

2021

Transmission-Line Protection Using Synchrophasors in Smart grid

Invited presentation at

Pad. Dr. Vithalrao Vikhe Patil College Of Engineering, Ahmednagar
Via virtual mode

By

Dr. Mrs. Trupti P. Hinge

Associate Professor

Department of Electrical Engineering

JSPM's Rajarshi Shahu College Of Engineering, Pune

Email: truptihinge_elec@jspmrscoe.edu.in




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College of Engineering
Ahmednagar

Attendance for:
Date:

class-list
"2021-05-18"

"Time:" "12:40"

Names	"2021-05-18"	"Email"	"Comments"
Ajinkya Sonawane	" ✓ "	""	""
Ajit Laware	" ✓ "	""	""
Akshata Kamble	" ✓ "	""	""
Akshay Bhosale	" ✓ "	""	""
Amol Lekurwale	" ✓ "	""	""
Amruta Mane	" ✓ "	""	""
Aniket Raut	" ✓ "	""	""
Aniket Waghmare	" ✓ "	""	""
Ankita Shinde	" ✓ "	""	""
Ashwini Sanap.	" ✓ "	""	""
Atish Bhalerao	" ✓ "	""	""
Bajrang Varade	" ✓ "	""	""
Bhagyashri Jadhav	" ✓ "	""	""
Datta Admane	" ✓ "	""	""
Dhanashree Landage	" ✓ "	""	""
Dipa Lokhande	" ✓ "	""	""
Divya Sonawane	" ✓ "	""	""
Ganesh Murade	" ✓ "	""	""
Ganesh Shirsat	" ✓ "	""	""
Gaurav Varute	" ✓ "	""	""
Gauri Lahange	" ✓ "	""	""
Gayatri Dhabadgaonkar	" ✓ "	""	""
Gopal Ubale	" ✓ "	""	""
Harshal Mhaske	" ✓ "	""	""
Jaydeep Musmade	" ✓ "	""	""
Jyoti Jha	" ✓ "	""	""
Kajal Shinde	" ✓ "	""	""
Kiran Harihar	" ✓ "	""	""
Krushna Maske	" ✓ "	""	""
Madhavi Nerkar	" ✓ "	""	""
Mahesh Shinare	" ✓ "	""	""
Mangesh Mundhe	" ✓ "	""	""
Mansi Shinde	" ✓ "	""	""
Mayur Baviskar	" ✓ "	""	""
Monali Thombare	" ✓ "	""	""
Mu Irfan Nijamudeen	" ✓ "	""	""
Nehru Usare	" ✓ "	""	""
Nikita Kamble	" ✓ "	""	""
Niks Warade	" ✓ "	""	""
Omkar Swami	" ✓ "	""	""
Onkar Konge	" ✓ "	""	""
Pandurang Waghmare	" ✓ "	""	""
Pooja Ghugare	" ✓ "	""	""



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Yogesh Patil

" ✓ "

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Help/more info:

"<https://tinyurl.com/y5peu3nk>"

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<https://tinyurl.com/y6k2yqts>

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"Meet ID:" "ohk-xtnf-xxj"

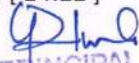
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"13:15"	"14:21"	"67"	"1"	
"12:50"	"14:22"	"84"	"5"	"13:02 (60min) [14:01]"
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"13:03"	"14:22"	"80"	"1"	
"12:55"	"14:22"	"88"	"1"	
"12:51"	"14:22"	"92"	"4"	"12:57 (20min) [13:16]"
"13:00"	"13:29"	"31"	"2"	"13:00 (5min) [13:04]"
"12:59"	"14:15"	"77"	"1"	
"13:14"	"13:19"	"6"	"1"	
"12:56"	"14:22"	"87"	"1"	
"13:01"	"14:22"	"83"	"3"	"14:12 (11min) [14:22]"
"12:58"	"14:20"	"82"	"2"	"12:58 (4min) [13:01]"
"13:19"	"14:03"	"45"	"1"	
"13:03"	"13:32"	"30"	"1"	
"13:43"	"13:50"	"8"	"1"	
"12:52"	"14:22"	"91"	"1"	
"13:16"	"13:54"	"39"	"1"	
"12:58"	"14:22"	"84"	"2"	"12:58 (9min) [13:06]"
"13:04"	"13:44"	"41"	"1"	
"13:32"	"13:32"	"1"	"1"	
"12:54"	"14:20"	"87"	"1"	
"13:02"	"14:22"	"80"	"2"	"13:02 (7min) [13:08]"
"12:50"	"14:18"	"89"	"1"	
"12:59"	"14:22"	"84"	"1"	
"12:59"	"13:58"	"60"	"1"	
"12:56"	"14:09"	"72"	"2"	"13:26 (44min) [14:09]"
"13:09"	"14:22"	"53"	"2"	"14:21 (2min) [14:22]"




