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Practical Aspects of Reactive Power Control in Smartgrid

J. Priya

***Abstract** - Smartgrid has the advantage that if the generation capacity exceeds the maximum demand, the exess power can be fed back to the utility grid or it can be stored. Thus power flow becomes bidirectional in smartgrid. Basics of grid operations, Load-frequency control, Reactive power-voltage control, Sources of reactive power, Power system stability (Angle, Frequency, Voltage), Excerpts from technical standards and grid codes, Generator capability chart, Generator excitation system, Power system stabilizer (PSS) are the factors to be considered which influences the cost of electricity in India power market.*

***Key Words:** Power system stabilizer (PSS), Load-frequency control, Reactive power-voltage control, Gas turbine power projects (GTPP) , Integrated gasification combined cycle (IGCC)*

I. INTRODUCTION

Due to rapid increase in population, economic growth and rise in industrial sector the generation capacity needs to be increased. There are several limitations and environmental constraints in the path of power generation by conventional methods. These limitations can be overcome by using renewable energy sources and hence the application of distribution generation is becoming popular. [1]. Power the executives in smartgrid is a vital territory which needs examination. The effect of Distributed Generators on the conveyance framework, where the investigation of burden sharing among different Distributed Generators and utility lattice is a territory which needs examination. PV and power module based Distributed Generators does not carry on as consistent current or voltage source either because of parametric vulnerabilities or because of outside aggravations like climate conditions and burden changes [2].

1.1 Global trends

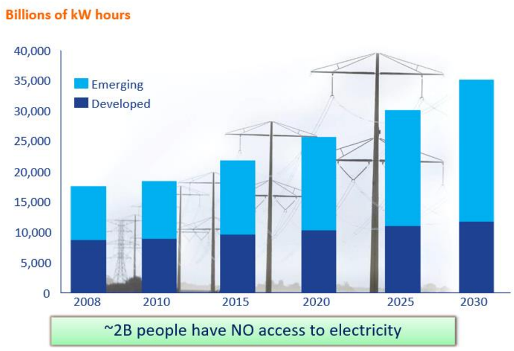

Figure 1.1: Global trends

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(i) Global dynamics
- Major additions in Asia, Africa, the Middle East and Latin America
- Europe, Japan, Korea and North America would stay nearly flat

(ii) Around 40% of the existing power plants due to retire
(iii) Growth in energy efficiency programs … Generation & distribution systems
- 4x Cost of generating a KWh versus the cost of saving a KWh

(iv) Electricity accounts for 40% Greenhouse gases Stricter emission norms
(v) Renwables power generation to increase

1.2 A grid:

Grid can be defined in many ways as per our requirements. Here it is considered as the interconnection of many elements including distributed energy resources [3].

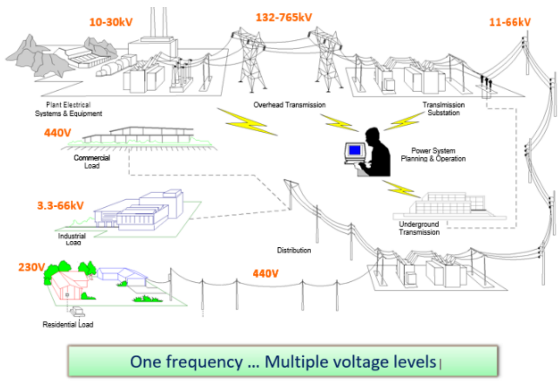

Figure 1.2 Smart Grid

II. POWER PROJECTS

2.1 Gas turbine power projects (GTPP)

GTTP has two cycles. Simple cycle and combined cycle. In combined cycle, heat recovery system is incorporated.

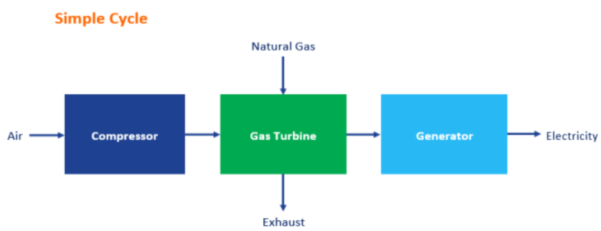

Figure 2.1 a. GTPP Simple cycle

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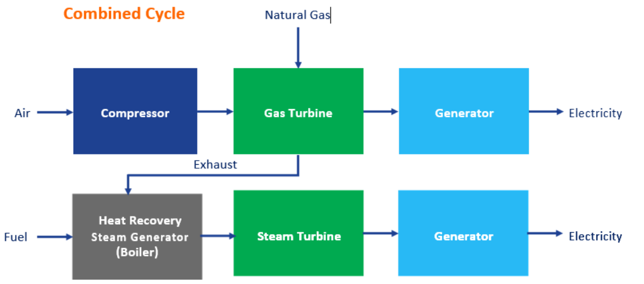

Figure 2.1 b GTPP Combined cycle

2.2 Integrated gasification combined cycle (IGCC)

IGCC has five basic systems namely Gasification, Cooling Stage, Clean up stage, Air separation System and Combined Cycle System.

