NUCLEAR POWER PLANTS FOR SRI LANKA BY YEAR2020

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Abstract

Ever increasing demand for electricity, due to increased consumption, industrial development and electrification, will have to be met by the Sri Lankan electricity industry. Ceylon Electricity Board has a long term generation plan, which mainly focuses on coal power. Despite the massive environmental pollution, it is not wise to depend only on coal power since coal resource is also a limited conventional resource. Therefore a country like Sri Lanka should have a good mixture of energy options for electricity generation rather than adhering to one conventional energy source as coal.

Aim of this study is to investigate the possibility of adopting Nuclear Power option to Sri Lanka. Due to the limited capacity of the current electricity network to absorb an economic scale nuclear power plant, the consideration was made for the year 2020, by which time the electricity network capacity will be large enough. An interesting fact is that some countries smaller in size than Sri Lanka successfully adopted nuclear power plants for their electricity generation. Hence this study could be considered as timely.

The study focuses on following facts;

1. Future demand and generation of Sri Lanka up to year 2020
2. World status of the Nuclear Power Plants and Technology
3. Pre-feasibility study - Technology
4. Pre-feasibility study - Economics
5. Pre-feasibility study - Site Survey
6. Pre-feasibility study - Environmental Impact Assessment

The technological pre-feasibility study addresses suitable type and size of a nuclear power plant for Sri Lanka. Thereby the CANDU technology is discussed which is adopted mainly in India and Canada.

In economic pre-feasibility study, the Leve1ized Unit Electricity Costs were calculated for the nuclear power plant as well as for the coal power option. As per the calculation unit electricity cost for the nuclear option seems to be slightly higher than from the oal option at current market conditions. Also a sensitivity analysis was done considering the changes in fuel cost and it shows that nuclear power unit cost dependency on fuel price is very much less than that of coal option. Under the economics, the possible initial financing methods for a country like Sri Lanka are also discussed.

For the site survey, author proposes 9 locations for initial consideration. Screening to select final sites, should be done by the authority that is responsible for feasibility study. The main criteria for selecting these sites were population density, cooling water availability, and land availability. The selected sites should also have minimum impact on the environment.

Existing local regulations and international obligations as well as required local regulations for setting up a nuclear power plant are also discussed in this document. Especially the adaptation of International Atomic Energy Agency (IAEA) safeguard system is elaborated.

The worst nuclear power plant accident in the world history is analyzed to have a clear picture on the possible maximum damage in case of a major accident, even though the probability of occurrence of such a disaster is extremely low. India, the closest neighbor country of Sri Lanka, is increasing nuclear power share drastically and some nuclear power plants are being built near to Sri Lanka. A complete information regarding the locations of Indian nuclear power plants are also discussed.

For the formidable question, "In case of a nuclear accident, can Sri Lanka bear it?", the most common answer will be "NO!". It is not possible to rule out accidents. On the other hand, as the conventional fuels deplete and their prices escalate, the only long term sustainable and dependable energy source is nuclear. Renewable sources

such as solar, wind, hydro etc are either limited in availability or economically unviable as a standalone supply source. Unless there is an economically competitive supply of energy, any country will not be able to provide its services at an acceptable price and thereby will become economically bankrupt. Thus the recommendation conceived from this project is "Study the subject of nuclear power at national level and be cautiously ready to implement nuclear power projects at an appropriate stage in the future to come"

DECLARATION

The work submitted in this dissertation is the result of my own investigation, unless otherwise stated.

It has not already been accepted for any degree, and is also not being concurrently submitted for any other degree.

UOM Verified Signature

B.M.A.T. Priyadarshana
Date: 30-03-2010

I endorse the declaration by the candidate.

Eng. W.D.A.S. Wijayapala

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Acronyms

ABWR	Advanced Boiling Water Reactor
AEA	Atomic Energy Authority
AGR	Advanced Gas Cooled Reactor
BOO	Build Own and Operate
BOT	Build Own and Transfer
BWR	Boiling Water Reactor
CANDU	CANada Deuterium Uranium
CAESAR	Clean And Environmentally Safe Advanced Reactor
CEB	Ceylon Electricity Board
ECA	Export Credit Agencies
ECCS	Emergency Core Cooling System
EPZ	Emergency Planning Zone
ESBWR	Economic Simplified Boiling Water Reactor
GCR	Gas Cooled Reactor
HLW	High-Level Waste
HWR	Heavy Water Moderated Reactor
HTGCR	High Temperature Gas Cooled Reactor
IAEA	International Atomic Energy Authority
ILW	Intermediate-Level Waste
INES	International Nuclear Event Scale
JVC	Joint Venture Company
LLW	Low Level Waste
LMFBR	Liquid Metal Fast Breeder Reactor
LUEC	Levelized Unit Energy Cost
LWR	Light Water Moderated Reactor
MSR	Molten Salt Reactor
NPP	Nuclear Power Plant
OMR	Organically Moderated Reactor
PHWR	Pressurized Heavy Water Reactor
PWR	Pressurized Water Reactor
RBMK	Reaktor Bolshoy Moshchnosti Kanalniy (High Power Channel Reactor)

SSTAR	Small Sealed Transportable Autonomous Reactor
VLLW	Very Low Level Waste
4S	Super-Safe, Small, and Simple

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