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"13:06"	"14:22"	"77"	"1"	
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"12:56"	"14:18"	"83"	"1"	
"13:05"	"13:16"	"12"	"1"	
"13:11"	"14:22"	"71"	"2"	"13:59 (24min) [14:22]"
"12:56"	"14:22"	"85"	"2"	"13:29 (54min) [14:22]"
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"12:57"	"13:40"	"44"	"2"	"12:57 (1min) [12:57]"
"12:53"	"14:22"	"86"	"4"	"13:38 (45min) [14:22]"
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"13:00"	"13:20"	"16"	"2"	"13:00 (7min) [13:06]"
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"13:10"	"13:45"	"36"	"1"	
"13:15"	"13:18"	"4"	"1"	
"13:03"	"13:26"	"24"	"1"	
"13:02"	"13:22"	"21"	"1"	
"13:03"	"14:22"	"80"	"1"	
"13:06"	"14:21"	"78"	"4"	"13:06 (11min) [13:16]"
"13:09"	"14:22"	"74"	"1"	
"12:52"	"14:06"	"17"	"7"	"13:05 (7min) [13:11]"
"12:52"	"14:22"	"91"	"2"	"12:52 (66min) [13:57]"
"12:40"	"14:22"	"203"	"5"	"12:49 (92min) [14:20]"
"13:00"	"14:22"	"83"	"1"	
"12:55"	"14:22"	"88"	"1"	
"12:56"	"14:20"	"85"	"1"	
"12:56"	"14:22"	"86"	"2"	"12:56 (69min) [14:04]"
"12:52"	"14:21"	"90"	"1"	
"12:58"	"14:22"	"85"	"1"	
"13:02"	"14:22"	"66"	"3"	"13:02 (2min) [13:03]"
"13:00"	"14:22"	"84"	"3"	"13:11 (72min) [14:22]"




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12:51 (1min) [12:51]

12:57 (33min) [13:29] 13:55 (13min) [14:07]

13:05 (3min) [13:07] 13:50 (2min) [13:51]

12:50 (9min) [12:58] 14:03 (5min) [14:07] 12:58 (4min) [13:01] 14:17 (6min) [14:22]

13:12 (2min) [13:13]

13:17 (3min) [13:19] 13:20 (63min) [14:22] 12:51 (6min) [12:56]
13:04 (26min) [13:29]


13:08 (65min) [14:12] 13:01 (7min) [13:07]
13:03 (78min) [14:20]

13:08 (75min) [14:22]

13:10 (73min) [14:22]

12:56 (28min) [13:23]
13:09 (51min) [13:59]




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13:00 (6min) [13:05]

13:11 (47min) [13:57]

12:56 (31min) [13:26]

14:02 (2min) [14:03]

12:57 (6min) [13:02]

13:50 (6min) [13:55]

13:16 (6min) [13:21]

12:58 (43min) [13:40]

13:31 (1min) [13:31]

12:53 (38min) [13:30]

13:32 (2min) [13:33]

13:12 (9min) [13:20]

13:02 (10min) [13:11]

14:21 (1min) [14:21]

13:16 (57min) [14:12]