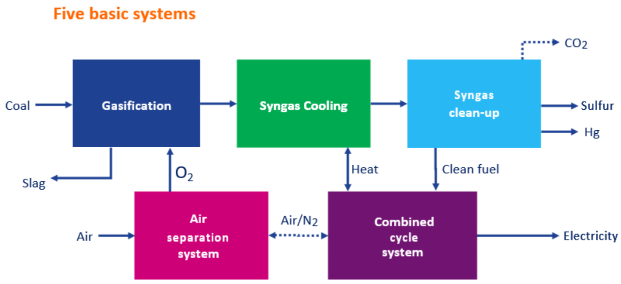

Figure 2.2 Integrated gasification combined cycle

2.3 Technology efficiency (%)

Power senario[4] shows that demand is increasing and smarter technology is needed to meet the future demand. The technology efficiency in percentage for different processes is shown.

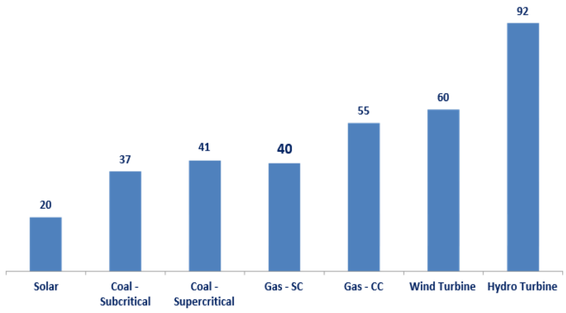

Figure 2.3 Technology efficiency

2.4 Typical load duration curve

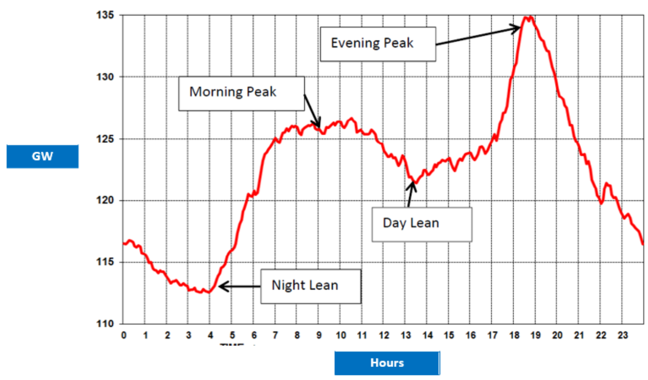

Figure 2.4. Load duration Curve

III. RESULT FOR POWER DEMAND

To meet the power demand, energy storage plays a vital role [5], in which energy can be stored during off peak hours and can be used during peak hours. Knowledge of peak demand at each region is necessary to plan the system accordingly.

