

CHAPTER-6: CONCLUSION AND RECOMMENDATION

1. At national level India had already attained 11% renewable energy sources in March 2014. Indian Railway had installed 50 MW of renewable energy generation capacity by March 2016 which can generate about 75 to 100 million units. This constitute about 0.5% of total electricity consumption of IR. As discussed earlier, the target of 10% electricity from renewable sources has been planned by 2020.

It is felt that IR can achieve the target through solar route as costs are favorable. Maintenance outsourcing is the best option. In addition, IR may go through developer route or purchase green energy. In either case, target is too stiff and therefore, IR need to pace up work.

2. Indian Railway has Indian Railway proposes to harness about 1000 MW solar power by 2020. As part of this, about 500 MW solar plants are planned on rooftops and about 500 MW through land mounted panels. GOI has planned more than 5 times increase in Renewable Capacity from 35 GW (upto March 2015) to 175 GW by 2022. The gross generation of electricity from utilities and non-utilities in India was 11,79,256 GWh in 2013-14 and growing @ of 6%. If India is able to achieve its target, the share of Grid interactive renewable energy will go up to 28%. To match this, IR may have to purchase power from renewable energy generating companies.

3. Indian Railways may prioritize following additional de-carbonization strategies for coming years (2022/2030).

- Tree plantation along side track:

Increasing green cover is one of the three dimensions of reducing carbon footprint, the other two being reducing GHG emission and reducing power demand. IR has issued policy directive to Zonal Railway to liaise on priority with State Forest Departments in their jurisdiction and enter into agreements with them for boundary plantation of trees alongside track.

But unplanned tree growth along side track may obstruct signal visibility and hamper train operation. It may even cause accident or break down of OHE (Overhead Equipment). However, with proper selection of trees to be planted and distance to be maintained, its adverse impact on train operation especially in electrified sections can be prevented/ minimized under extreme weather conditions.

The majority of officers surveyed feel that there is no problem in planting tree along side track especially if we choose medium height trees. However, tree plantation drive by IR in the past has been mostly on paper. Also, forest department officials have not been cooperative on the issue of trimming, and unchecked growth has hampered train operation. There is also apprehension that forest officials are overloaded with work and will not take interest in planting trees along side track. The initiative of tree plantation along side track appears to be a one sided affair from Ministry of Railways. There is an

apparent need for issue of policy directive from Forest Department to its officials to make it a joint responsibility.

- Localised processing of waste:

Railways world over are processing their own waste and IR should urgently take this step for environment protection.

Centralised processing of waste has failed miserably across cities in India. Municipal corporations are over burdened with solid waste. Hence, solid waste generated at major stations needs to be processed at same locations. There are two options available for waste disposal:

- a. Installation of waste to energy conversion plant.
 - b. Installation of waste to compost plant.
- Discontinuing production of Diesel Locomotives:

Diesel locomotives are the biggest source of GHG emission in IR. Now, IR has accelerated pace of electrification. By end of 2014-15, IR had 22224 Kms of electrified route length which constituted about 33% of total route length of IR.

Railway has 5714 nos Diesel locomotives as against 5016 nos Electric locomotives. Most of the officers surveyed agree that further production of diesel locomotives needs review and the same can now be done easily as both are under same

administration. However, diesel locomotives will still be needed for accident relief trains, shunting purpose, back up for clearing train in case of power failure. Production of energy efficient diesel locomotives needs to be done to replace inefficient ones. The progress of electrification is not satisfactory. Traffic growth needs to be considered. Requirement of new lines (un-electrified) needs to be considered. It should be noted that electricity generated in India is also not clean. However, there is no denying the fact that reduction of population of diesel locomotives progressively is needed to bring significant reduction of carbon footprint.

- Use of bio-diesel in interim period:

The use of bio-fuel by way of partial mixing in petro-diesel is being pursued in IR to increase share of renewable energy. It is felt that the policy initiative to directly procure bio-diesel for 5% blending with High Speed Diesel (HSD) Oil will facilitate reduced dependence on fossil fuel. However, even bio-Diesel produces GHG (CO₂). Hence, pursuing this policy does not support Railways' and India's commitment towards reducing GHG.

There is a view that IR's experience with Jatropha has not been successful and it competes with land for food. This issue needs attention of policy makers and further research. There are also views such as bio-diesel is not cost effective and burden on logistics. In any case, 5% substitution is too low a target and will have very little impact towards reducing carbon footprint. It can never be a substitute for electric traction where same land can be used for generating solar energy which is much more effective.

However, view of some officers that it may be allowed on low key till diesel locomotives are phased out, should not be ignored provided land, where *Jatropha* is grown, is not replacing any food crop.

- Pursuing hydrogen powered train technology:

World over technological advancement is being done to use hydrogen as fuel for replacing fossil fuel. Germany has taken lead in this matter to find solution for replacing diesel locomotives. Recently, Germany hosted world's first zero emission, hydrogen fuel passenger train in year Nov'2016 and planning it as replacement for 4000+ Diesel powered train running in their system.

It is suggested that IR should start exploring in this direction seriously with substantial financial commitment to keep pace with the best in the world. The suggestions of surveyed officers range from full enthusiasm for the adoption of new technology to full doubt about its future potential in Indian context. Some officers are viewing the technology as competing with solar energy. This has been deliberated in detail in the course of research. The fuel cell technology will work as supplement to time variant solar and wind energy. This technology will almost become a necessity as the share of renewable energy increases. The surplus solar energy/ wind energy generated has to be stored to take care of shortages when generation is not taking place.

After achieving its initial target of increasing renewable power generation, use of hydrogen for energy has to be given importance at national level too. MNRE has already

done some work in this area. Indian Railway may consider joining hands with MNRE on this issue. Technology tie up with Alstom may be another way forward.

SUGGESTIONS FOR FURTHER RESEARCH

The Indian Railways is presently having data on total electrical power consumed. A research is needed to find out how much its demand varies over time of the day. It may then be superimposed with renewable energy generated to find out requirement of energy storage. In the later phases, say after year 2022 when India achieves its goal of solar power generation, Indian Railways may have to find out ways to match electrical energy demand with electrical energy generated on time of the day basis. In brief, India may become energy surplus during daytime and energy deficit during night time unless energy storage options are explored.