**
- **Degree of relevance**

30 days

connection

yes

license

no

execução da obra

will be considered in the next network expansion if a bank guaranty is given to the network operator

yes

license

with restrictions

Similar to the previous case

The new law (Dec.Law 339-C/2001) for tariff establishes:

1 – Different tariffs for each type of origin

2 –Establishes a tax of 2.5% over the gross income for the municipalities (some lawyers say that this is against the Constitution, and is not yet regulated)

The new tariff formula is:

Monthly value of the energy bill

$$VRD = K \times [\ PF + PV + PA \times Z\ ] \times Inflation \times Losses$$

Modulation coefficient

Environmental term

Coefficient for each type of source

Losses avoided in the grid
$= 1/\ (1\text{-}LEV)$
$LEV = 0.015$ if $P \ge 5$ MW
$LEV = 0.035$ if $P < 5$ MW

$= IPC_{m-1}\ /\ IPC_{ref}$
$IPC_{ref} = 104.38$ (Dec. 98)

Term corresponding to the avoided fuel expenditure

Fix term -   avoided power installed

VRD = K x [PF + PV + PA x Z] x Inflation x Losses

Power plants without modulation K = 1.0

Power plants with modulation K = KMHO

$$KMHO = (KMHO_{pc} \times ECR_{pc} + KMHO_v \times ECR_v) / ECR$$

$KMHO_{pc}$ coefficient for peak and high hours (14/day) = 1.15
ECR_{pc} monthly energy produced in peak and high hours

$KMHO_v$ coefficient for low hours (10/day) = 0.65
ECR_v monthly energy produced in low hours

ECR total monthly energy produced

VRD = K x [PF + PV + PA x Z] x Inflation x Losses

$PF = PF(U)_{ref} \times COEF \times POT_{med}$

$PF(U)_{ref} = 5\ 436.9\ € / MW$

$COEF = ECR / (576^* \times POT)$ ECR = total monthly energy

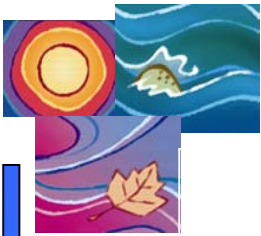$POT_{med} = \min \{ POT ; [ECR / (24 \times 30)]\}$ * 576 = 0.80x24x30

VRD = K x [PF + PV + PA x Z] x Inflation x Losses

PV = PV(U) $_{ref}$ x ECR

PV(U) $_{ref}$ = 24.9 € / MWh

ECR = total monthly energy

$$VRD = K \times [\, PF + PV + PA \times Z \,] \times Inflation \times Losses$$

$$PA = ECE(U)_{ref} \times CCR_{ref} \times ECR$$

$$ECE(U)_{ref} = 75\ \text{€} / t\ CO_2$$

$$CCR_{ref} = 370\ g\ CO_2 / kWh = 0.37\ t\ CO_2 / MWh$$

$$ECE(U)_{ref} \times CCR_{ref} = 75\ \text{€} / t\ CO_2 \times 0.37\ t\ CO_2 / MWh = 27.75\ \text{€} / MWh$$

ECR = total monthly energy

VRD = K x [PF + PV + PA x Z] x Inflation x Losses

Z wind farms

**Z = 1.70 for the energy produced in the first 2 000 hours of operation of each year ***

Z = 1.30 for the energy produced between 2 000 - 2 200 hours of operation*

Z = 0.95 for the energy produced between 2 200 - 2 400 hours of operation*

Z = 0.65 for the energy produced between 2 400 - 2 600 hours of operation*

Z = 0.40 for the energy produced after 2 600 hours of operation*

* hours of operation = energy produced / power of the farm
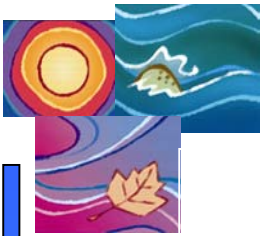
VRD = K x [PF + PV + PA x Z] x Inflation x Losses

Z small hydro

Z = 1.20

Z wave energy

Z = 6.35 up to 20 MW installed in Portugal (after z= ?)

Z photovoltaics up to 50 MW installed in Portugal (after z= ?)

Z = 6.55 power plants above 5 kW

Z = 12.0 power plants up to 5 kW

Other type of renewable power plants   Z = 1.0

Value of the MWh in February 2002

Types of power plant		Z	VRD*
		(-)	(€/MWh)
Wind farms	up to 2 000 h	up to 20	85.31
	from 2 000 - 2 200 h	1.30	73.42
	from 2 200 - 2 400 h	0.95	63.01
	from 2 200 - 2 400 h	0.65	54.09
	above 2 600 h	0.40	46.66
Small hydro		1.20	70.44
Waves		6.35	223.55
Phototvoltaic	up to 5 kW	12.00	399.65
	above 5 kW	6.55	234.26
Other types		1.00	64.50

up to 20 MW in Portugal

up to 50 MW in Portugal

* K = 1.0

Averaged value of the MWh in February 2002 for a wind farm

	2 000	2 100	2 200	2 300	2 400	2 500	2 600	2 800	3 000
€ / MWh	85.31	84.74	84.23	83.31	82.46	81.32	80.28	77.88	75.79