3.1 Peak demand Northern Region

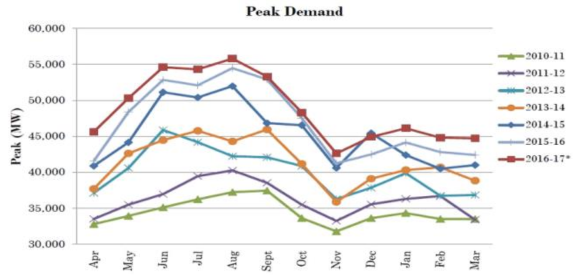

Figure 3.1 Peak demand Northern Region

3.2 Peak demand Western Region

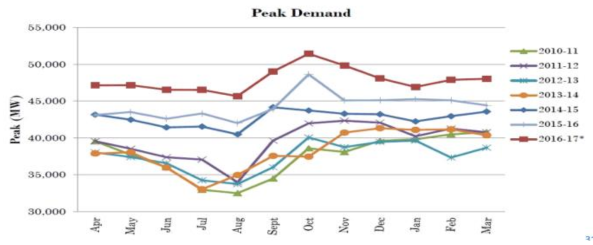

Figure 3.2 Peak demand Western Region

3.3 Peak demand Southern Region

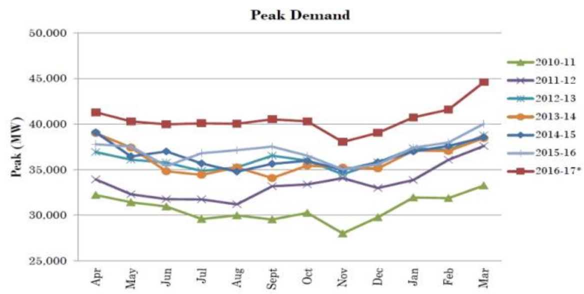

Figure 3.3 Peak demand Southern Region

3.4 Peak demand Eastern Region

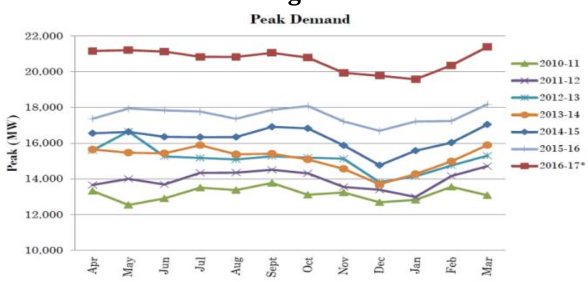

Figure 3.4 Peak demand Eastern Region

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IV. RESULT FOR LOAD DURATION

4.1 Typical load duration curve

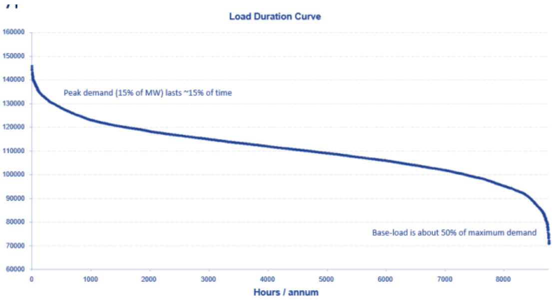

Figure 4.1 Typical load duration curve

4.2 India load curve

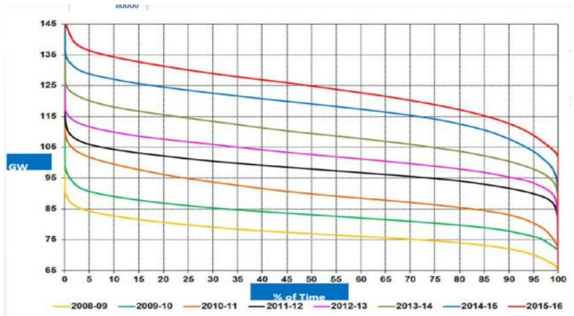

Figure 4.2 India load curve

4.3 Plant load factor (PLF)

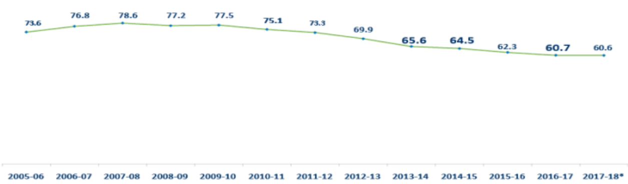

Figure 4.3 Plant load factor

4.4 Peak deficit (Energy / MW%)

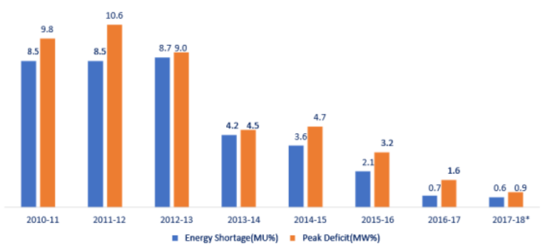

Figure 4.4 Peak deficit

4.5 AT&C losses (%)

Figure 4.5 Losses

V. ITS TIME TO BUILD SMART GRIDS

Smart grids with reactive power control is a solution to many challenges faced in the power market [6-9]. Percentage load distribution and per capita energy consumption is a dynamic factor.

5.1 Load distribution (%)

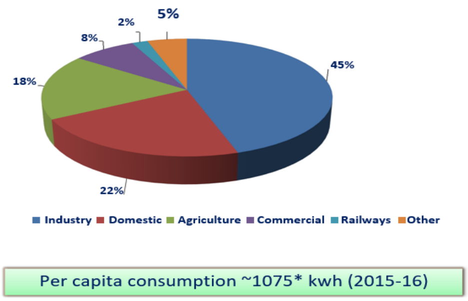

Figure 5.1 Load Distribution

5.2 Structure of India power market

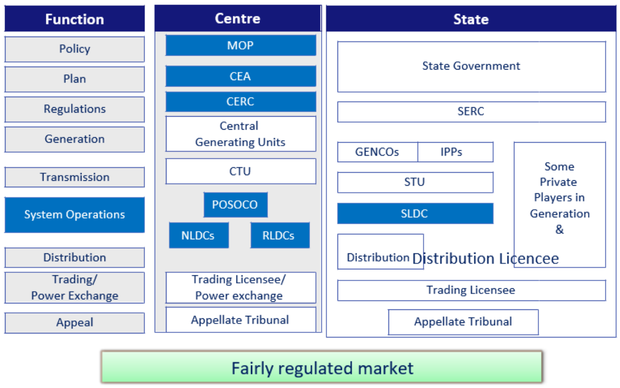

Figure 5.2 Structure of India power market

5.3 Structure of India power marke- Central

5.3.1 Ministry of Power (MoP)

(i) Responsible for administration and enforcement of legislation

5.3.2 Focal Electricity Authority

(i) Advises the legislature on issues identifying with the National Electricity Policy

