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Regional Testing Laboratory, Guwahati

The idea of setting up a Regional Testing laboratory in North East was conceived in 2005–2006. The Government of Assam and especially the Assam State Electricity Board (ASEB) took a keen interest in the project and with their sincere cooperation and necessary funding by the Ministry of Power, Govt. of India, the idea of a Regional Testing laboratory materialized in Guwahati. On 20th July 2007, the official journey of the Regional Testing Laboratory, Guwahati was set off. Apart from regular testing activities, the RTLG is also acting as a coordinating center between the potential clients of this region and the other divisions of CPRI.

1.0 INTRODUCTION

The North East India refers to the easternmost region of India consisting of the contiguous Seven Sisters states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura) and Sikkim [1]. This North Eastern Region (NER) is a true frontier region. It has over 2000 km of border with Bhutan, China, Myanmar and Bangladesh and is connected to the rest of India by a narrow 20 km wide corridor of land known as the Siliguri Corridor in West Bengal. The region is one of the most ethnically and linguistically diverse regions in Asia. Each state has its distinct cultures and traditions. Being a home for more than 166 separate tribes and a wide range of distinguishable languages, the NER has been the meeting point of many communities, faiths and cultures, a place renowned for its magical beauty and bewildering diversity [2].

Unlike other parts of the country, the NER remained isolated and untouched from the economic development for decades. The main stumbling block for economic development of the region is the disadvantageous geographical location [3] and rise of insurgency. It is until recently that the Government of India's "Look East" policy has ascertained a fresh initiative for the infrastructure and economic development of the North Eastern Region [4].

2.0 POWER SECTOR SCENARIO OF THE NORTH EASTERN REGION

Despite a visible grim status at present, the North East India is considered as the future power house of the country. The region has a vast potential of hydropower, estimated of around 60,000 MW and 2% of which could be tapped so far [5]. The large hydropower potential of the NER has remained mostly unexploited for a number of reasons, such as status of the development of grid systems in the country, availability of economic and accessible sites near to the load centers in the other regions of the country, low demand for power in the sparsely populated NER, and considerations regarding the impact of hydropower development on the livelihoods of the indigenous population, the river ecosystem and the safety of dam construction in this seismically active zone [6].

Despite all the obstacles, a good number of Hydro Electric as well as Thermal power plants are coming up, mostly initiated by NHPC, NEEPCO, NTPC, ONGC and various state Electricity Boards. With key projects like 750 MW Palaton Thermal Project in Tripura, 750 MW Bongaigaon TP in Assam, 2000 MW Lower Subansiri HEP and 600 MW Kameng HEP in Arunachal Pradeshare scheduled to be operational by 2013–2014 [7], an estimated 5000 MW of power will be available for consumption by 2014.

TABLE 1

STATE/MODE-WISE GENERATION (THERMAL/NUCLEAR AND HYDRO) INSTALLED CAPACITY OF POWER UTILITIES IN NER (AS ON 31 MARCH 2010) [8] (IN MW)

States	Mode-wise breakup							
	Thermal				Nuclear	Hydro (renewable)	RES (MNRE)	Total
	Coal	Gas	Diesel	Total				
Arunachal Pradesh	0.00	0.00	15.88	15.88	0.00	0.00	67.42	83.30
Assam	60.00	239.00	20.69	319.69	0.00	100.00	27.11	446.80
Manipur	0.00	0.00	45.41	45.41	0.00	0.00	5.45	50.86
Meghalaya	0.00	0.00	2.05	2.05	0.00	156.00	31.03	189.08
Mizoram	0.00	0.00	51.86	51.86	0.00	0.00	28.47	80.33
Nagaland	0.00	0.00	2.00	2.00	0.00	0.00	28.67	30.67
Sikkim	0.00	0.00	5.00	5.00	0.00	0.00	47.11	52.11
Tripura	0.00	127.50	4.85	132.35	0.00	0.00	16.01	148.36

Source: Ministry of Power, Govt. of India.

