5. INVESTMENT ON COGENERATION

Investors are concerned about the risk of the investment and the returns they get for the investment. Even though, the technologies for cogeneration exist, no cogeneration projects have been started in diesel engine power plants in Sri Lanka. Hence, there are problems and business risks that investors face in these projects.

5.1. Risks Associated with Investment on Cogeneration Projects

1. Most of the Power Purchase Agreements of diesel engine power plants are about to finish in the near future.

2. In the future, installed capacity of coal power plants will increase. Hence, no assurance of energy dispatch in the future. With the increase of installed power capacity in Sri Lanka, plant factor of diesel engine power plants can reduce in the future. According to the sensitivity analysis carried out to “Heladhanavi”, if plant factor drops to 70%, the project IRR will fall to 14.9% and equity IRR will fall to 12%.

3. Also, there are risks associated with the tariff. From the sensitivity analysis, it is obvious that tariff is a major concern. If tariff is low, profits will drop drastically.

4. Cogeneration technology is new to Sri Lanka, not much experience on the technology and capital cost may get increase than predicted.

5. The effect of cogeneration on the engine performance and exhaust gas. If back pressure from the cogeneration system increases, engine efficiencies drop. If the flue gas temperature reduces, the dispersion of gases gets reduced and will exceed permissible ambient air quality limits. Also, reduction in exhaust gas exit temperature can increase corrosion of exhaust gas stack.

6. If fuel prices come down expected savings from the project would lower.

In the present scenario, investors in diesel engine power generation earn very good returns. Therefore, they are not motivated to undertake additional risks.
5.2. Existing Regulatory Provisions

The Public Utilities Commission is the regulatory body for Electricity Generation. They have announced two tariff options for electricity purchased by the Transmission Licensee, CEB for non-conventional renewable Energy sources for Standard Power Purchase Agreement (SPAA). Therefore, cogeneration developers can sign a SPAA and export power to the national grid.

Table 5-1: Three-tier Tariff announced by PUCSL for standard power purchase agreements

All prices are in Sri Lanka Rupees per kilowatt-hour (LKR/kWh).

Option 1: Three-tier Tariff

<table>
<thead>
<tr>
<th>Technology</th>
<th>Escalable Base O&amp;M Rate</th>
<th>Escalable Base Fuel rate</th>
<th>Year 1-8</th>
<th>Year 9-15</th>
<th>Escalable Year 16+</th>
<th>Year 16+ Royalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-hydro</td>
<td>1.61</td>
<td>None</td>
<td>12.64</td>
<td>5.16</td>
<td>1.68</td>
<td>10% of total tariff</td>
</tr>
<tr>
<td>Mini-hydro - Local</td>
<td>1.65</td>
<td>None</td>
<td>12.92</td>
<td>5.28</td>
<td>1.68</td>
<td>10% of total tariff</td>
</tr>
<tr>
<td>Wind</td>
<td>3.03</td>
<td>None</td>
<td>17.78</td>
<td>7.26</td>
<td>1.68</td>
<td>10% of total tariff</td>
</tr>
<tr>
<td>Wind - Local</td>
<td>3.11</td>
<td>None</td>
<td>18.28</td>
<td>7.47</td>
<td>1.68</td>
<td>10% of total tariff</td>
</tr>
<tr>
<td>Biomass (Dendro)</td>
<td>1.29</td>
<td>9.10</td>
<td>7.58</td>
<td>3.10</td>
<td>1.68</td>
<td>No royalty</td>
</tr>
<tr>
<td>(1-15 years)</td>
<td></td>
<td>1.61 (16th year onwards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass (Agricultural &amp; Industrial Waste)</td>
<td>1.29</td>
<td>4.95</td>
<td>7.58</td>
<td>3.10</td>
<td>1.68</td>
<td>No royalty</td>
</tr>
<tr>
<td>(1-15 years)</td>
<td></td>
<td>1.61 (16th year onwards)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipal Waste</td>
<td>4.51</td>
<td>1.75</td>
<td>15.16</td>
<td>6.19</td>
<td>1.68</td>
<td>No royalty</td>
</tr>
<tr>
<td>Waste Heat Recovery</td>
<td>0.43</td>
<td>None</td>
<td>7.13</td>
<td>2.65</td>
<td>1.68</td>
<td>No royalty</td>
</tr>
<tr>
<td>Escalation rate for year 2010</td>
<td>7.64%</td>
<td>5.09%</td>
<td>None</td>
<td>None</td>
<td>5.09%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Non Conventional Renewable Energy Tariff Announcement from Public Utilities Commission for Purchase of Electricity to the National Grid under Standardized Power Purchase Agreements (SPPA), 25th November 2010
Table 5-2: Three tier Tariff announced by PUCSL for SPAA

