Alternatives to Ilisu

Review of the EIAR for the Ilisu Dam and HEPP

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Executive Summary

The purpose of this Review is to evaluate the extent to which the recently published *Ilisu Dam and HEPP: Environmental Impact Assessment Report* (EIAR) has assessed the alternatives to the Ilisu Dam.

The EIAR is analysed against the international Guidelines of the World Bank and of the OECD, guidelines which the EIAR itself has consulted and which dictate that an EIA should compare the project with reasonable alternatives. These guidelines have been considered to represent international best practice. In order to conform to international best practice, the Ilisu EIAR should therefore demonstrate that Ilisu has been compared with all reasonable alternatives.

None of these guidelines been met in full, and the majority have not even been met in part. It is therefore concluded that the EIAR does meet international best practice on its assessment of alternatives to the Ilisu Dam.

Omissions in the EIAR's consideration of alternatives to Ilisu include:

- an incomplete assessment of the positives and negatives of hydropower
- an incomplete assessment of the positives and negatives of solar energy
- an incomplete assessment of the positives and negatives of wind energy
- an incomplete assessment of the positives and negatives of other alternatives such as gas
- an incomplete assessment of the potential of the non-project alternative of energy efficiency and demand side management.

Hydropower generally and the Ilisu dam in particular have many negatives not covered in the assessment of alternatives. The EIAR presents an unbalanced view of hydropower.

Turkey has plenty of sunshine and solar energy would represent a cost-effective (in the long term) alternative to Ilisu. Turkey also has plenty of wind (enough to generate more than its existing total energy consumption) and is ideally placed to utilise this. The costs of wind power are competitive with the costs of hydropower. The cost of electricity generated by gas-fired plants is less than one third of the estimated cost of electricity generation by Ilisu.

Grid losses mean that Turkey wastes 17% of all the electricity it produces. The EIAR's consideration of improving its transmission and distribution (i.e. grid) losses is incomplete, with transmission losses only partially discussed and distribution losses not discusses.

This electricity wastage skews Turkey's demand projections for the future. Also not considered is the future potential for demand management and demand side efficiency.

It is concluded that the EIAR's analysis of alternatives to the Ilisu Dam is incomplete and does not meet internationally accepted best practice. On this basis, **we recommend that the ECGD reject any applications being considered for export credit or investment guarantee support for Ilisu.**

1. Introduction

1.1 Purpose

The purpose of this Review is to evaluate the extent to which the recently published *Ilisu Dam and HEPP: Environmental Impact Assessment Report* (EIAR) has assessed the alternatives to the Ilisu Dam.

Explicit in the Environmental Impact Assessment (EIA) process is the need to assess alternatives to the project being proposed and the relevant World Bank and OECD guidelines (considered international best practice) on conducting EIA give details of what should be included.

In its Desk Review[1] of the original Ilisu EIA Report, Environmental Resources Management (ERM) stated:

> *"Neither the original EIA, or the subsequent review, present much in the way of an analysis of alternatives ... whilst they may of course have been discounted for a number of reasons, including economic and /or political, the report should at least present the reasons for their exclusion, and if appropriate, their comparative advantages and disadvantages."*

The new EIAR does cover alternatives. This Review assesses the extent to which this coverage meets the international best practice of the World Bank and OECD.

1.2 Scope

The scope of this review is limited to an assessment of whether the EIAR has fully considered all of the alternatives to the Ilisu Dam in line with international best practice of the World Bank and OECD. Since Unfortunately it does not compare the EIAR with the relevant guidelines in the World Commission on Dams report.[2] These guidelines are widely recognised to be stricter or of a higher standard than those of the World Bank and OECD and have crystallised into international best practice.

1.3 Structure

This review deals with three main areas:

- demand and current generating capacity (section 2)
- methods of electricity generation (section 3)
- energy efficiency (section 4)

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[1] Environmental Review of Ilisu Dam Project: Desk Review of EIA and Associated Documents, Environmental Resources Management, November 1999

[2] Dams and Development. A new Framework for Decision Making - The Report of the World Commission on Dams, London November 2000

2. International Best Practice and Standards

This section details the international best practice standards for consideration of alternatives in environmental impact assessment (section 2.1). The table in section 2.2 then compares each part of the guidelines considered in section 2.2 and asks whether it has been met. The reader is referred to the relevant parts of the EIAR (where applicable) and to further analysis in this report (sections 3, 4 and 5) for more information on the justification for assessing whether each guideline has been met.

2.1 The Standards

The major World Bank, OECD guidelines, directives, operational policies and procedures which relate to assessment of the alternatives are considered in this section.