TABLE 2

STATE-WISE ACTUAL POWER SUPPLY POSITION (ENERGY) IN NER (NOVEMBER 2007 AND 2008) [9]

States	November 2008				November 2007			
	Energy				Energy			
	Requirement (MU)	Availability (MU)	Surplus/Deficit (–)		Requirement (MU)	Availability (MU)	Surplus/Deficit (–)	
			(MU)	(%)			(MU)	(%)
Arunachal Pradesh	36	24	–12	–33.3	33	26	–7	–21.2
Assam	404	366	–38	–94	394	369	–25	–6.3
Manipur	50	43	–7	–14	51	50	–1	–2
Meghalaya	143	120	–23	–16.1	138	108	–30	–21.7
Mizoram	29	24	–5	–17.2	23	22	–1	–4.3
Nagaland	42	37	–5	–11.9	30	27	–3	–10
Sikkim	29	28	–1	–3.4	29	28	–1	–3.4
Tripura	65	54	–11	–16.9	67	52	–15	–22.4

Source: Lok Sabha Unstarred Question No. 451, Dated on 20 February 2009.

Tables 1 and 2 below give details of the power scenario in the NER.

3.0 CPRI IN THE FRONTIER REGION

The CPRI was not a stranger in the NER. Many power utilities were using the expertise of CPRI even in the 80s and 90s. In 2004, when the Government of India had given a new dimension to its "Look East" policy and emphasized on better partnership with the ASEAN countries, the faster development of the NER was given much importance. The thrust area was the power sector. Perceiving the vast expansion of power sector in NER in near future and encouraged by the Ministry of Power, Government of India, CPRI also decided to step up its activities and use its expertise for the service of the region. The idea of setting up a Regional Testing laboratory in North East was conceived in 2005–2006. The Government of Assam and especially the Assam State Electricity Board (ASEB) took a keen interest in the project and with their sincere cooperation and necessary funding by the Ministry of Power, Govt. of India, the idea of a Regional Testing laboratory materialized in Guwahati. A small Assam Type building located inside the ASEB office complex in Narengi area of the city was identified to be used for the purpose.

On 20th July 2007, the official journey of the Regional Testing Laboratory, Guwahati was set off by the Director General of CPRI, Mr. A. K. Tripathy, in presence of the Hon'ble Minister of Power, Industries, Commerce and Public Enterprises, Govt. of Assam, Mr. Pradyut Bordoloi, The Chairman of ASEB, Mr. S.C. Das, the Director of CPRI, Mr. P. K. Kognolkar and other dignitaries.

4.0 PRESENT STATUS

At the outset, a mobile testing laboratory van was used to serve the clients. Gradually, when the proposed laboratory building was almost ready after necessary renovation, the mobile laboratory was shifted permanently into the present building. At present, the Regional Testing Laboratory, Guwahati (RTLG) is fully equipped with test facilities of insulating oil used in electrical equipments according to the relevant standards. The major tests that are conducted regularly on the transformer oil are:

1. Inter Facial Tension
2. Flash Point
3. Sludge Content
4. Electric Strength
5. Dielectric Dissipation Factor (Tan δ)
6. Resistivity
7. Water Content
8. Neutralization value
9. Dissolved Gas Analysis

All most all the major power utilities and industries in the region are regular clients of Regional Testing Laboratory Guwahati. The three companies under Assam State Electricity Board (viz. Assam Power Generation Corp. Ltd. (APDCL), Assam Electricity Grid Corporation Ltd. (AEGCL) and Assam Power Distribution Corp. Ltd. (APDCL), NEEPCO, NHPC, ONGC, IOCL, OIL, PGCIL, Meghalaya Energy Corporation Ltd. (MeECL), Tripura State Electricity Corporation Ltd. (TSECL) and other power utilities and industries in the region are also utilizing the test facilities of RTLG.

Apart from regular testing activities, the RTLG is also acting as a coordinating center between the potential clients of this region and the other divisions of CPRI like DMD, DCCD, MTD, PSD, EATD and training Division.

5.0 CONTRIBUTION TO POWER SECTOR

Over a short period of time since inauguration, the Regional Testing Laboratory, Guwahati has proved its indispensability in the service of the power sector in the North Eastern Region. In addition to the characterization of transformer

oil, the laboratory is also specialized in Dissolved Gas Analysis (DGA), which is the most sensitive and reliable technique used for evaluating the health of oil filled electrical equipment.