**Option 2: Flat Tariff**

<table>
<thead>
<tr>
<th>Technology</th>
<th>All inclusive rate (LKR/kWh) for years 1-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini-hydro</td>
<td>13.04</td>
</tr>
<tr>
<td>Mini-hydro - Local</td>
<td>13.32</td>
</tr>
<tr>
<td>Wind</td>
<td>19.43</td>
</tr>
<tr>
<td>Wind - Local</td>
<td>19.97</td>
</tr>
<tr>
<td>Biomass (Dendro)</td>
<td>20.70</td>
</tr>
<tr>
<td>Biomass (Agricultural &amp; Industrial Waste)</td>
<td>14.53</td>
</tr>
<tr>
<td>Municipal Waste</td>
<td>22.02</td>
</tr>
<tr>
<td>Waste Heat Recovery</td>
<td>6.64</td>
</tr>
</tbody>
</table>

Source: Non Conventional Renewable Energy Tariff Announcement from Public Utilities Commission for Purchase of Electricity to the National Grid under Standardized Power Purchase Agreements (SPPA), 25th November 2010

These projects do not have a life of twenty years, because these are based on primary power generation equipment (Diesel Engines) and period of power purchase agreements for primary cycles are short. Therefore, developers have to move to the flat tariff. It is Rs. 6.64 /kWh. With this tariff, Project IRR will be 13.7% for five year life and Equity IRR is a negative value. Therefore, with this tariff project should be at least seven years. Even for seven year project IRR is 21.6% and Equity IRR is 21%. These are very low compared to other Electricity Power Projects and to current interest rates of around 14-16%. This is not attractive enough to invest, with consideration of the above risks.
5.3. Reasons to Encourage Cogeneration

1. Power comes at no extra fuel cost

The Sri Lankan power system is facing problems in meeting its peak electricity demand with the limited water resources and there is an 8-10% annual growth in electricity demand. So, the addition of 10-20 MW would be beneficial. Further, this can be produced without extra cost for fuel. Fuel prices are also increasing continuously, and this helps to reduce production cost as a whole. Further this saves exchange spent for fuel. Almost all the diesel engine thermal power plants run at their full capacity at the peak demand period, hence this power can be used to provide to meet the demand and reduce dispatching expensive power plants.

2. Reduce Green House Gases

These can be identified as a green energy, because no need to burn extra fuel and it will reduce the necessity of a new fuel burning power plant. Therefore, this can be involved in green house gas emission controlling. Sri Lanka is eligible to sell carbon credits under Clean Development Mechanism. According to Sustainable Energy Authority, recent grid emission factor is 0.7507 t-CO$_2$/MWh. This value is according to combined margin calculation for first crediting period.

As per the above calculations from the total potential, Sri Lanka will be able to save 101,120 t-CO$_2$ and will generate a foreign income of € 50,560 / year.

3. Low technology risk

This technology is used in most countries and proven technology. Therefore the risk is low.

