

Use of geothermal resources in The Azores islands

“Green Islands”: identify means to increase RES penetration in
small islands systems

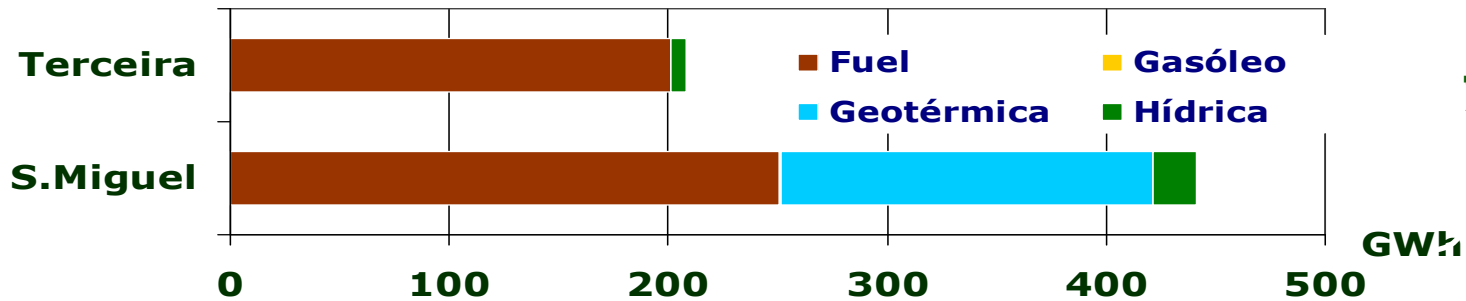


Azores archipelago

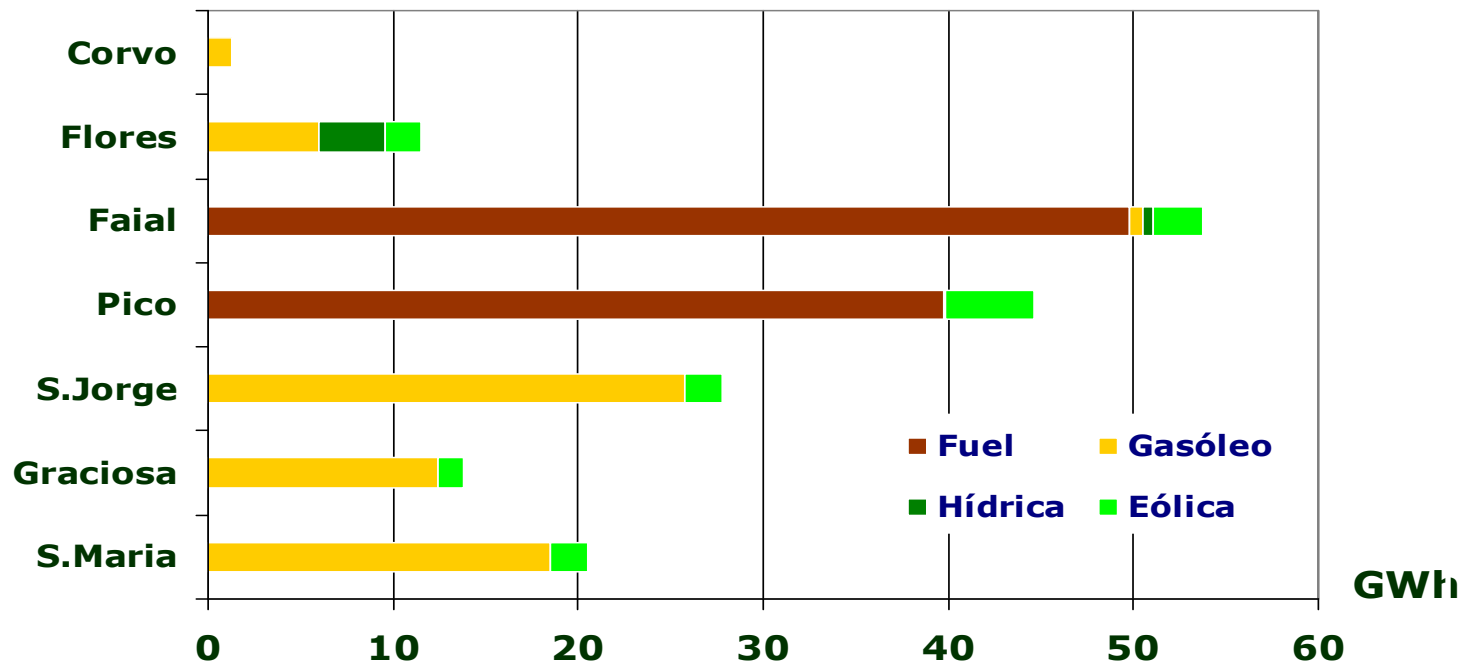


Mix of sources per island

2008

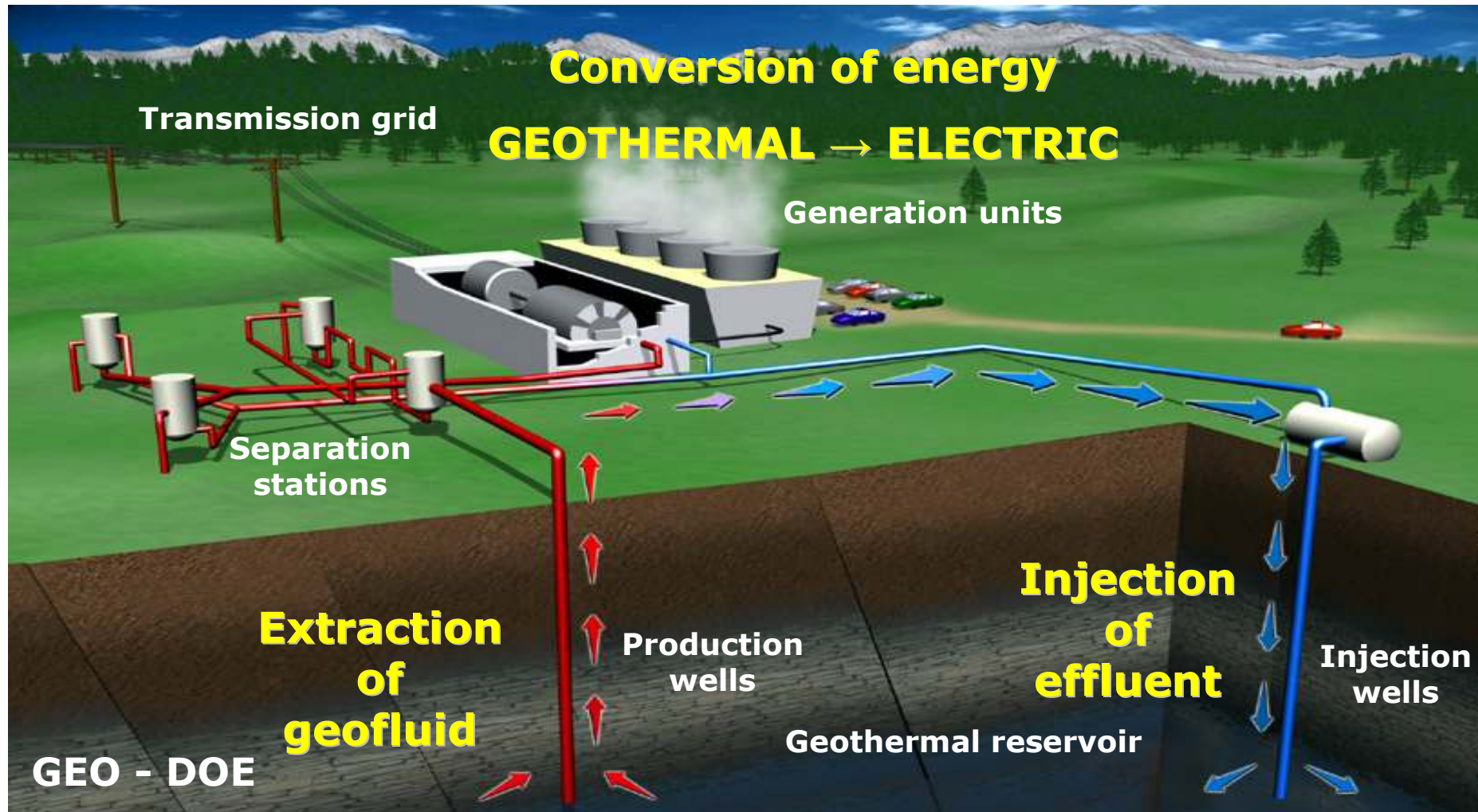


79 % da produção da EDA



21 % da produção da EDA

Conceptual model of the geothermal project



History of geothermal development

São Miguel

- **1974-1980: Exploration of Ribeira Grande field, pilot plant at Pico Vermelho (3 MW)**
- **1988-1994: Development and start-up of the Ribeira Grande plant (5 MW) Finance: POSEIMA- energie et REGIS II**
- **1996-2000: Expansion of the Ribeira Grande plant (to 13 MW)**
- **2002-2006: Development and start-up of new Pico Vermelho plant (10 MW) Finance: PRODESA & EIB**

