

## Memorandum

### The Portuguese Dam Program: an economic and environmental disaster

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#### 1. A wrong energy policy

For three decades, the central focus of energy policy in Portugal has been the promotion of new energy sources, including new electric power plants, to satisfy a growing demand. Little attention has been paid to energy efficiency or demand management. By 2007 energy intensity in Portugal was 197 toe/M€ 2000 – 4% worse than the 1990 figure, 17% worse than EU-27 average, the worst in the EU-15 except Finland; in the same period, the UE-27 improved energy efficiency by 27% (EC 2010). In 2008 the Portuguese Government approved the national energy efficiency plan, known as the PNAEE (PCM 2008). To little avail, alas. The plan is not very ambitious to begin with – 10% reduction in seven years off the “business as usual” scenario – and was not supported by adequate means to implement even this paltry ambition; expected State expenditure in energy efficiency and source shift on the consumer 2008-2015 was estimated at no more than 30 M€/year, and already this was curtailed under pretext of the economic crisis. In 2010, despite the crisis, electricity consumption in Portugal grew 4.7% (DGEG 2011). More significant, the trend in the last decade was a growth of electricity consumption of about 4% per year, more than twice the growth of GDP at constant prices in the same period (EC 2010).

#### 2. Dam program expensive and unjustified

The national large dam program, known as PNBEPH (INAG *et al.* 2007), was approved by the Portuguese Government in 2007, supposedly to reduce energy dependency and greenhouse gas emissions, improve renewable share of energy production and complement wind power with hydroelectric pumping. We shall demonstrate that every one of these goals is either moot or could be attained with alternative investments with much better cost-effectiveness. The set target of the program (never justified) was an increase of 1100 MW in hydroelectric capacity, over pre-existing 5900 MW. No energy target was defined, and no alternatives to large dams were studied. The following table compares the PNBEPH and the proposals by concession holders.

Dam	Power capacity (MW)		Production (GWh/year)		Investment (M€ 2008)	
	PNBEPH	Prop.conc.	PNBEPH	Prop.conc.	PNBEPH	Prop.conc.
Foz Tua	234	324	340	350	177	340
Gouvães	112	660	153	52	103	
Padroselos *	113	230	102	110	101	1700
Vidago/A.Tâmega	90	127	114	142	106	
Daivões	109	118	148	161	144	
Fridão	163	256	199	327	134	242
Alvito	48	136	62	66	67	268
Pinhosão	77	-	106	-	109	-
Girabolhos	72	355	99	104	102	360
Almourol	78	-	209	-	96	-
<b>Total PNBEPH</b>	<b>1096</b>	<b>2206</b>	<b>1532</b>	<b>1312</b>	<b>1139</b>	<b>2910</b>
Baixo Sabor		170		230		481
Ribeiradio Ermida		77		134		150
<b>PNBEPH+2</b>	<b>1343</b>	<b>2453</b>	<b>1896</b>	<b>1676</b>	<b>1546</b>	<b>3541</b>

Sources: INAG 2011, EDP 2011, DGTF 2010.

Note: Padroselos dam was reprovved, but its power is to be redistributed in the Alto Tâmega system

The Government approved 7 out of the 10 dams in PNBEPH (there were no candidates for two and one was reapproved), with twice the target power capacity and nearly thrice the original cost estimate, but with 14% less energy production. Average use of installed capacity in the new dams is less than one month a year – a third of a typical hydropower project. No explanation was forwarded by the authorities regarding the huge discrepancies in proposed power and cost.

### 3. Dam program irrelevant for alleged goals

Together with two previously approved dams (Baixo Sabor and Ribeiradio Ermida), the electricity generated by the whole large dam program amounts to 1.68 TWh/year, that is 3.2% of the 52.2 TWh Portuguese electricity consumption in 2010 (DGEG 2011), corresponding to 0.8% of final energy demand, 0.7% savings on GHG emissions and 0.8% reduction in fossil fuel imports (computed from EC 2010). This pitiful contribution to the energy system is offset by just nine months worth of increase in electricity demand. The same effects could be obtained with a variety of less expensive investments, best of which the efficient use of energy.