The World Bank has ten environmental and social safeguard policies, intended to ensure that Bank operations "do no harm" to people and the environment. The policies, which are mandatory, have been in place since the early to late 1980s.

When first formulated, the safeguards took the form Operational Directives which combined mandatory policy, Bank procedures and "good practice" advice. In order to distinguish "policies" from "procedures", however, the Bank is in the process of converting the old ODs into Operational Policies (OPs) and Bank Procedures (BP). The Bank has stated that the conversions will not result in any dilution of the safeguards. Most of the ODs have now been converted. The safeguards relevant to consideration of alternatives to Ilisu are discussed below.

The EIAR states that the *"" World Bank Operational Directive 4.01 on Environmental Assessment ... as well as the "OECD Guideline on Environment and Aid No 1. Good Practices for Environmental Impact Assessment""*[3] have *"influenced [it] to a significant degree*"[4]. It goes on to say *"full compliance with them could not be attained"*[5] and lists three reasons why. None of these reasons relate to or include mention of assessment of alternatives.

[3] EIAR section 1.2.2

[4] EIAR section 1.3.1

[5] EIAR section 1.3.1

WORLD BANK

(i) World Bank OP 4.01 Environmental Assessment, January 1999

(a) Para 8a

"EA for Category A project[6] examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation) and recommends any measures needed to prevent, minimise, mitigate or compensate for adverse impacts and improve environmental performance."

So, in its analysis of alternatives, we would expect the EIAR to

- compare Ilisu's environmental impacts with those of feasible alternatives;
- compare Ilisu's environmental impacts with the "without project" situation;

(b) Annex B, "Content of an Environmental Assessment Report for a Category A Project".

"The EA should include the following items . .. .

f) Analysis of alternatives: [footnote - see below] Systematically compares feasible alternatives to the propsed project site, technology, design and operation - including the "without project" situation - in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training and monitoring requirement. For each alternative, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and justifies recommended emission levels and approaches to pollution prevention and abatement".

The para contains a footnote where marked:

"Environmental implications of broad development options for a sector (eg. alternative ways of meeting projected electric power demand) are best analyzed in least-cost planning or sectoral EA . . . EIA is normally best suited to the analysis of alternatives within a given project concept (eg. a geothermal power plant, or a project aimed at meeting local energy demand), including detailed site, technology and operational alternatives."

So, in its analysis of alternatives, the EIAR should:

- compare feasible alternatives (including the "without project" situation) to the proposed project site, technology, design and operation, in terms of
  - its potential environmental impacts;

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[6] The Ilisu Dam falls under category A

- the feasibility of mitigating these impacts;
- its capital and recurrent costs;
- its suitability under local conditions;
- its institutional, training and monitoring requirement;

- For each alternative, quantify the environmental impacts to the extent possible;
- For each alternative, attach economic values where feasible;
- State the basis for selecting the particular project design proposed.

(ii) World Bank Bank Proceedures 4.01 Environmental Assessment, Annex B, Application of EA to Dam and Reservoir Projects

para 4.

"In reviewing the EA, the TT [Task Team] and the RSU [Regional Environment Sectoral Unit] ensure the EA examines demand management opportunities. In appraising the project, they ensure the project design adequately takes into account demand management as well as supply options (eg. conservation of water and energy, efficiency improvements, system integration, cogeneration and fuel substitution).

So it should be checked that the EIAR's analysis of alternatives:

- examines demand management opportunities;
- adequately takes into account supply options (eg. conservation of water and energy, efficiency improvements, system integration, cogeneration and fuel substitution)

OECD

(iii) OECD, Development Assistance Committee: Guidelines on Aid and Environment

No.1, Good Practices for Environmental Impact Assessment of Development Projects, Paris 1992

(a) Page 6

"The EIA should consider alternative project designs (including the "non-action" alternative) as well as required mitigation and monitoring measures."

So, the EIAR should consider:

- alternative project designs (including the non-action alternative)

(b) Page 10

"EIA should be viewed as an integral part of the project planning process. It should begin with an early identification of project alternatives and the potentially significant environmental impacts associated with them."

So the EIAR should:

- Begin with an early identification of project alternatives and the potentially significant environmental impacts associated with them;

(c) Page 11

"In general the terms of reference for a thorough EIA should include the responses to the following questions . . . a comparison of project alternatives and mitigation measures in terms of their potential for eliminating adverse impacts, the associated capital and recurrent costs, suitability under local conditions, and the institutional, training and monitoring requirements."

So the EIAR should include:

- a comparison of project alternatives and mitigation measures in terms of their potential for eliminating adverse impacts;
- a comparison of project alternatives and mitigation measures in terms of the associated capital and recurrent costs;
- a comparison of project alternatives and mitigation measures in terms of the suitability under local conditions,
- a comparison of project alternatives and mitigation measures in terms of the and the institutional, training and monitoring requirements.