14:13 (9min) [14:21]

13:32 (1min) [13:32]

12:54 (1min) [12:54]

13:01 (4min) [13:04]

12:52 (2min) [12:53]

13:58 (25min) [14:22]

12:48 (95min) [14:22]

12:40 (7min) [12:47]

14:21 (2min) [14:22]

12:40 (7min) [12:47]

14:06 (17min) [14:22]

13:05 (63min) [14:07]

14:22 (1min) [14:22]

13:00 (7min) [13:06]

13:07 (5min) [13:11]




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Contents:

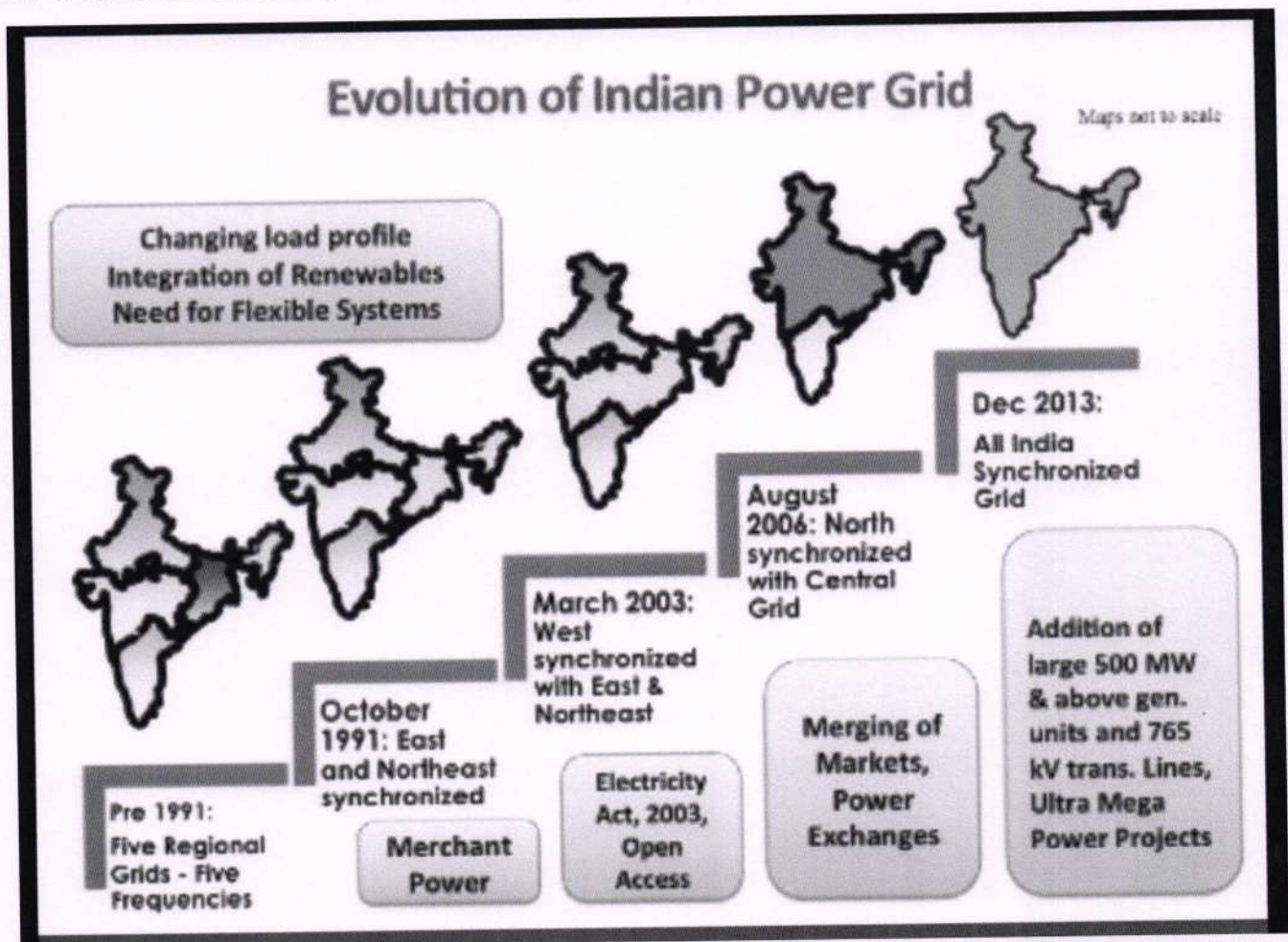
- Indian Power Grid and scenario
- What is Smart Grid
- Synchrophasor
- WAMS, PMU
- Transmission-Line Protection Scheme