Regarding the need for pumping, the PNBEPH states that Portugal should have a capacity of 1 MW hydro pumping for each 3.5 MW wind power. The target for wind power in the national energy strategy ENE2020 (considered by many analysts as overly optimistic) is 8600 MW in 2020 (PCM 2010); thus a hydro pumping capacity of 2430 MW should suffice. Pumping capacity in existing dams, operational or under construction, already amounts to 2507 MW. Thus, no new dams are needed for pumping (see following table).

Dam / power plant	River	Basin	Commission year	Pump power (MW)
Vilarinho das Furnas	Homem	Cávado	1972	79
Alto Rabagão	Rabagão	Cávado	1964	68
Agueira	Mondego	Mondego	1981	336
Torrão	Tâmega	Douro	1988	140
Alqueva I	Guadiana	Guadiana	2004	214
Frades	Rabagão	Cávado	2005	192
Total in operation				1029
Alqueva II	Guadiana	Guadiana	2012	220
Venda Nova III	Rabagão	Cávado	2015	736
Salamonde II	Cávado	Cávado	2016	204
Paradela II	Cávado	Cávado	2016	318
Total under construction or advanced study				1478
<b>Total pump power available in existing dams by 2016</b>				<b>2507</b>

Sources: EDP 2011, EC 2010

### 4. The real cost of the dam program

The investment cost of the dam program is already excessive when compared to the alternatives, but future costs will be much higher. Four factors contribute to this: (i) banking cost (claimed by EDP as 3.5% year<sup>-1</sup>); (ii) incentive for electric power availability, recently approved by the Government (SEEI 2010), likely to benefit these dams by 20 000 €/MW/year; (iii) concession horizons between 65 and 75 years; (iv) high price of electricity sold to the grid at peak hour.

Neither the PNBEPH nor any official source have performed an evaluation of the impact of the dam program on the consumers and taxpayers. Based on available information, we can estimate the total burden created by the dam program at about **15 000 M€**. **This corresponds to a future gross burden of 4600 € per family, or a permanent increase in the electricity bill (and/or taxes) of 4% on average.** If the interest rate is higher, this burden may increase significantly.

## 5. The alternatives

There are a number of possible alternatives to hydropower, including wind, biomass, solar and natural gas (assuming that coal and oil power plants will be phased out). The acknowledged best alternative, however, is energy saving: it has the highest potential of all energy sources, and, at present market conditions, it is the only option with a positive economic and ecologic balance.

Various studies estimate the economically interesting potential for energy saving in Portugal at 20 to 30% of present consumption (e.g. BCSD Portugal 2005, CENSE 2010). The national energy efficiency plan PNAEE has a target of 10% reduction 2008-2015, and the national energy strategy ENE2020 has a target of 20% reduction 2010-2020, off BAU scenarios. However, neither the PNAEE nor the ENE2020 have created the means or incentives to achieve the targets.

Based on available technology and energy auditing data, using the methodology proposed by Madeira and Melo (2003), we can estimate the potential and cost-benefit of electricity savings:

- *Payback period under 3 years.* Housing and services: end of life substitution for more efficient lighting, washing machines, stove and water heating. Industry: energy management including monitoring and reduction of power factor. Investment: 410 M€. Savings: 2.4 TWh/year ~ 280 M€/year.
- *Payback period of 3-6 years.* Housing and services: end of life substitution for more efficient house and office appliances; solar heating; improved climatization (central heating, roof insulation, better HVAC); public lighting. Industry: better lighting; electronic speed variators; high yield engines, transmission systems, compressed air circuits. Investment: 3400 €. Savings: 8.2 TWh/year ~ 980 M€/year.
- *Payback period over 6 years.* Housing and services: wall insulation, double-glazing and building refitting for climatic performance; more efficient engines, compressors, refrigeration, heat pumps. Investment: 2400 M€. Savings: 2.0 TWh/year ~ 240 M€/year.