New investment projects

São Miguel

2009-2014

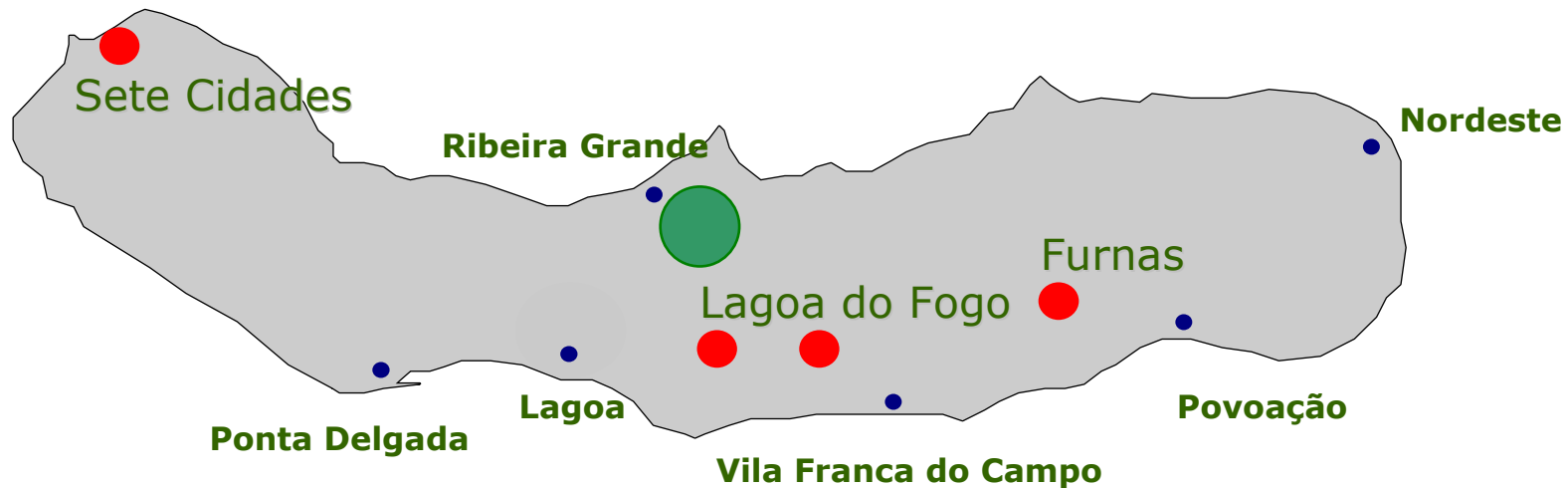
- **2009-2010: Drilling of new geothermal wells for production, injection and evaluation**
- **2010-2012: Detailed testing of the geothermal wells and fluid circulation studies**
- **2011-2014: Expansion of the Pico Vermelho plant (+10 MW) or development and construction of the new Caldeiras plant (12 MW)**

Recent evolution

PRODUCTION OF ELECTRIC ENERGY (kWh) TOTAL RAA

Annual values	2000	2001	2002	2003	2004	2005	2006	2007 (Jan/ Août)
TOTAL	520.082.355	559.202.401	600.889.920	641.237.654	702.686.404	750.076.045	780.699.610	530.711.122
THERMAL	419.245.827	421.733.779	472.920.253	512.286.234	576.310.414	633.502.501	650.353.266	379.797.768
HYDRO	19.048.468	29.748.592	27.892.597	29.827.760	30.408.455	30.869.662	29.723.491	22.710.060
GEOTHERMAL	79.598.100	105.288.600	95.718.600	88.870.500	83.969.620	70.668.757	83.842.259	117.639.050
WIND	2.189.960	2.431.370	4.358.470	10.253.160	11.766.130	14.551.150	16.397.006	10.502.720
% Renewables	19 %	24,5 %	21,2 %	20,1 %	20,1 %	15,5 %	16,6 %	28,4 %

Geothermal resources on São Miguel



A photograph of a geothermal field. In the foreground, there is a rocky, greyish-brown ground with several small vents emitting wisps of white steam. In the background, a larger vent releases a thick plume of white steam that rises into the air. The area is surrounded by green trees and a clear blue sky with a few clouds. The overall scene is a natural geothermal landscape.

