

## Memorandum

### The Portuguese dam program: economic, social and environmental disaster

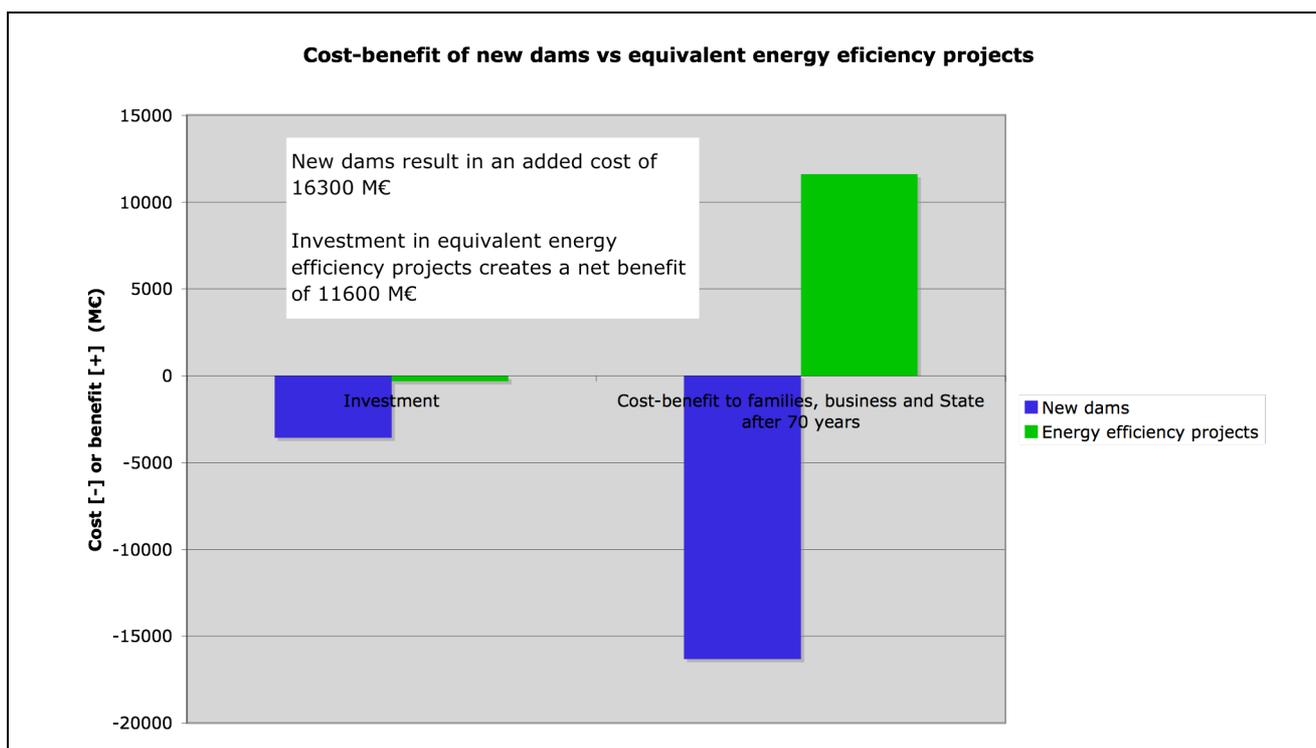
GEOTA, FAPAS, LPN, Quercus, CEAI, Aldeia, COAGRET, Flamingo, SPEA, MCLT — August 2011