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Evaluation of Indian Power Grid



Source :<http://posoco.in/>

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Indian Power Scenario

March 2021: Capacity:382 GW

- ✓ THERMAL: 61.82%
- ✓ NUCLEAR: 1.81%
- ✓ HYDRO: 12.21%
- ✓ RENEWABLE: 24.1%

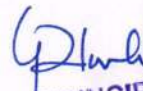
MAHARASHTRA: 42 GW (11.36%)

Fourth Largest Electricity using Company after USA, China and Europe

Source: https://en.wikipedia.org/wiki/Electricity_sector_in_India

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WESTERN REGIONAL GRID

The Western Grid has an installed capacity of 133.054 GW (as on 30-11-2020)

- 92 GW - thermal
- 7 GW- hydro
- 1,840 MW - Nuclear
- 34 GW from renewable energy sources.

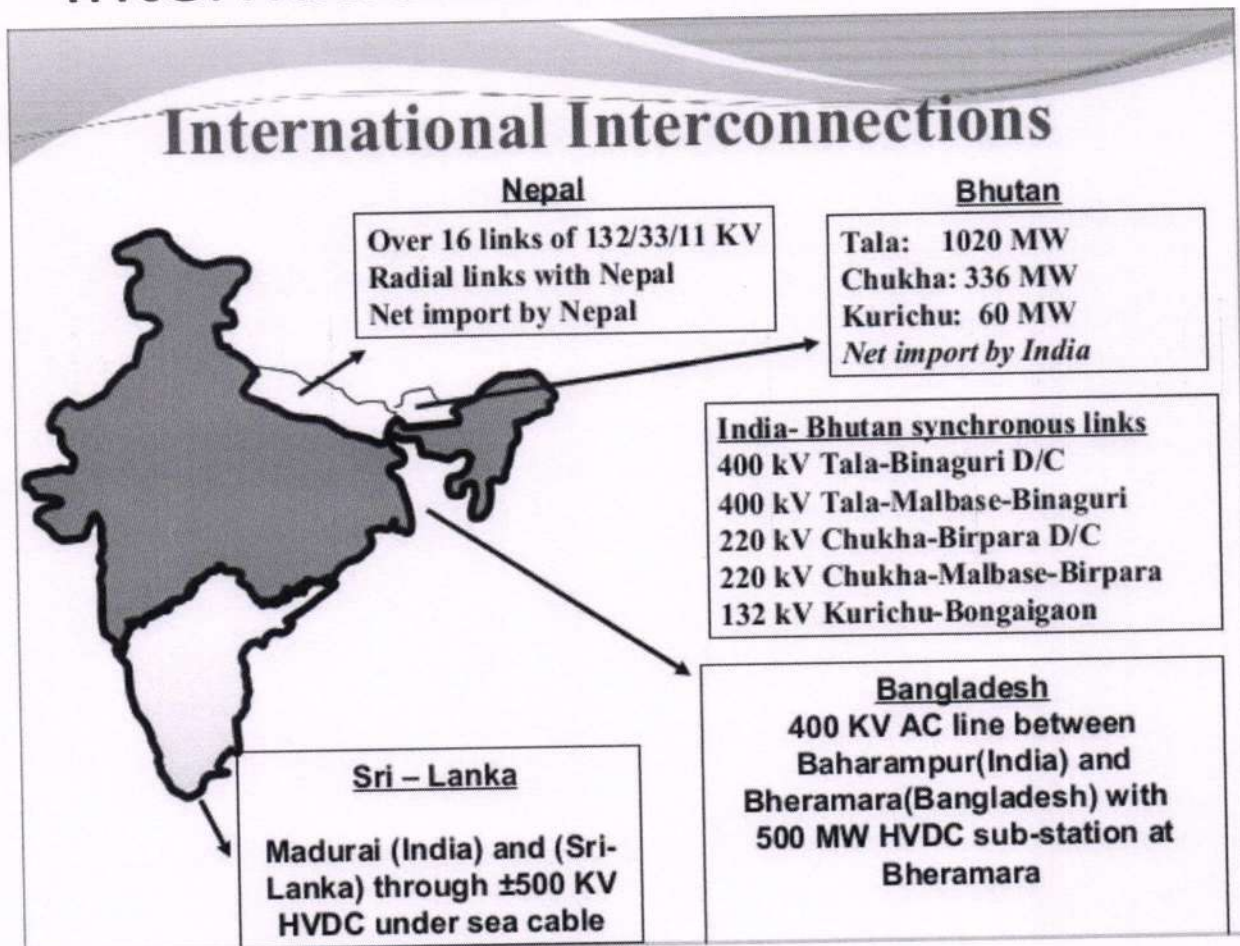
Source: https://en.wikipedia.org/wiki/Electricity_sector_in_India