In a nutshell, an investment of 3810 M€ in efficient electricity use or substitution, saving 25% of current consumption, would create a net value for investors of about 55 000 M€ over 65 years, or a 14% decrease in the electricity bill. Reduced coal and gas use in power plants would lower national imports of fossil fuels by 9%. It should be noted that most of the referred measures are already recommended in PNAEE and ENE2020; they just lack the right public incentives to be actively procured by families and business.

## 6. Large dams: the myth of development

Contrary to official propaganda, dams do not usually create local development (WCD 2000). They do create construction jobs, but much less than other kinds of investment. Energy efficiency and urban renewal works benefit the whole economy (families, institutions, small and large business), and generate approximately twice the number of jobs per M€ invested, as compared with dams and other major public works.

In Portugal, many existing large dams are located in some of the poorest regions in the country; very few promoted any meaningful local development. Many of the dams in the PNBEPH have met with frontal opposition of local populations: the municipalities of Abrantes and Constância (affected by the Almourol dam), Amarante (affected by the Fridão dam) and Mirandela (affected by the Foz Tua dam), among others, have been notorious opposers to the Government plans. Studies developed for the Tua valley, sentenced to be destroyed by the Foz Tua dam along with a hundred-year old railway, show that eco- and

cultural tourism would generate 11 (eleven) times more jobs per M€ invested than the construction of the dam (Simão and Melo 2011, IDP 2009).

## **7. Large dams: a major environmental disaster**

Contrary to official propaganda and widespread popular belief, large dams are notorious for irreversible ecosystem destruction (EEB/WWF 2009). Major impacts include (i) obliteration of rare river and riverbank ecosystems, including the extinction of migratory fish and other species that depend on natural rivers; (ii) disruption of ecological corridors essential for the connectivity of larger ecosystems, affecting other habitats and species (e.g. the wolf among many others); (iii) cumulative degradation of river habitats resulting from several dams in the same basin, especially in the Tagus and Douro basins and the Tâmega sub-basin; (iv) water quality degradation, by creating conditions for eutrofication; (v) added risk of coastal erosion by retention of sediments; (vi) destruction of good agricultural land that, in mountain areas, is largely confined to the riverbanks of major valleys; (vii) elimination of the last few large wild rivers in Portugal, with a unique landscape.

The official environmental impact statements (cf. e.g. CPPE/Ecossistema 2003 on the Baixo Sabor dam, EDP/Profico Ambiente 2008 on the Foz Tua dam) and independent studies commissioned by the EU (Arcadis/Atecma 2009) clearly identify the gravity of those environmental impacts, that infringe upon European legislation, including the Habitats Directive and the Water Framework Directive. The main reason why the European Commission is not moving against the Portuguese State on the dam program appears to be that they are afraid to tackle before the EU Court of Justice the delicate issue of “overriding public interest”, never demonstrated but assiduously invoked by the Portuguese Government to dismiss the dispositions of European directives.

## **Conclusion**

The Portuguese large dam program (PNBEPH) and other new large dams in Portugal are consistently bad business, a social burden and an environmental threat. They will sink the country ever more into debt, burdening uselessly the Portuguese consumers and taxpayers to the amount of some 15 000 M€, and contributing to a wrong energy policy. The purported goals of the program are either moot (like the pumping capacity) or, in the case of increasing the share of renewables, reducing GHG emissions and external dependence, could be achieved with alternative measures, much more cost-effective and with positive social and environmental impacts, such as the efficient use of energy.

**The whole dam program should be immediately stopped and revoked, if not for the sake of the people and the environment, then for the sake of Portuguese economy and State budget.**

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