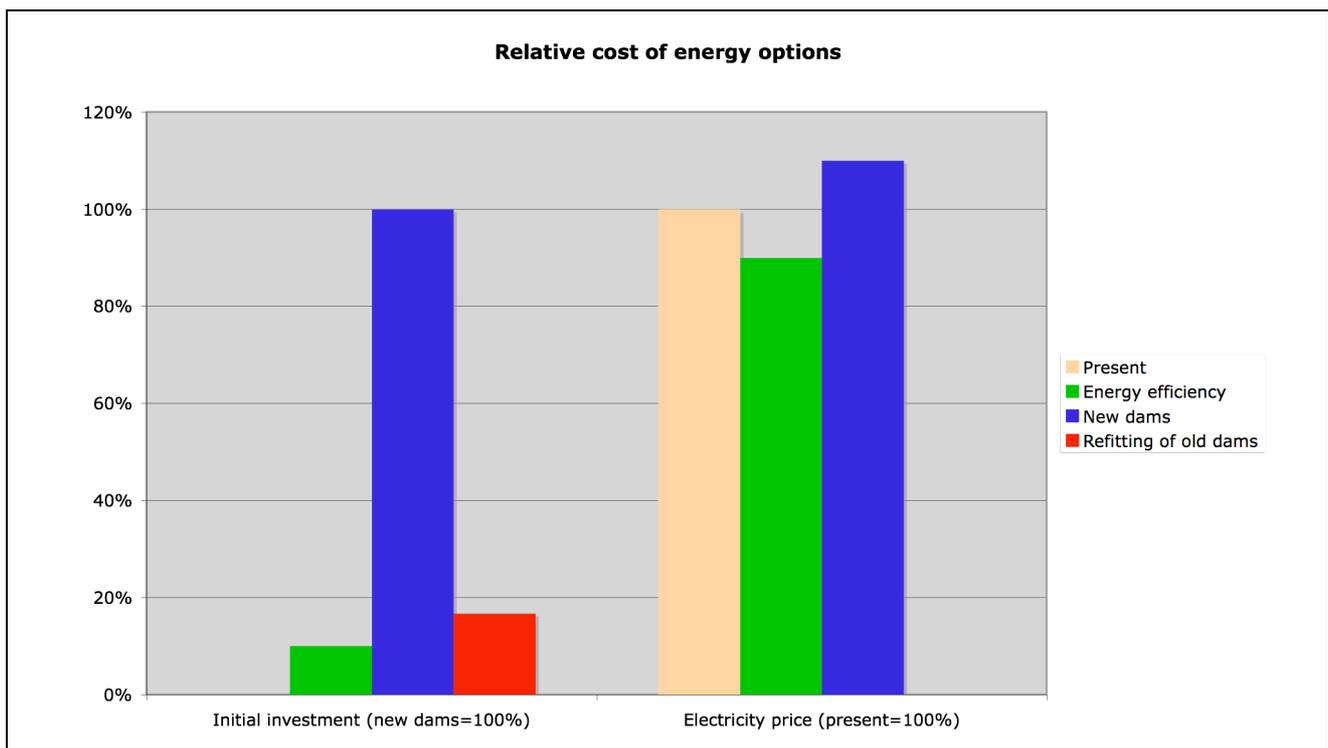
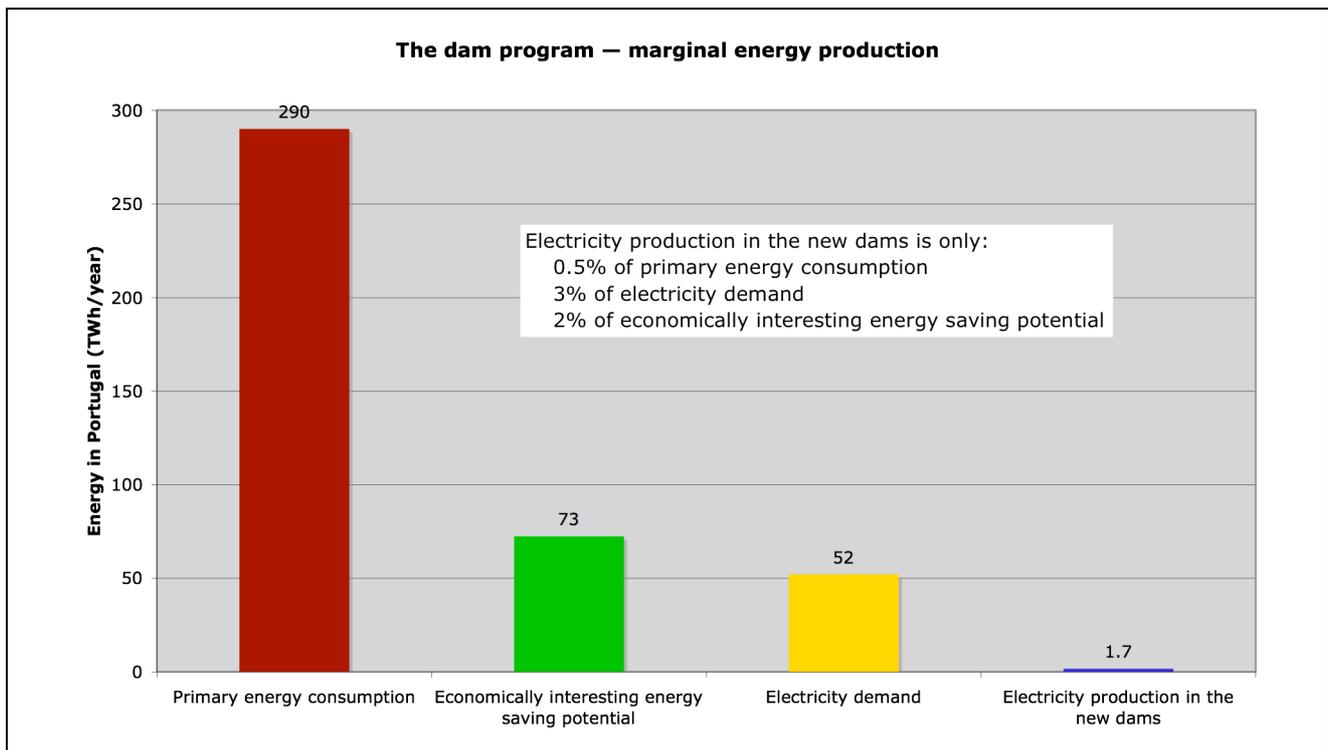
#### Summary