WORLD COMMISSION ON DAMS (WCD)

In November 1999 the World Commission on Dams (WCD), an international body charged with drawing up new guidelines for the hydro industry, reported. Its report is widely regarded as setting the benchmark for best practice in dam projects - and hence for international standards.

Alternatives are dealt with in Strategic Priority 2 "Comprehensive Options Assessment" which is one of the WCD's seven strategic priorities. This states:

"Alternatives to dams do often exist. To explore these alternatives, needs for water, food and energy are assessed and objectives clearly defined. The appropriate development response is identified from a range of possible options. The selection is based on a comprehensive and participatory assessment of the full range of policy, institutional, and technical options. In the assessment process social and

environmental aspects have the same significance as economic and financial factors. The options assessment process continues through all stages of planning, project development and operations.

Effective implementation of the strategic priority depends on applying these policy principles depends on:

2.1 Development needs and objectives are clearly formulated through an open and participatory process before the identification and assessment of options for water and energy resource development.

2.2 Planning approaches that take into account the full range of development objectives are used to assess all policy, institutional, management, and technical options before the decision is made to proceed with any programme or project.

2.3 Social and environmental aspects are given the same significance as technical, economic and financial factors in assessing options.

2.4 Increasing the effectiveness and sustainability of existing water, irrigation, and energy systems are given priority in the options assessment process.

2.5 If a dam is selected through such a comprehensive options assessment process, social and environmental principles are applied in the review and selection of options throughout the detailed planning, design, construction, and operation phases."

These guidelines are far more comprehensive than those of the World Bank and OECD as they involve continual options assessment throughout the life of the project. Unfortunately this Review has not formally analysed whether the EIAR meets these guidelines, however it is apparent from the following table and analysis that a comprehensive assessment of the options has not been carried out and it is therefore highly unlikely that the guidelines of the WCD have not been met.

2.2 Have the World Bank and OECD Standards Been Met?

STANDARD	STANDARD MET?	EVIDENCE
World Bank OP 4.01 Environmental Assessment, January 1999 (Para 8)		
compare Ilisu's environmental impacts with those of feasible alternatives	not met	- environmental impacts of alternative hydro projects not mentioned (EIAR sections 2.4.2 and 2.4.3) - environmental impacts of alternative power generation discussed but is incomplete (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not consider non-project alternatives such as demand management and energy efficiency (see sections 3 and 5 of this report)
compare Ilisu's environmental impacts with the "without project" situation	not met	- the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see sections 3 and 5 of this report)

World Bank OP 4.01 Environmental Assessment, January 1999 (Annex B, "Content of an Environmental Assessment Report for a Category A Project")			
compare feasible alternatives (including the "without project" situation) to the proposed project site, technology, design and operation in terms of:	its potential environmental impacts	not met	- environmental impacts of alternative hydro projects not mentioned (EIAR sections 2.4.2 and 2.4.3) - environmental impacts of alternative power generation discussed but is incomplete (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not consider non-project alternatives such as demand management and energy efficiency (see sections 3 and 5 of this report)
	the feasibility of mitigating these impacts	not met	- mitigation of environmental impacts of alternative hydro projects not mentioned (EIAR sections 2.4.2 and 2.4.3) - mitigation of environmental impacts of alternative power generation not mentioned (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see sections 3 and 5 of this report)
	its capital and recurrent costs;	partially met	- capital and recurrent costs of alternative hydro projects is considered (EIAR section 2.4.3) - capital and recurrent costs of alternative power generation is mentioned but is incomplete/ inaccurate (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see section 3 and 5 of this report)

	its suitability under local conditions	not met	- suitability under local social and political conditions not fully addressed (see "Resettlement Review of EIAR and Summary RAP for the Ilisu Dam and HEPP" and "Cultural Heritage Review of EIAR and Summary RAP for the Ilisu Dam and HEPP" submissions) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see section 4 of this report)
	its institutional, training and monitoring requirement	not met	- institutional, training and monitoring requirement not discussed for Ilisu or for alternatives
For each alternative, quantify the environmental impacts to the extent possible.		not met	- environmental impacts of alternative hydro projects not assessed or quantified (EIAR section 2.4.3) - environmental impacts of alternative power generation discussed but is incomplete and not quantified (see section 4 of this report) (EIAR section 2.2.3)
For each alternative attach economic values where feasible.		Partially met	- economic values of alternative hydro projects is considered (EIAR section 2.4.3) - economic values of alternative power generation is mentioned but is incomplete/ inaccurate (see section 4 of this report) (EIAR section 2.2.3)
State the basis for selecting the particular project design proposed.		Not met	- basis for selection is neither explicitly stated nor drawn out in any form of conclusion.
World Bank: Bank Procedures 4.01 Environmental Assessment, Annex B, Application of EA to Dam and Reservoir Projects			
examines demand management opportunities		not met	- current demand management ("Energy saving programs" EIAR section 2.2.5) policies and initiatives are mentioned, but future demand management opportunities are not mentioned or examined (see section 5 of this report)