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International Interconnections



Source :<http://posoco.in/>

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India's Blackout 30 and 31 July 2012

- The total load of about 48,000 MW was affected
- Factors that led to the initiation of the Grid Disturbance :
 - Weak Inter-regional Corridors due to multiple outages
 - High Loading on 400 kV Bina-Gwalior-Agra link
 - Inadequate response by SLDCs to the instructions of RLDCs to reduce
 - overdrawal by the NR utilities
 - Loss of 400 kV Bina-Gwalior link

Source: http://www.cercind.gov.in/2012/orders/Final_Report_Grid_Disturbance.pdf

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Measures that could have saved the system from collapse

- (i) **Better coordinated planning of outages of state and regional networks**, specifically under depleted condition of the inter-regional power transfer corridors.
- (ii) **Mandatory activation of primary frequency response of Governors** i.e. the generator's automatic response to adjust its output with variation in the frequency.
- (iii) **Under-frequency and df/dt based load shedding** relief in the utilities' networks.
- (iv) **Dynamic security assessment and faster state estimation** of the system at load dispatch centers for better visualization and planning of the corrective actions.
- (v) **Adequate reactive power compensation**, specifically Dynamic Compensation.
- (vi) **Better regulation to limit overdrawal/underdrawl** under UI mechanism, specifically under insecure operation of the system.
- (vii) **Measures to avoid mal-operation of protective relays**, such as the operation of distance protection under the load encroachment on both the days.
- (viii) **Deployment of adequate synchrophasor based Wide Area Monitoring System and System Protection Scheme.**

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Recording Showing Angular Separation between NR and Rest of NEW Grid on 30/07/2012