The Portuguese large dam program has been advertised as renewable energy, solution to pollution, external dependence and energy storage. In fact, new dams will become a huge financial burden and alleged goals would be better achieved with alternative investments.

- **The dam program will represent a 10% increase in the electricity bill.** It will burden State budget and consumers by an estimated **16 000 M€** in the next 75 years;
- The dam program has wrongly been propoganded as a “private investment”. In fact, it is supported by a “**guaranteed power**” **State subsidy amounting to 49 M€ per year**;
- **International experience shows that energy efficiency is by far the best investment in the energy industry** – shown by a constant reduction of energy intensity in the past two decades e.g. in the EU, USA, Canada, Russia, China and India (unlike Portugal);
- In Portugal, **the best investments in energy saving projects cost 10 (ten) times less than new dams**; refitting of old dams costs 6 (six) times less than new ones. **Energy efficiency creates new jobs and large net value. Economically interesting investments in energy efficiency could save 25% or more of current energy consumption**;
- **New dams represent only 0.5% of primary energy, 3% of electricity demand and 2% of potential energy savings** in Portugal. The alleged “national public interest” is false;
- **Energy efficiency and new dams are incompatible**: they compete for investment funds, State budget incentives, financial effort of consumers and skilled labour;
- Last but not the least, contrary to propaganda, **large dams are among the worst energy production systems regarding social and environmental impacts**: they imply very significant loss of cultural heritage, loss of jobs in tourism, loss of railway mobility, loss of biodiversity, loss of agricultural soil, loss of unique landscapes.

**The whole dam program should be immediately suspended and revoked.**





## 1. Why do we need a new 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 for Finland (EC 2010). By contrast worldwide, in the period 1990-2007 the EU-27 improved energy intensity by 27%, the USA by 25%, Russia by 26%, China by 52%, India by 35% and Canada by 19% (EC 2010).

In 2008 the Portuguese Government approved the national energy efficiency plan, known as PNAEE (PCM 2008). To little avail, alas. The plan was 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 in the period 2008-2015 was estimated at no more than 30 M€/year, and this was already 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 rate of electricity consumption of about 4% per year, more than twice the growth rate of GDP (EC 2010).

The continued promotion and subsidizing of energy production and the neglect of demand management and of rational energy use led to a sadly inefficient economy and energy system, one of the worst in Europe.

## 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 the 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 achieved with alternative investments with much better cost-effectiveness.