4. Saving fuel for future

Fuel is a limited resource for in the world and it is a depleting energy source; fuel saved today would be available for the future generations.
5.4. **Developments in International Cogeneration Markets**

1. **The Public Utility Regulatory Policies Act of 1978 (PURPA) - USA**

   This is a legacy of the energy policy of the late 1970’s, which attempted to substitute the government’s fuel-choice and energy conservation judgments for those of the marketplace. The dramatic run up in oil prices by over 230% between 1970 and 1980, was viewed as a threat to both national security and economic stability. This was a major reason to introduce PURPA [13].

   This was intended to conserve fossil fuels, increasing the efficiency of electricity use and encourage renewable energy.

   PURPA requires utilities to purchase power from “Qualifying Facilities” (QFs) at the utilities avoided cost of producing power. QFs consist of small-power producers (SPPs) using renewable resources and waste heat [13].

2. **Western European Countries**

   The governments of these countries provide cogeneration investors with subsidies and tax breaks. These subsidies caused the number of cogeneration installations to increase, which had the effect of having cogeneration technology become more advanced and less expensive. All these factors started a cogeneration boom in the late 1980’s and early 1990’s in certain Western European nations.[14]

   Reasons to increase in cogeneration,

   I. **Social and Political Factors**
      - Public Pressure against large power plants
      - Emission regulations
      - Energy saving strategies
• Deregulation and liberalization

II. Economic Factors,

• General High Energy prices
• Attractive gaps between electricity prices and primary fuels.
• Decreasing investment and operation costs. Generally High Energy prices
• Attractive gaps between electricity prices and primary fuels.
• Decreasing investment and operations costs.

3. Sell Electricity generation to consumers as green energy

Most of the countries have similar kind of systems to encourage Green Energy. In California, cost of Green Energy is advertised as being slightly higher per kilowatt to the consumer than conventional energy. The California Energy Commission is collecting a small surcharge from all California’s power bills and, through a fund called Renewable Resources Trust Fund, is subsidizing green energy to keep the cost of this energy to the consumer competitive with that from conventional sources. The idea is to foster green energy, because it generates less air pollution, does not pose long-term waste issues, and is otherwise considered to have far-reaching social benefits [13].

Sri Lankan exporters also export green products, which were manufactured from green energy; like branded garments. In Europe there are customers who would like to buy goods manufactured from green energy and they are willing to pay more for that. Therefore, in Sri Lanka also we can carry out same mechanism to encourage cogeneration.
5.5. **Encouragements to Investors**

From the financial feasibility and the sensitivity analysis, it was identified that return is not adequate for the risk for the investment. That is the main reason for not coming up of cogeneration projects in Sri Lanka. Government should look into the problems and should take necessary actions to encourage cogeneration projects.

1. **Negotiate and decide the lifetime of the diesel engine power plants**

   Government should evaluate these diesel thermal power plants in their generation plan and with the cogeneration capacity. If it is feasible, planners should clearly state the agreement periods in agreement renewals. In the agreement renewal process, government institutes should encourage investors for cogeneration and should include clauses related to cogeneration.

2. **Tariff**

   As discussed in the financial feasibility assessment and in the sensitivity analysis, the return for the investment is low with the current announced tariff of Rs. 6.64. And the risk is high. Therefore returns are not very much attractive for the investors. Government should consider this and change agreements accordingly. Further they can propose a tariff between current tariff for waste heat generation and present tariff for diesel power plant export.

   Further, government can declare cogeneration energy and sell it to interested consumers at a higher rate. That margin can be transferred to investors.
3. Proper Energy Planning

Government institute should forecast energy dispatch pattern for next few years. Then, investors can take the investment decisions accordingly.

4. Amend regulations and power purchase agreements to encourage cogeneration

Government should reconsider Power Purchase agreements and change them accordingly to absorb cogeneration and to encourage cogeneration. Further, remove regulatory barriers and other legal barriers for cogeneration.