Recent development

GEOHERMAL

POWER

PICO VERMELHO

700 kW

10 MW Nov.2006

RIBEIRA GRANDE

2x 2,5 MW in 1994

+ 2x 4 MW in 1998

Total power in 2007 – 23 MW

Pico Vermelho pilot power plant



Pico Vermelho project area



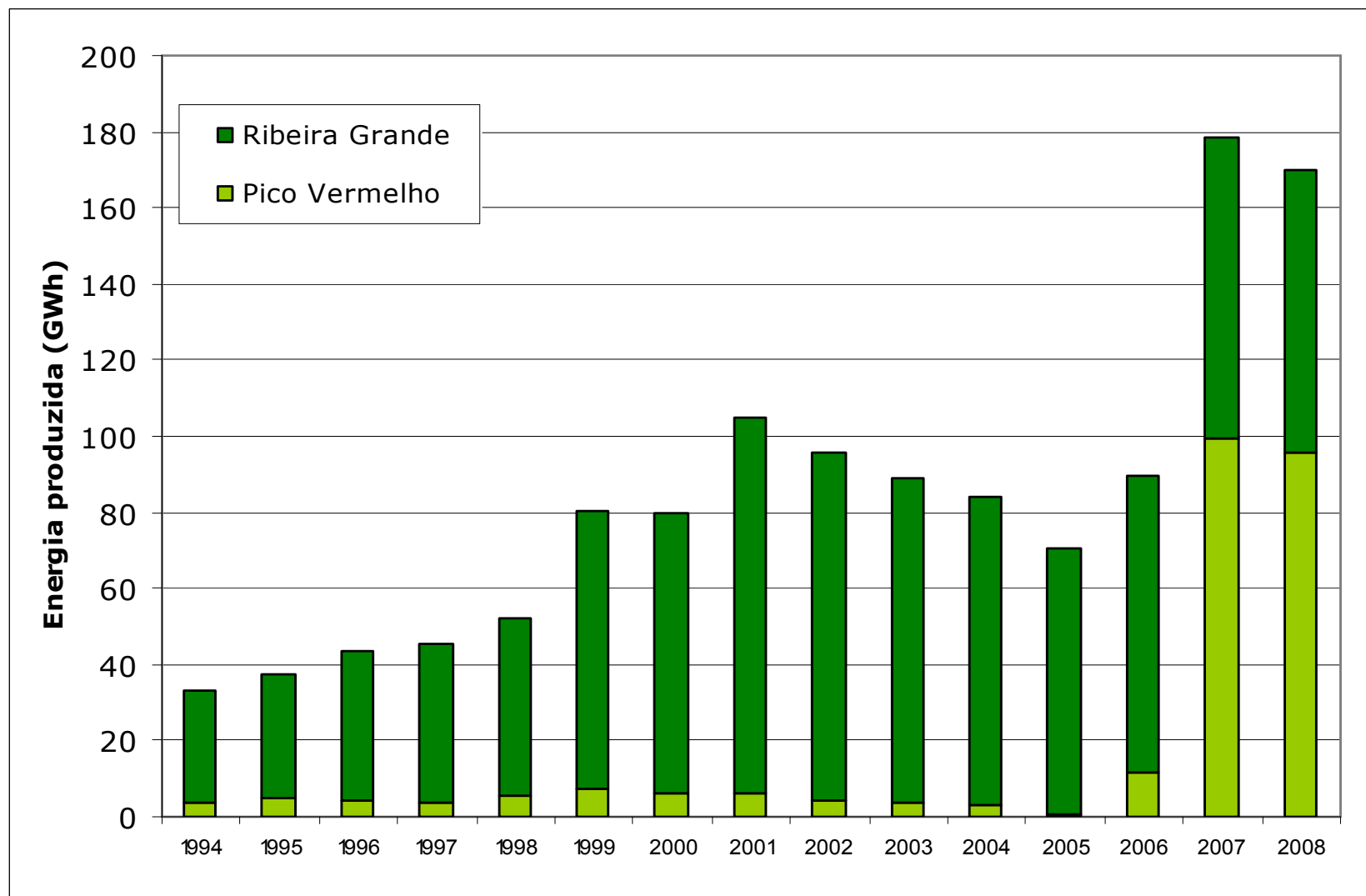
Ribeira Grande power plant



Ribeira Grande power plant



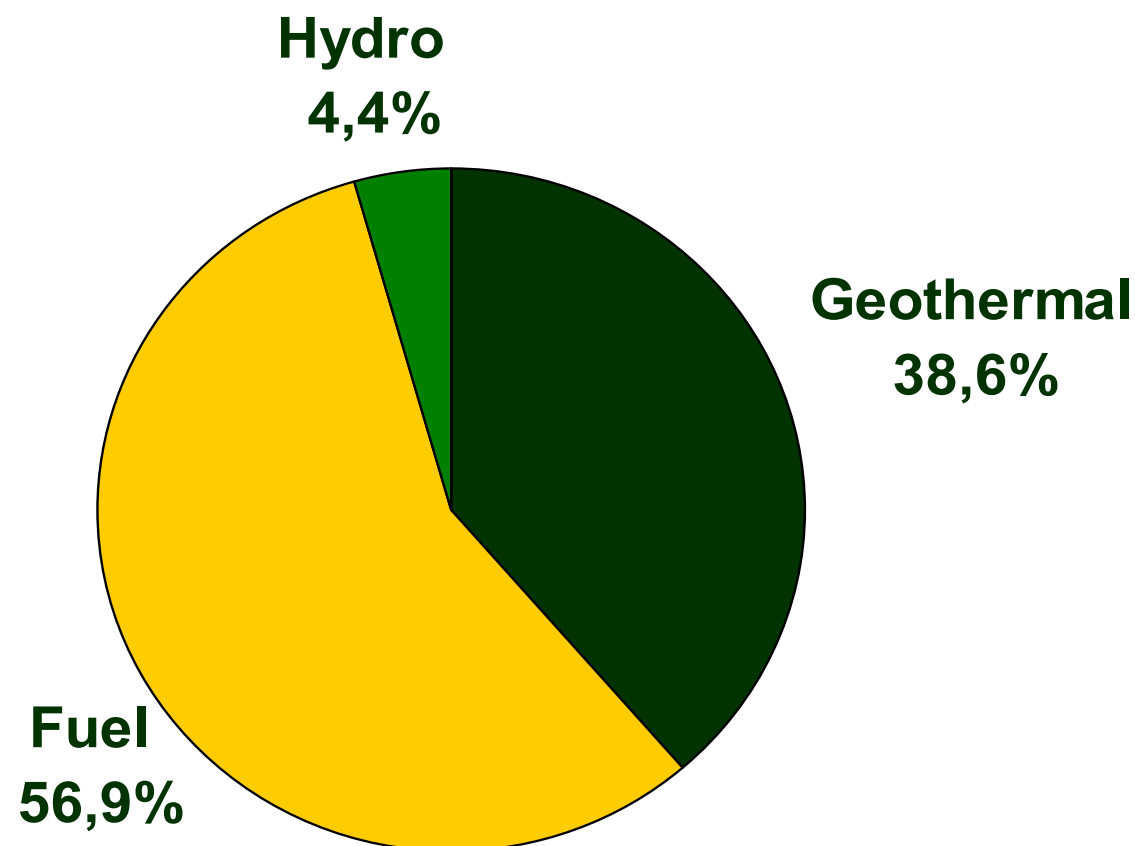
Geothermal power generation



Geothermal power contribution

São Miguel

2008



São Miguel - renewables

Production (kWh)

Annual values	2001	2002	2003	2004	2005	2006	2007 Jan / Août
TOTAL	304.645.051	330.572.062	353.827.574	386.699.705	400.109.134	413.136.995	282.241.595
Geothermal	105.288.600	95.718.600	88.870.500	83.969.620	70.668.757	83.842.259	117.639.050
Hydro	20.838.662	20.777.284	23.439.020	22.935.230	21.826.780	21.563.530	16.502.700
Renewables	41%	35 %	31%	27%	23%	25%	47%



The future

1- New Geothermal Plant of 12 MW in Terceira

2 – New Wind Farm of 4,5 MW in Terceira

3 – New group of 10 MW in central Geothermal Plant of São Miguel

The objective

Reach about 50 % of RES- electricity production

The strategy

Follow an ideal “ mix ” which allows the maximum use of RES in all ACORES islands.