Distributed energy systems botswana

DE technologies include the full array of renewables suitable for deployment on local networks such as photovoltaics, biogas and biomass cogeneration, and geothermal, wind, wave, tidal and small-scale hydroelectric power. Cogeneration through "combined heat and power" (CHP) and trigeneration through "combined cooling, heat and power" (CCHP) are also considered as distributed energy technologies.

DER deployment has experienced steady growth over the years while more and more power is now being provided by IPP"s. Benefits of DE include low transmission and distribution costs, improved accessibility, improved energy efficiency, security and reliability, as well as a reduction in environmental impact. The challenges to full-scale adoption of DE include political, legislative, finance and economic, as well as technical barriers.

The number of countries implementing policy measures and targets aimed at improved distributed energy deployment has been observed to be on the increase, especially regarding renewable energy sources; there is also an increase in the diversity of these policies. Table 1 shows a global coverage of regions with renewable energy policies in the years 2004, 2013 and 2014.

Reciprocating Engines: reciprocating engines are a mature technology that is largely proliferated mainly due to their lower capital investment costs, fast start- up capabilities and higher energy efficiencies when combined with heat recovery systems. Most reciprocating engines run either on fuel or natural gas with an

increasing number of engines running on biogas produced from biomass and landfill waste. Most of the reciprocating engines are used as back-up or stand-by generators; some are used as peaking generators and as continuous generators. Reciprocating engines, however, do not perform well in terms of noise, maintenance and emissions.

Gas Turbines: gas turbines are widely used for electricity generation. They mostly run on natural gas and have lower emission levels. They are widely used as continuous generators; with some being used as standby generators and peaking generators. Gas turbines are widely used in cogeneration.

Fuel cells: instead of converting mechanical energy into electrical energy, fuel cells are built to convert chemical energy of a fuel into electricity; and usually either natural gas or hydrogen is used as fuel. Fuel cells continue to be a major field of research and considerable effort is put in cutting down capital costs and improving efficiency which are the two main drawbacks to this technology.

Renewable sources: renewables have been utilised as distributed energy resources; renewable energies range from photovoltaics, wind, thermal energy etc. These sources only qualify as distributed generation if they satisfy the definition criteria. Distributed generation is thus not identical as renewable energy. For instance,

offshore wind farms are not considered as "true" distributed generation.

Storage: a distributed energy resource is not limited to electricity generation but may also include a device to store distributed energy. Distributed energy storage systems (DESS) applications include numerous types of battery, pumped hydro, compressed air, and thermal energy storage.

In addition to the technologies listed in the forgoing sections, are interface or interconnection technologies; these consist of both hardware and software equipment that makes up the physical link (or electrical connection) between distributed energy resource and the outside electrical power system (usually the local electric grid); and it can also include monitoring, control, metering, and dispatch of the distributed energy resource unit. They include inverters, transformers, power meters, transfer switches, and information and telecommunication technology.

With the persistence load shedding affecting the whole sub-region it makes sense at least in the short term to encourage small businesses and individuals to invest in energy generation either for own use or for distribution to other users having energy deficits. This will improve security and reliability of energy availability and supply in terms of:

- Back up generation: the use of distributed generation as backup or standby supply will prevent operational failures during peak hours or when there are network problems; in fact backup generators have been installed at critical locations such as hospitals and shopping malls; and increasingly many small businesses are investing in backup generators.