Technology Fact Sheet for Mitigation

C. Reciprocating Engines (RE) [i]

Sector: Energy	
Subsector: Power	
Technology characteristics	
Introduction	An engine in which the movement of the pistons back and forth causes the rotary motion of the crankshaft, thus driving an alternative current generator to generate electricity.
Technology characteristics/highlights	• There are many types of RE's. Slow Speed, Medium Speed, and High Speed. High speed RE's are the most efficient units with an efficiency reaching 58%. • Could operate on a wide variety and grade of fuels (except coal). • For countries where oil products are redundant the technology could be a perfect economical solution. • Diesel engines are used to provide the motion.
Institutional and organizational requirements	• EDL does not have sufficient expertise to operate these plants. • Training programs and capacity building initiatives will be needed to ensure proper management and operation of the plant. • Could be incorporated into MOEW plans through the feed in tariff and PPP rules.
Operation and maintenance	Compared to other technologies, such unit does not need a lot of maintenance, no need for so many people in the plant.
Endorsement by experts	Recommended by experts mainly for distributed generation.
Adequacy for current climate	• RE are not very sensitive to site conditions. • Increase in temperature has no effect on the performance and no significant reduction in efficiency.
Scale/Size of beneficiaries group	The whole power network will benefit from improved efficiency.
Disadvantages	Disadvantages are relative and are very project specific. Below are some: • High capital cost compared to CCGT and other technologies. • GHG emissions will depend on the fuel used.
Capital costs	
Cost to implement mitigation technology	• The cost varies between USD1,000 and USD1,600 per each installed kW. It depends on the project mode of operation, speed type and the size of units. • As for the cost of production this solely depends on the type of fuel used in the pant. • According to MOEW, the cost of production is: RE @ NG is 9.86 ¢/kWh RE @ HFO is 10.5 ¢/kWh

	RE @ DO is 18 ¢/kWh
Additional cost implement mitigation technology, compared to "business as usual"	It is given that today the average cost of production in Lebanon is ~18.5 ¢/kWh. If the plant is constructed to operate on NG, DO or HFO, there will be no additional cost.
Development impacts, direct and indirect benefits	
Direct benefits	RE @ NG is 9.86 ¢/kWh RE @ HFO is 10.5 ¢/kWh RE @ DO is 18 ¢/kWh Compared to existing cost of around 17 cents/kWh
Reduction of vulnerability to climate change, indirect	No negative impact.
Economic benefits, indirect Employment Growth & Investment	There are many economic benefits one can think off when considering a power plant. MOEW has identified two figures in economic improvements: • The value of loss of load (VoLL) is around USD1,600 /MWh. Thus the additional energy produced satisfies the economy by reducing the losses due to unsupplied energy. • Cost of Private Generation: since the Lebanese community invests a lot in private generation thus additional supply will remove the burden of private generation from Lebanese individuals.
Social benefits, indirect income, education	New jobs for distributed generation option.
Environmental benefits, indirect	More efficient energy conversion will lead to GHG emissions reduction.
Local context	
Opportunities and Barriers	No trend to use reciprocating engines on the national scale and with capacities up to 50MW.
Market potential	Good market potential especially for the private sector.
Status	The technology has been adopted for partial base load generation and in some cases as peaking units.
Timeframe	Short and medium time
Acceptability to local stakeholders	Stakeholders, and Lebanese in general, are familiar with the technology.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment Reports For Climate Change Mitigation – Lebanon. You can access the complete report from the TNA project website http://tech-action.org/**