(ii) Formulates momentary and point of view plans for advancement of power frameworks

(iii) Prescribes the guidelines on issues, for example, development of electrical plants, electric lines, network to the framework, establishment &operation of meters and wellbeing and specialized models

(iv) Promotes incorporated tasks of the provincial/SAARC control matrices

(v) Advises focal government, state governments and administrative commissions on every single specialized issue identifying with age, transmission and dissemination of power

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5.3.3 Central Electricity Regulatory Commission (CERC)

(i)Tariff for Central Generators/producing organizations selling in different states

(ii) Interstate transmission of power

(iii)Tariff for interstate transmission of power

(iv) Issue licenses: Interstate transmission/exchanging, fixing exchanging edge

(v)Specify Indian Electricity Grid Code

(vi) Advise on definition of Tariff Policy and National Policy

5.4 Structure of India control showcase State

5.4.1 State Regulator (SERCs)

(I) Tariff for age, supply, transmission, wheeling of power inside the state

(ii) Electricity buy and obtainment procedure of the appropriation licensees, including the cost of acquisition of power

(iii) Intra-state transmission and wheeling of power

(iv)Specify state network code

(v) Advise the State Government on arrangement matters

5.4.2 India grid vision

One Nation, One Grid, One Frequency

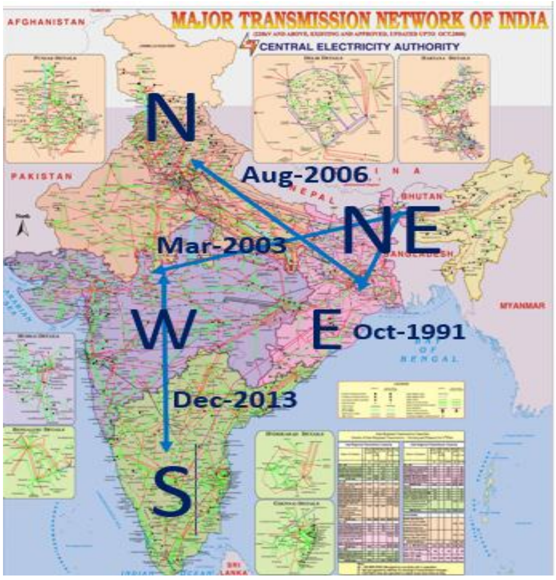

Figure 5.4 Vision of Indian Grid

(i) ONE grid

(ii) National level Load Dispatch Centre (NLDC)

(iii) Five Regional Load Dispatch Centre (RLDC)

(iv) "High capacity power transmission corridor" (HCPTC) 400kV/765kV AC, +/- 800kV HVDC

VI. CONCLUSION

By analyzing the reactive power control strategies in Indian Power Market, it is seen that the vision of One Nation, One Grid, One Frequency is fairly possible and this helps in delivering quality power to the people and makes power control flexible.

REFERENCES

1. Microgrids: Integration for power cost and control ABB. New York; 2015, [Online].
2. Mishra A, Irwin D, Shenoy P, Zhu T. Scaling distributed energy storage for grid peak reduction. In: Proceedings of the fourth international conference on Future energy systems, 2013.Association for Computing Machinery, p. 3-14.
3. Pollitt MG, Davies S, Price CW, Haucap J, Mulder M, Shestalova V, et al. Vertical unbundling in the EU electricity sector. Intereconomics 2007;42:292–310.
4. Nayek P. Many PQ events result in end-user problems. Power Today; 2016, [Online].
5. Yan X, Zhang X, Chen H, Xu Y, Tan C. Techno-economic and social analysis of energy storage for commercial buildings. Energy Convers Manag 2014;78:125–36.
6. Malinowski J, Kaderly K. Peak shaving-a method to reduce utility costs. In: Region Conference: Annual Technical and Leadership Workshop, IEEE; 2004. p. 41-4.
7. Cartes D, Ordonez J, Harrington J, Cox D, Meeker R. Novel integrated energy systems and control methods with economic analysis for integrated community based energy systems. In: Power Engineering Society General Meeting, IEEE; 2007. p. 1-6.
8. Luo X, Wang J, Dooner M, Clarke J. Overview of current development in electrical energy storage technologies and the application potential in power system op-eration. Appl Energy 2015;137:511–36.
9. Gajduk A, Todorovski M, Kocarev L. Stability of power grids: an overview. Eur Phys J Spec Top 2014;223:2387–409.

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