adequately takes into account supply options (eg. conservation of water and energy, efficiency improvements, system integration, cogeneration and fuel substitution)	partially met	- takes into account some (EIAR section 2.2.4) but not all (and not even the majority of) supply options (see section 5 of this report)
OECD, Development Assistance Committee: Guidelines on Aid and Environment No.1, Good Practices for Environmental Impact Assessment of Development Projects, Paris 1992 (page 6, 10 and 11)		
consider alternative project designs (including the non-action alternative)	partially met	- alternative hydro "project design" considered in EIAR section 2.4.2 - alternative power generation project design discussed but incomplete (see section 4 of this report) (EIAR section 2.2.3) - the non-action option (which could include demand side management and energy efficiency) considered (EIAR sections 2.2.4 and 2.2.5) but not adequately (see sections 3 and 5 of this report)
Begin with an early identification of project alternatives and the potentially significant environmental impacts associated with them	not met	EIAR is the first time alternatives have been addressed. See section 1.1 of this report.
OECD, Development Assistance Committee: Guidelines on Aid and Environment No.1, Good Practices for Environmental Impact Assessment of Development Projects, Paris 1992 (page 11)		
a comparison of project alternatives and mitigation measures in terms of their potential for eliminating adverse impacts	not met	- mitigation of environmental impacts of alternative hydro projects not mentioned (EIAR sections 2.4.2 and 2.4.3) - mitigation of environmental impacts of alternative power generation not mentioned (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see section 4 of this report)

a comparison of project alternatives and mitigation measures in terms of the associated capital and recurrent costs	not met	- capital and recurrent costs of alternative hydro projects is considered (EIAR section 2.4.3) - capital and recurrent costs of alternative power generation is mentioned but is incomplete/ inaccurate (see section 4 of this report) (EIAR section 2.2.3) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see section 4 of this report)
a comparison of project alternatives and mitigation measures in terms of the suitability under local conditions	not met	- suitability under local social and political conditions not fully addressed (see "Resettlement Review of EIAR and Summary RAP for the Ilisu Dam and HEPP" and "Cultural Heritage Review of EIAR and Summary RAP for the Ilisu Dam and HEPP" submissions) - the without project situation is not addressed as the EIAR (section 2.2.1) assumes the project is essential and does not adequately consider non-project alternatives such as demand management and energy efficiency (see section 4 of this report)
a comparison of project alternatives and mitigation measures in terms of the and the institutional, training and monitoring requirements	not met	- institutional, training and monitoring requirement not discussed for Ilisu or for alternatives

3. Demand and Current Generating Capacity

The power production in Turkey amounted to 120,000 GWh in 2000: an increase of 24,000 GWh on the 96,000 GWh quoted in the EIAR (section 2.2.1) as being produced in 1998. Electricity production increased by 68% between 1985 and 1990, even though demand only increased by 58%.[7]

Power demand is projected to increase rapidly over the next 20 years, as shown below by these Government projections:

Turkish Electricity Demand Forecast (TWh)[8]

Year	Official Forecast
1996 (actual)	94.7
2000	131.2
2005	199.6
2010	289.8
2015	398.2
2020	547.1

However, these demand projections are exaggerated as Turkey is very energy inefficient, with up to 30% of energy generated wasted (see Energy Efficiency section). This affects demand projections and locks the country into a cycle of using exaggerated demand figures to set unnecessary and unachievable production targets.

The Ministry of Energy of the Turkish Government has not produced plans for demand side management or energy efficiency measures.

Exaggerated demand forecasts and inadequate energy efficiency on both supply and demand sides imply that Turkey (now and in the future) is over estimating the amount of energy it needs to generate and is not considering alternatives to the management of its electricity needs.

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[7] "Turkey at an energy crossroads" Greenpeace, June 1997

2. Reproduced from "Turkey at an energy crossroads" Greenpeace, June 1997

4 Electricity Generation

Section 2.2.2 (Hydropower development in Turkey) of the EIAR presents a one-sided case for hydropower development in Turkey: it outlines the benefits of but not the problems associated with increasing hydropower generation. Section 2.2.3 (Alternative Energy Production) gives an incomplete, and at times inaccurate, assessment of the potential of alternatives to hydropower: it outlines the problems but not the benefits associated with increasing solar and wind power generation. Nowhere is the mitigation of environmental impacts of alternatives discussed.