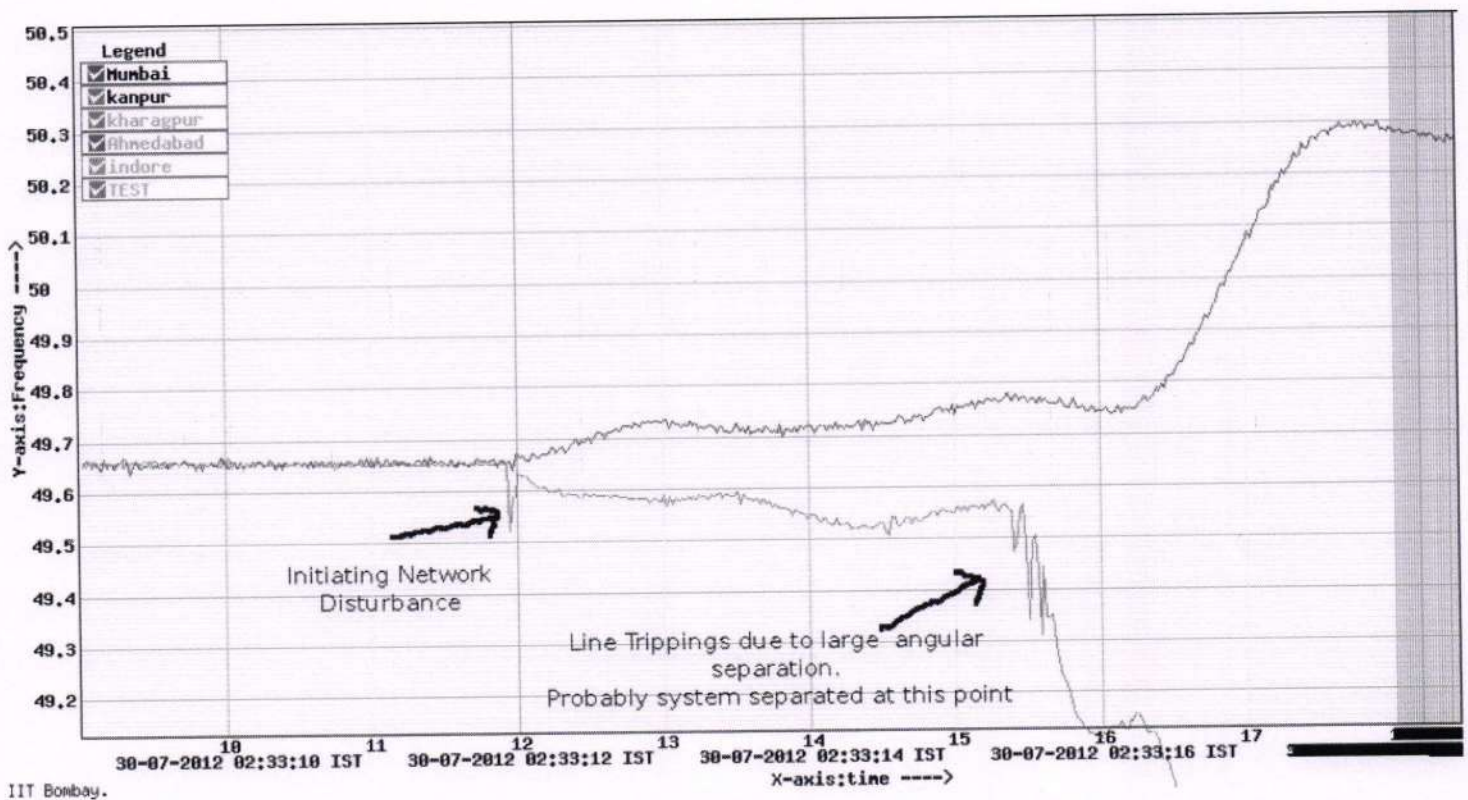


Fig 1: (source: Wide Area Frequency Measurement system developed by IIT-B, Mumbai.)

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The Smart Grid –What is it?

- Smart: another word for intelligent
- Quick/prompt in exercising correct intelligent action
- The term “smart grid” has been used to describe a broad range of technologies, design concepts and operating practices that collectively paint an exciting picture of what our electric power infrastructure might look like in ten or twenty years..
- “The smart grid is an optimized grid in every aspects”

Courtesy ABB

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How does the Smart Grid differ?

