Подкомитет Технического комитета РНК СИГРЭ по тематическому направлению С6 «Системы распределения электроэнергии и распределенная генерация»

Промежуточный отчет

о деятельности рабочей группы WG C6.28 "Гибридные системы для автономного электроснабжения", август - декабрь 2014 года

Представитель РНК СИГРЭ в исследовательском комитете С6 "Распределительные сети и распределенная генерация", член рабочей группы WG C6.28 **П.В. Чусовитин**

Екатеринбург, 2014

На 45-ой Сессии СИГРЭ в августе 2015 года прошло первое собрание рабочей группы WG C6.28 "Гибридные системы для автономного электроснабжения". На собрании обсуждался состав участников, возможные места для последующих встреч, а также проекта содержания итогового отчета о деятельности группы.

В группу вошли два представителя от РНК СИГРЭ:

- Чусовитин Павел Влерьевич, к.т.н., доцент кафедры "Автоматизированные электрические системы" Уральского федерального университета;
- Корев Дмитрий Андреевич, руководитель подразделения Smart Grid компании EnerZ в России.

В ходе первой встречи и последующей переписки обсуждались и вносились правки в проект содержания итогового отчета по работе группы. Окончательно содержание отчета (представлено в Приложении 1) было согласовано в ноябре 2014 года.

После встречи на 45-ой Сессии СИГРЭ работа в группе велась по переписке через электронную почту. В ходе переписки была установлена договоренность на первом этапе работы сфокусироваться на изучении существующих автономных систем электроснабжения. От некоторых членов рабочей группы поступили инициативные предложения предоставить информацию о некоторых существующих автономных схемах электроснабжения. Корев Д.А. предложил подготовить информацию о проекте электроснабжения комплекса золотодобычи, которым занимается компания EnerZ.

На данный момент от членов группы поступило несколько отчетов с описанием существующих систем автономного электроснабжения. Описание основных представлено в таблице 1.

Таблица 1 - Описание автономных схем электроснабжения

Место размещения системы	Мощность установок на органическом топливе, кВт	Мощность установок ВИЭ, кВт	Мощность/емкость накопителей, кВт/кВт*ч
Остров Китнос, Греция	9	11 (солнечные панели)	-/48 кВт*ч (аккумуляторные батареи)
Оркнейские острова, Шотландия	12700	11320 (ГЭС); 11500 (ВЭС)	6000/- (ГАЭС)

Кроме представленных в таблице 1, направлено обобщенное описание применения автономных систем в ВС США, а также в станах Африки. Обобщение информации по этим отчетам пока не производилось.

В ходе переписки активно обсуждался вопрос наполнения рабочей группы представителями максимального числа стран. За период с сентября по декабрь 2014 года к группе присоединились представители Бразилии, Чили, Южной Кореи, Индонезии. Актуальный список членов рабочей группы представлен в Приложении 2.

Еще одним вопросом, обсуждаемым в переписке было место и время проведения следующей встречи. После многочисленных обсуждений круг был сужен до следующих мероприятий:

- Indian Smart Grid Forum, March 3-7 in Bangalore, India;
- IEEE PES GM, July 26–30, 2015 Denver, USA;
- Cigre Symposium, Oct 26-30, 2015, Cape Town, South Africa (Our Second Meeting selected).

Симпозиум СИГРЭ в Кейп Тауне уже определен в качестве места встречи рабочей группы. Что касается первых двух мероприятий, между ними еще идет выбор.

В заключение следует отметить, что пока ведется подготовительная работа конкретных результатов в работе группы пока не достигнуто.

Приложение 1. Содержание итогового отчета рабочей группы WG C6.28

CIGRE C6.28 WG
Hybrid Systems for Off-grid Power Supply
(Remote Grids)
Finalised Table of Contents

Nov.10, 2014

(Target 120 pages)

ACKNOWLEDGEMENT

- Members, Experts, Corresponding Members,
- Other Contributors

EXECUTIVE SUMMARY

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A.1.0 Functional Definitions & Terminology

A.1.1 Functional Definition

A.1.2 Key Elements of Remote Grids

A.1.3 Key Differentiating Factors

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A.2.1 Motivation and Strategic Directions

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- Access to clean energy

A.2.1.2 Economic Development Opportunities

- Energy as an essential means to poverty alleviation
- Rural and Agriculture Sector Development

A.2.1.3 Maximization of Renewables, Minimizing Fossil Fuel Dependency

- Islands – reduce dependency on fossil fuel imports;
- Advance control systems to maximise renewables