The set target of the program (never justified) was an increase of 1100 MW in hydroelectric power 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	257	481
Ribeiradio Ermida		77		134	150	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, and DGTF 2010.

The Government approved 7 out of the 10 dams in PNBEPH (there were no candidates for two; one, Padroselos, was reprovved, although installed power is to be redistributed among others), 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, untenable unless subsidized.

No explanation was forwarded by the authorities regarding the huge discrepancies in proposed power and cost, or the absence of a serious study of alternatives.

### 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 1.7 TWh/year, that is 3.2% of the 52.2 TWh Portuguese electricity consumption in 2010 (DGEG 2011); corresponding to 0.5% of primary energy, 0.7% 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 much less expensive investments, best of which the efficient use of energy.

Regarding the need for pumping, the PNBEPH declares 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 2460 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 table below).

Dam and 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 (sources: EC 2010 and EDP 2011)				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 project (source: EDP 2011)				1478
<b>Total pump power available in existing dams by 2016</b>				<b>2507</b>

### 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 interest rate (claimed by EDP to be at 3.5%); (ii) incentive for electric power availability, approved by the Government in August 2010 (SEEI 2010), bound to benefit the new 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 other official source has 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 to consumers and State budget (hence taxpayers) at about **16 300 M€**. **This corresponds to a future gross burden of 4 900 € per family, or a permanent increase in the electricity bill of at least 10%**. Should the interest rate rise to 6%, the total burden would amount to about 20 000 M€.

The incentive for electric power availability alone will cost the State 3 400 M€ over the concession horizon, virtually covering initial investment cost. Just in the first 15 years the subsidy will amount 736 M€, far above the concession dues paid by the electric companies. In short, **the infamous argument that dams were a “private investment” is a fraud**.

Those are only the direct costs to consumers and taxpayers. It was not possible at this moment to compute the large indirect costs, including electric grid cost, loss of jobs in tourism, health problems related to water quality, loss of cultural and ecological heritage and others.

## 5. Alternatives for a sound energy policy

There are a number of alternatives to new hydropower, including wind, biomass, solar and natural gas (assuming that coal and oil power plants will be phased out), and refitting of existing dams. **The undisputed 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, saving natural and financial resources.

The national energy efficiency plan PNAEE has a target of 10% reduction 2008-2015, and the national energy strategy ENE2020 a target of 20% reduction 2010-2020, off BAU scenarios. **Existing 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).

Based on available technology and energy auditing data, using the methodology proposed by Madeira and Melo (2003), we 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 ~ 5% of electricity demand.
- *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 and compressed air circuits. Investment: 3400 €. Savings: 8.2 TWh/year ~ 980 M€/year ~ 16% of electricity demand.
- *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 ~ 4% of electricity demand.

Investments of 6 210 M€ in efficient electricity use, saving 12.6 TWh/year (25% of current consumption), would create a net value for investors (families, business and public institutions) of about 61 100 M€ over 70 years, or the decrease in the electricity bill by one third. Reduced coal and gas use in thermal power plants would lower national imports of fossil fuels by 10%. Additional savings can be obtained with investments with longer payback periods. Best projects equivalent to the dam program, saving 1.7 TWh/year, with a 290 M€ investment, could create a net value of 11 600 M€ and reduce electricity price by 10%.

Another significant comparison is new dams versus refitting of existing dams. E.g. the investment on the new hydro power plant Venda Nova III (benefiting on the existing dam) will cost about 300 M€ (EDP 2011) for a net production of 880 GWh/year — a ratio of investment cost to production six times better than the PNBEPH average.

It should be noted that most of the referred measures are recommended in PNAEE and ENE2020; they just lack adequate incentives to be actively procured by families and business. Tax incentives to the efficient use of energy, abolition of environmentally harmful subsidies and transparent energy pricing would promote energy efficiency and reduce energy cost.

## 6. Large dams versus local 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, and only temporary. 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 and Mondim de Basto (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 eutrophication; (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. CPPE/Ecosystema 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 seriousness 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 “national public interest”, never demonstrated but assiduously invoked by the Portuguese Government to dismiss the dispositions of European directives.

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