Transformers are vital components in both the transmission and distribution of electrical power. The early detection of incipient faults in transformers is extremely cost effective by reducing unplanned outages. Insulating oils under abnormal electrical or thermal stresses break down to liberate small quantities of gases. The qualitative composition of the breakdown gases is dependent upon the type of fault. By means of dissolved gas analysis (DGA), it is possible to distinguish faults such as partial discharge (corona), overheating (pyrolysis) and arcing in a great variety of oil-filled equipment.

Information from the periodic analysis of gasses dissolved in insulating oil is valuable in a preventative maintenance program. Data from DGA,

- Reveals internal condition of transformers
- Give, advance warning of developing faults
- Monitors the rate of fault development

CASE-I		
Particulars	**DGA-I**	**DGA-II (after 6 months)**
Gen. Tr. rating	28.5 MVA	
TGC (µl/lit)	94775	128509
Methane (ppm)	2	197
Ethane (ppm)	ND	22
Ethylene (ppm)	6	216
Acetylene (ppm)	ND	305
Hydrogen (ppm)	ND	ND
Carbonmonoxide (ppm)	154	344
Carbondioxide (ppm)	4261	5578

A regular and periodic DGA can detect any incipient fault and can monitor the rate of fault development inside the transformer. And thus, DGA can minimize the maintenance expenditure by avoiding the unscheduled outages and can act as the only guide for continuation of a faulty transformer.

Some of the interesting cases of DGA which have helped the clients of RTLG to detect and take timely action on the faulty transformer are listed below:

A normal transformer developed a thermal fault within 6 months. The results were communicated to the client and they confirmed the same after inspection.

The sample was tested after Bucholtz relay actuated. The DGA clearly indicates Arcing.

CASE-II	
Particulars	**DGA-I**
Power Tr. rating	16 MVA
TGC (µl/lit)	160636
Methane (ppm)	1028
Ethane (ppm)	172
Ethylene (ppm)	453
Acetylene (ppm)	159
Hydrogen (ppm)	516
Carbonmonoxide (ppm)	2609
Carbon dioxide (ppm)	17079

The DGA results leads to a probable thermal fault. But as the concentration of gases did not increase as expected, it is possible that the fault does not exist anymore. The feedback from the client is still expected.

DGA indicates a steady increase in TGC as well as in the concentration of Acetylene. The client was communicated and explained about the implications.

CASE-III		
Particulars	**DGA-I**	**DGA-II (After 4 months)**
Power Tr. rating	16/20 MVA	
TGC (µl/lit)	136541	160636
Methane (ppm)	1600	1279
Ethane (ppm)	1240	1403
Ethylene (ppm)	1880	2166
Acetylene (ppm)	37	25
Hydrogen (ppm)	ND	ND
Carbonmonoxide (ppm)	156	144
Carbondioxide (ppm)	4875	5634

CASE-IV			
OIL SAMPLES OF A NEW TRANSFORMER OF 160 MVA, THE FIRST OF THIS TYPE IN THIS REGION WAS SENT TO RTLG FOR DGA			
Particulars	**DGA-I (before commis-sioning)**	**DGA-II (before loading)**	**DGA-III (24 hrs after loading)**
Power Tr. rating	160 MVA		
TGC (µl/lit)	44987	61042	70680
Methane (ppm)	ND	ND	1
Ethane (ppm)	ND	ND	ND
Ethylene (ppm)	ND	ND	3
Acetylene (ppm)	1	2	5
Hydrogen (ppm)	ND	ND	ND
CO (ppm)	ND	2	6
Carbondioxide (ppm)	94	160	206

This type of conclusive analysis through DGA has helped RTLG to gain confidence of its clients. As a result, periodic DGA of almost all the generating transformers of NEEPCO and ASEB are conducted at RTLG. Recently, the APDCL has also decided to monitor all of its 5 MVA and above capacity transformers through DGA at RTLG.

6.0 CONCLUSION

It is beyond doubt that the RTLG is still in the budding state and yet to achieve the goals initially setup for it. But with the growing power sector in the region and simultaneous increase in inter laboratory competition, the RTLG also needs continuous upgradation of existing facilities and infrastructure, augmentation of new facilities and more effective marketing strategy. Already an expansion proposal of RTLG is under consideration to the Ministry of Power, Government of India. Efforts are on even for procurement of suitable land for the proposed expansion. Given the kind of expertise and range of research and test facilities CPRI possesses, RTLG can play a pivotal role in serving the power sector of not only in this NER but also of the neighboring countries to a great extent in future.

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