4.1 Hydropower

The EIAR (section 2.2.2) does not address any of the potential problems with hydropower in general nor in specific relation to the Ilisu Dam. Integrated Resource Planning should be used to compare hydropower with all alternatives and this has not been done in the EIAR.

This section covers some points not raised in the EIAR about hydropower in general, in Turkey and the Ilisu Dam in particular.

Hydropower in General

It is widely recognised that hydropower has both benefits and drawbacks and it is therefore the EIAR is not convincing in its presentation of solely positive elements for hydropower. The many concerns surrounding large dams are not even mentioned in this section of EIAR.

The World Commission on Dams (WCD), an independent body set up by the World Bank and the World Conservation Union (IUCN) which included representatives of all stakeholders in the building of large dams, carried out a comprehensive review of large dam projects. On the performance of dams, it concluded that large dams "have a large tendency towards schedule delays and significant cost overruns" and that expectations of large dams for the delivery of power has "considerable variability, much of it on the downside".[9]

The EIAR mentions the environmental positives - for example minimal greenhouse gas emission - of hydropower, but does not balance these with environmental negatives such as habitat destruction and siltation

Hydropower in Turkey

Hydropower generation specifically in Turkey, also has negative impacts not mentioned by the EIAR. For example, recent drought in the GAP region has caused an acute shortage of electricity due to low water levels in many large hydro reservoirs, which are experiencing their lowest water levels in ten years. Officials said the levels in the dams - which supply one

[9] Dams and Development: A new framework for decision making. The Report of the World Commission on Dams, London, November 2000.

fifth of the nation's electricity - were so low that it might take four or five years before they return to normal.

Contrary to the implications in the EIAR, hydropower generation will not go far towards mitigating the impacts of a potential oil crisis in Turkey, since in Turkey oil is used for transport and its role in electricity generation is relatively minimal.

Sunshine and wind (for photovoltaic and wind energy generation respectively) are also available in Turkey, and would also have many of the advantages of hydropower. They emit very few greenhouse gases. The implementation of important wind projects and solar projects could also represent opportunities to promote the economic development of southeastern Anatolia by generating regional spin-offs.

Ilisu Dam

In addition to general problems with hydropower, the EIAR's summary of hydropower development in Turkey fails to mention some serious problems relating to the particular cases of Ilisu and other GAP dams. Hydropower developments could severely disrupt the downstream flow of the Tigris to Syria and Iraq, affecting communities reliant on seasonal agriculture and heightening political tensions between Turkey and its neighbours in what is already a volatile region. The fears have been heightened by the armed conflict that has dogged the region since 1984, with Turkey increasingly at odds with Syria and Iraq for sheltering the Kurdish guerrilla movement, the Kurdish Workers Party (PKK).

There are as yet no convincing plans or substantiated budgets for mitigation of the social and environmental impacts of the Ilisu Dam. These impacts include cultural heritage impacts, resettlement impacts, health impacts, and hydrological and water quality impacts.[10] Without consideration of these, the true cost of the dam cannot be assessed and therefore it cannot be meaningfully compared to other alternatives.

4.2 Fossil Fuels

Promoters of lignite in Turkey advocate that "clean-coal" projects would generate sufficient energy to cover Turkey's needs. Oil as a source of electricity is not a viable option in Turkey as it is prohibitively expensive. It is not currently used to a large degree in electricity generation and it is misleading to include it as a potential alternative to hydropower.

Gas

Gas-fired plants are used in Turkey but are not considered as an alternative in the EIAR. They appear to offer a cheaper alternative to Ilisu.

[10] Refer to submissions on these for further information

In November 1998, the Swiss government guaranteed contracts for Ankara gas power project. The Ankara Gas Power Project has a capacity of 720 Megawatt (MW) for a cost of $276 million. This translates into a cost of US$380/kW. Ilisu has a capacity of 1,200 MW for a cost of US$1,500 million or $1270/kW. The Ankara gas project is over three times more cost effective. This conclusion holds despite the Ankara project having higher operational costs, since its capital costs (interest charges etc) are lower than for Ilisu.

The recent private sector investment in three gas-fired power plants in the Marmara region has also demonstrated the attractiveness of this option from a financial point of view. A Fact-Finding Mission, undertaken in October 2000 by the Ilisu Dam Campaign, was also informed that the Marmara plants' contribution to power supply in Turkey was sufficient to allow the government to reject the Akkuyu nuclear project without the danger of creating power cuts.

