CIGRÉ Study Committee C6

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG C6-28	**Name of Convenor : Ravi Seethapathy (Canada)** **E-mail address**: **ravi.seethapathy@gmail.com**
Technical Issues : 1, 3, 4, 7	**Strategic Directions : 1,3**
The WG applies to distribution networks : yes	
Title of the Group: Hybrid Systems for off-grid power supply	

Scope, deliverables and proposed time schedule of the Group :

Background:

Access to electricity is still lacking for some 1.3 billion people – one fifth of the global population. Most of these people live in the rural and remote areas of the developing world. Another one billion people in these countries are served by unreliable power supply characterized by unplanned power outages, massive losses, and low power quality. The efforts of power utilities and other stakeholders in these countries are directed to provide access to reliable electricity services in yet un-electrified or poorly electrified areas, and to cope with the affordability problems of poor communities. The United Nations has set the year 2030 as a target date for universal access to modern energy services, including electricity.

The electrification of rural areas has often been based on electricity supply from a central grid. But current renewable energy technologies offer enhanced opportunities for off-grid power systems, and include photovoltaic systems, wind turbines, biomass-fuelled combined heat and power units, hybrid systems, storage facilities and fuel cells. Individual off-grid facilities include Solar Home Systems, portable battery kits and similar solutions to satisfy initial electricity needs. However, as well-being increases so does electricity demand with the consequence, that after time, a more powerful electricity supply is needed, such as through collective mini-grid based systems. Estimates of the number of off-grid power systems needed to achieve global electrification, rank from 95,000 mini-grid based systems of approx. 300 kW to 400,000 systems of approx. 70 kW. It is justified to argue that regarding mini-grid based power systems a large market exists for which both utility-scale systems and private or community owned systems are needed.

The context and objectives for grid-connected and off-grid systems are completely different. From an off-grid perspective, challenges include a 24/7 electricity supply and possible connection of the system to a future grid extension for which the technical features need to satisfy certain standards.

Scope:

The study will:

- Review the state of the art of hybrid facilities including the mini-grids for off-grid power supply to rural and remote areas.
- Consider all potential consumers including households, shops, public institutions, and small industries.
- Review the various options for power generation including, fossil fuelled facilities, small-hydro, photovoltaics, biogas, and wind turbines.
- The study will also consider the local context including the need for education, technology

transfer and training, particularly regarding developing countries.

- Storage facilities are critical components of hybrid systems, and a major cost factor during the life time of hybrid systems. The study will address storage options and the suitability and field performance of various battery types for hybrid applications, their battery management system and charge/discharge strategy.
- For the delivery of 24/7 electricity service, hybrid solutions normally use a diesel generator or similar source.The study will address the trade-off between a diesel-generator, a larger battery and a larger PV capacity.
- Provide case studies. If deemed useful, a questionnaire will be issued to investigate practices and experiences of relevant organisations.
- Define and evaluate test procedures.
- Determine the parameters of a hybrid system in order to fully assess the condition, performance, obsolescence etc, and establish a set of practical guidelines for engineers.
- Review existing technical and safety standards and assess their relevance.

Deliverables : Technical Brochure :

Summary in Electra :

Tutorial :

Time Schedule : start August 2014, end August 2016

Comments from Chairmen of SCs concerned :

Cooperation with organisations such as CIRED, IEEE/PES, ESMAP will be aimed for.

Approval by Technical Committee Chairman :
Date :

Table 1: Technical Issues of the TC project "Network of the Future" (cf. Electra 256 June 2011)

1	Active Distribution Networks resulting in bidirectional flows within distribution level and to the upstream network.
2	The application of advanced metering and resulting massive need for exchange of information.
3	The growth in the application of HVDC and power electronics at all voltage levels and its impact on power quality, system control, and system security, and standardisation.
4	The need for the development and massive installation of energy storage systems, and the impact this can have on the power system development and operation.
5	New concepts for system operation and control to take account of active customer interactions and different generation types.
6	New concepts for protection to respond to the developing grid and different characteristics of generation.
7	New concepts in planning to take into account increasing environmental constraints, and new technology solutions for active and reactive power flow control.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics.
9	Increase of right of way capacity and use of overhead, underground and subsea infrastructure, and its consequence on the technical performance and reliability of the network.
10	An increasing need for keeping Stakeholders aware of the technical and commercial consequences and keeping them engaged during the development of the network of the future.

Table 2: Strategic directions of the TC (cf. Electra 249 April 2010)

1	The electrical power system of the future
2	Making the best use of the existing system
3	Focus on the environment and sustainability
4	Preparation of material readable for non technical audience