A.2.1.4 Sustainability, Reliability and Dependability Considerations

- Local Community ownership, tariff setting, maintenance skills
- Hardy systems for “rustic settings”
- Baseline simple/requisite cybersecurity principles

A.2.1.5 Financial Viability and Bankability of Solutions

- Affordability, credit-worthiness of solutions, pre-paid options
- Credit Champions
- On-going performance /reporting metrics

A.2.1.6 Challenges

- Technical (required systems intelligence for autonomous operation)
- Standards/Testing protocols given its global diverse applications
- Regulatory/Ownership models
- Local Safety and Maintenance

- Quantifying Benefits (value, cost, reliability and resiliency)

A.3.0 Scope of Study

A.3.1 Inclusion

- Permanent Off-Grid
- Geographical Islands, Rural Villages, Remote Communities, Remote Mines, Mobile Platforms, Off-shore fixed Platforms, Shipping/Mobile Platforms, and Remote Observation/Security/Military bases
- Structured and Replicable Guidelines
- Grid-ready/Potential for Grid-tie later (not become stranded asset)
- SHORT review of different business models for off-grid rural electrification in developing countries

A.3.2 Exclusion

- DETAILED Socio-economic models, Social Customs and Practices

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B.2.6 Grid-Tie Ready / Future Potential - Interconnection Standards to Utility Grid

B.3.0 Power System and Energy Management Dynamics

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B.3.2 Power System Dynamic Performance and Challenges
B.3.3 Limitations in Islanded Capabilities
B.3.4 Real-time Fuel Switching Issues

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B.4.1 Diesel Hybrid Gensets
B.4.2 Energy Storage for Renewables
B.4.3 Supervisory Control Platforms (multiple Generation Control, Fuel Optimization)
B.4.4 Reliability, Maintainability and Operations

B.5.0 Existing Remote Grid Sites

B.5.1 Uses Cases included in Appendix -A

C. CHAPTER 3 – Evaluation of Existing Remote Grid Systems & Integration of Future Technologies

C.1.0 Sample Existing Off-Grid Sites

(Systems, Topology, Fuel Mix, Reliability, PQ, Dynamic Performance, Issues & Challenges)

C.1.1 Remote Communities (Northern Canada and Alaska, USA)
C.1.2 Mines (Australia)
C.1.3 Hutacondo Village (Chile)
C.1.4 Rural Villages (India, China, Brazil, South Africa, Russia, Other)
C.1.5 Kythnos Island (Greece)
C.1.6 Other Islands (Caribbean, Indonesia, Philippines)
C.1.7 Mobile Platforms (USA, Canada, Other)
C.1.7 Above Uses Cases (if available) to be included in Appendix

C.2.0 Externalities and Varying Local Conditions in Above Sample Off-Grid Sites

(Climatic, Power Theft, Crime, Education, Ownership models, Maintenance/Servicing considerations, Fuel delivery, Landed Cost of Delivered Fuel, Reliability, Power back-up provisions, Power Tariff, LCOE, How Financed and Built, etc.)

C.2.1 Remote Communities (Northern Canada and Alaska, USA)
C.2.2 Mines (Australia)
C.2.3 Hutacondo Village (Chile)
C.2.4 Rural Villages (India, China, Brazil, South Africa, Russia, Other)
C.2.5 Kythnos Island (Greece)
C.2.6 Other Islands (Caribbean, Indonesia, Philippines)
C.2.7 Lessons Learnt – Identification of Similarities and Differences

C.3.0 Issues in Implementing Future Technology in Above Sample Off-Grid Sites

(Power/Frequency/Voltage Balancing, Intelligent Load Management, Renewables Maximization, Instrumentation, Controls, Integration, Communications, etc.)

C.3.1 Remote Communities (Northern Canada and Alaska, USA)
C.3.2 Mines (Australia)
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10. Perfect Power, Illinois Inst. Of Technology and microgrid at UCSD Campus, USA
11. Microgrid at BCIT Campus and Hartley Bay First Nations Community in BC, Canada
12. Kasabonika Lake First Nation Community, and one more in Northern Ontario, Canada
13. Kangiqsualujjuaq First Nation Community, Quebec and Ramea Island (Wind-Diesel-Hydrogen), NFLD, Canada
14. Remote Mines that now has extensive Solar adoption
15. Kythnos Island and a few others, Greece
16. 59 Palms, CA and one Alaskan Remote Grid, USA
17. Examples of Rural Remote Grids, in Sub-Saharan Africa or in South Africa
18. Cronimet Mine, Thabazimbi, South Africa
19. Island of “Fernando de Noronha”, Brazil
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Hybrid Systems for Off Grid Power Supply

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