4.3 Solar Energy (PV)

The EIAR's paragraphs on solar energy reflect a lack of knowledge about the current use of PV cells and presents somewhat misleading arguments about their benefits and drawbacks.

Rather than having large photovoltaic (PV) installations, PV cells can be placed on individual rooftops and building facades. They are connected to the grid, supplying power to the grid at times when the cells are generating a surplus of extra electricity and taking power from the grid as necessary during the night.

Whilst electricity generated from PV cells is currently one of the most expensive options, a report by KPMG[11] shows that with a solar factory producing PV cells at the rate of 500MW/year prices can go down by 75%. In other parts of the world, PV cells are being installed as competitive alternatives to electricity generation.

For example, the Million Solar Roofs Initiative of the US aims to bring up to 4kW systems for a million public and private rooftops by 2010. It has an objective of 3,025 MW capacity installed by 2010, with an expected cost of $2/W (= $2,000/kW = $0.077/kWh)[12]. This is less than a quarter of the EIAR's estimated cost of $8,500/kW for photovoltaic, and is four-fifths of the EIAR's estimated cost of $2,500/kW for hydropower.

The EIAR focusses on the problems with batteries (installation, storage, control of, maintenance, cleaning, replacement). This detailed information is, however, irrelevant: batteries are not needed to store additional electricity produced during the day, since it is transmitted directly to the grid. Each building becomes, in effect a tiny power-plant, connected to the grid via a two-way meter.

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[11] "Solar Energy: from perennial promise to competitive alternative", KPMG Bureau voor Economische Argumentatie, August 1999

[12] http://www.eren.doe.gov/millionroofs/benchmark.html

The information in the EIAR about tree and other vegetation clearance is also irrelevant in the above scenario where PV cells are installed on individual buildings rather than in a larger power-plant.

Given Turkey's abundance of sunshine, it has the potential to use solar power to meet its energy needs. In addition to solar becoming a competitive method of energy generation, it has the advantage over large-scale hydro projects of having minimal social and environmental impacts. As with hydro projects, solar projects have the potential to generate regional economic spin-offs and other regional advantages. If Turkey used its need to increase electricity generation to generate PV expertise through investment and technology transfer, solar would also have additional development benefits for the country as a whole.

4.4 Wind Energy

Whilst the EIAR dismisses wind energy as an alternative to Ilisu, many experts see wind power as having great potential in Turkey. The EIAR (section 2.2.3) states that wind turbines "would contribute to cover the demand increase of one year". Presumably this refers only to wind turbines currently planned in Turkey, rather than the total wind potential in Turkey which is estimated to be considerable.

The Organisation for Economic Cooperation and Development (OECD) has estimated that Turkey has 166 TWh a year of wind potential [13]- more that Turkey's current total electricity production.

Aegean Tech in Turkey in a recent study *Wind Energy Opportunities of Turkey* [14] concluded:

> *"It is estimated that in the year of 2023 (100.Year of the Repuclic of Turkey) Turkey will need 600 billions of kWh/year. That means if we pursue an intelligent policy then in the year of 2023 about one third of the energy need of the country could theoretically be harvested from the wind."*

Another study [15] concluded that the existing technical wind energy potential of Turkey is good enough to supply twice as much the existing total consumption of electricity.

Wind energy is already in use in many parts of the world at a price competitive with conventional technologies. The latest technologies can produce electricity at 4.4c/kWh,

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[13] Wijk, A.J.M. van, J.P. Coelingh - Wind Power Potential in the OECD Countries- NW&S, Utrecht, in opdracht van ECN, (1993)

[14] http://www.egetek.org/pages/links/energy/wind.html

[15] Uyar,Tanay Sidki et.al, Turkish Wind Atlas Statistics, Project Reports No: 1-6, 1989, TÜBÝTAK Marmara Scientific and Industrial Research Institute, Gebze, Kocaeli

comparable to many conventional sources [16] The cost of generating electricity from wind turbines is currently only marginally more than that of hydro and is expected to decline over the next few years.

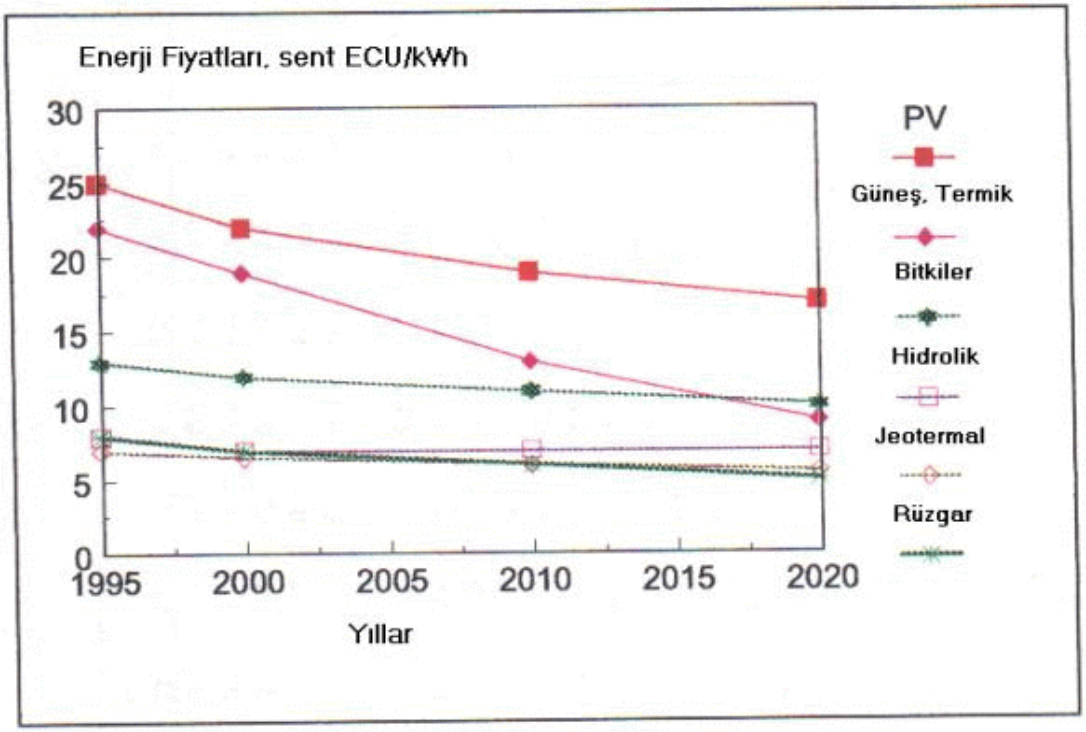
The graph below shows the comparable cost of wind power, hydro and other energy sources in ECU/kWh. [17] It shows the very similar current prices of wind and hydropower, and the projected decline in price of wind power relative to hydro.

[Note: Ruzgar is wind power; Hidrolik is hydropower.]

According to a thorough technical report published by the European Wind Association, the

[16] Elsam Power Pool Report, Denmark, Jan 1997, on http://www.greenpeace.org/

[17] Comparative Cost of Wind Power, American Wind Energy Association, 2000 in RÜZGAR ENERJÝSY: YLE DYÐER ENERJY KAYNAKLARININ, FYYAT / MALYYET. ANALYZ RAPORU (in Turkish available at http://www.egetek.org/pages/news/asmakmaliyet.html)



Graph: Comparative Cost of Wind Power

Forum for Energy and Development and Greenpeace International[18] it is evident that wind technology is experiencing a dramatic growth which will continue over the next few years. To date, about 4,000 MW are being installed in the world every year, with a actual potential of increasing ten fold by 2010 and employ 630,000 people worldwide in this industry at that time. In 1998, the investment cost for wind technology was 1,000 US$/KW installed - two-fifths of the EIAR's estimated cost of 2,500/KW for hydropower. The unit price for wind electricity was 4.7 UScents/KWh - a value which is already reasonably competitive with hydro electricity costs. The range of wind power costs today is 4-7 UScents/KWh. Under an actual potential scenario with a strong element of R&D backing, as considered in the study, investment costs might decrease to around 700 US$/KW installed by 2010 and wind electricity costs might realistically drop to 3 UScents/KWh by 2013. Similar results were produced by a United States Department of Energy study already in 1993, with figures of 3.6 UScents/KWh in 2010 and 3.1 UScents/KWh in 2020.

In addition, in contradiction to the implication of the EIAR, large turbines can be productive even at very low wind speeds. For example windmills operating in inland areas in Germany have shown that, even with low wind speeds, wind turbines can be efficient.

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[18] Wind Force 10, A BLueprint to Achieve 10% of the World Electricity from Wind Power by 2020, The Beacon Press, October 1999

As shown above, Turkey has enough wind to generate a significant proportion of its energy requirements. The cost of wind power is at least competitive with that of hydropower and can be lower.

4.5 Other Alternatives

The EIAR makes no mention of other alternatives such as gas, bio-gas, bio-mass and geothermal electricity.

5 Energy Conservation

5.1 Transmission and Distribution

Section 2.2.4 (Improvement potential of the high voltage transmission network) deals with losses in transmission. Four possibilities are mentioned but only two (raising the transmission voltage and installing adequate shunt reactors for reactive power compensation in the network) are analysed. Even then, the latter is only given the briefest mention (the reference to "capacitor banks" in section 2.2.5). The other two (improving the meshing of the grid system; increasing the cross section of the transmission lines) are given no further mention or consideration.

No figures for the EIAR's reference to the cost/benefit relation for raising the transmission voltage are given and we have not been able to find these. Other studies, however, point to about 5,000 MW of unutilised energy potential from the larger thermal plants in Turkey if the transmission voltage was raised.[19] This is over four times Ilisu's potential generating capacity of 1,200 MW.

Nowhere in the EIAR are distribution losses dealt with. Instead, the EIAR (section 2.2.4) states:

"The 20÷30% energy losses mentioned by some circles are misleading because they include not only the transmission but also all the distribution losses and they refer apparently to the difference between the total gross production and the total net consumption figures."

Official figures show that there in 1995 there were 17% grid losses throughout the network, compared to an international average of 6.5.[20] Less than 3% of these were losses in transmission and over 14% losses in distribution. Yet the EIAR does not cover measures to decrease these distribution losses.

In summary energy efficiency on the supply side is dealt with inadequately by the EIAR - measures to reduce transmission losses are partially discussed, measures to reduce distribution losses are not discussed.

5.2 Energy Efficiency

Turkey is the "most energy wasteful" country in Europe, spending twice the energy as some other countries for one unit of GDP produced. The energy wasted, also skews demand projections thus creating an exaggerated estimate of future energy demand (see above section on Demand).

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[19] "Turkey at an energy crossroads" Greenpeace, June 1997

[20] "Turkey at an energy crossroads" Greenpeace, June 1997

The International Energy Agency (IEA), in its 2000 Energy Efficiency Update for Turkey [21] states (emphasis added):

> *"**Energy efficiency is considered to be the cheapest energy source**, potential gains to be achieved by increased energy efficiency are substantial; various studies carried out in 1995 by the General Directorate of Electrical Power Resources Survey and Development Administration (EIEI) and the National Energy Conservation Center (NECC) with the participation of the European Union, estimate **the total energy saving potential for the three consumption sectors to be approximately 13.2 Mtoe per year, corresponding to slightly more than the current final energy consumption in the transport sector**."*

[Mtoe is "Tonnes of Oil Equivalent", a unit adopted by the OECD to present energy balances.[22]]

The IEA's recent report[23] details many additional (often simple) measures the Turkish authorities could be taking to promote energy efficiency. For example, in the industrial sector "about 40% of the energy conservation potential is usually basic good housekeeping and low investment measures".

Section 2.2.5 (Energy Saving Programs) briefly deals with energy efficiency in consumption. It does not give figures for potential energy savings, nor assess whether more could be done by the State to promote energy efficiency. In other words, improving energy efficiency by addressing demand side management is not covered by the EIAR.

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[21] http://www.iea.org/pubs/newslett/eneeff/TK.PDF

[22] http://www.iea.org/stats/files/mtoe.htm

[23] http://www.iea.org/pubs/newslett/eneeff/TK.PDF

6. Conclusions

The relevant World Bank and OECD guidelines for consideration of alternatives in environmental impact assessment include

- comparing feasible alternatives in terms of
  - potential environmental impacts,
  - mitigating these impacts,
  - capital and recurrent costs,
  - suitability under local conditions and institutional,
  - training and monitoring requirement;
- consideration of the "without-project" or "non-action" alternative;
- examines demand management opportunities;
- takes into account supply options.

The EIAR considers the following alternatives: other hydro schemes, solar power, wind power and fossil fuels. It gives no consideration of other alternatives, notably gas-fired power plants which could provide a much cheaper alternative. The assessment of alternatives in biased and unbalanced, with only economic impacts of alternative hydropower schemes considered but economic and environmental impacts of solar and wind power considered.

The assessment of wind and solar power in the EIAR is incomplete and biased against them: their advantages are not discussed and the information given is incomplete and inaccurate. The assessment of hydropower is incomplete and biased in its favour: the disadvatages are not discussed.

The "without-project" or "non-action" alternative is given no serious consideration in the EIAR. Turkey is very energy wasteful and savings could be made in the following areas: transmission and distribution, demand side energy efficiency and demand management. These options are either given incomplete analysis and consideration or are not considered at all.

The majority of the guidelines are not even met in part. None of them are met in full. The EIAR therefore does meet international best practice on its assessment of alternatives to the Ilisu Dam.

It is concluded that the EIAR's analysis of alternatives to the Ilisu Dam is incomplete and does not meet internationally accepted best practice. On this basis, **we recommend that the ECGD reject any applications being considered for export credit or investment guarantee support for Ilisu.**