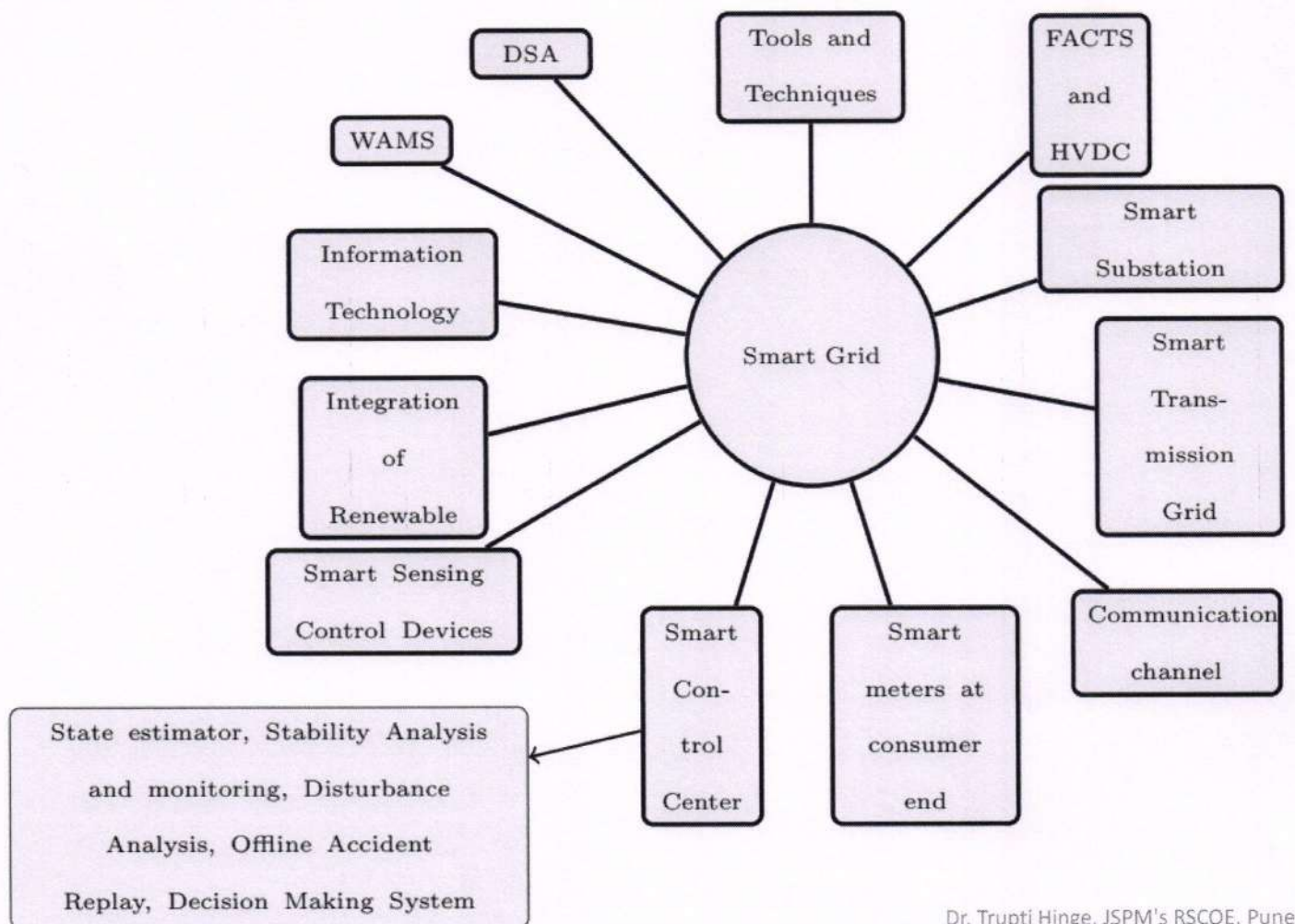
20th century Grid	21 st century Smart Grid
Electromechanical	Digital
One-way communications(if any)	Two-way communications
Built for centralized generation	Accommodates distributed generation
Radial topology	Network topology
Few sensor	Monitor and sensor throughout
"Blind"	Self-monitoring
Manual restoration	Semi-automated restoration and eventually, self healing
Prone to failures and balckouts	Adaptive protection and islanding
Check equipment manually	Monitor equipment remotely
Emergency decision by committee & phone	Decision support systems, predictive reliability
Limited control over power flows	Pervasive control systems
Limited price information	Full price information

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Components of Smart Grid

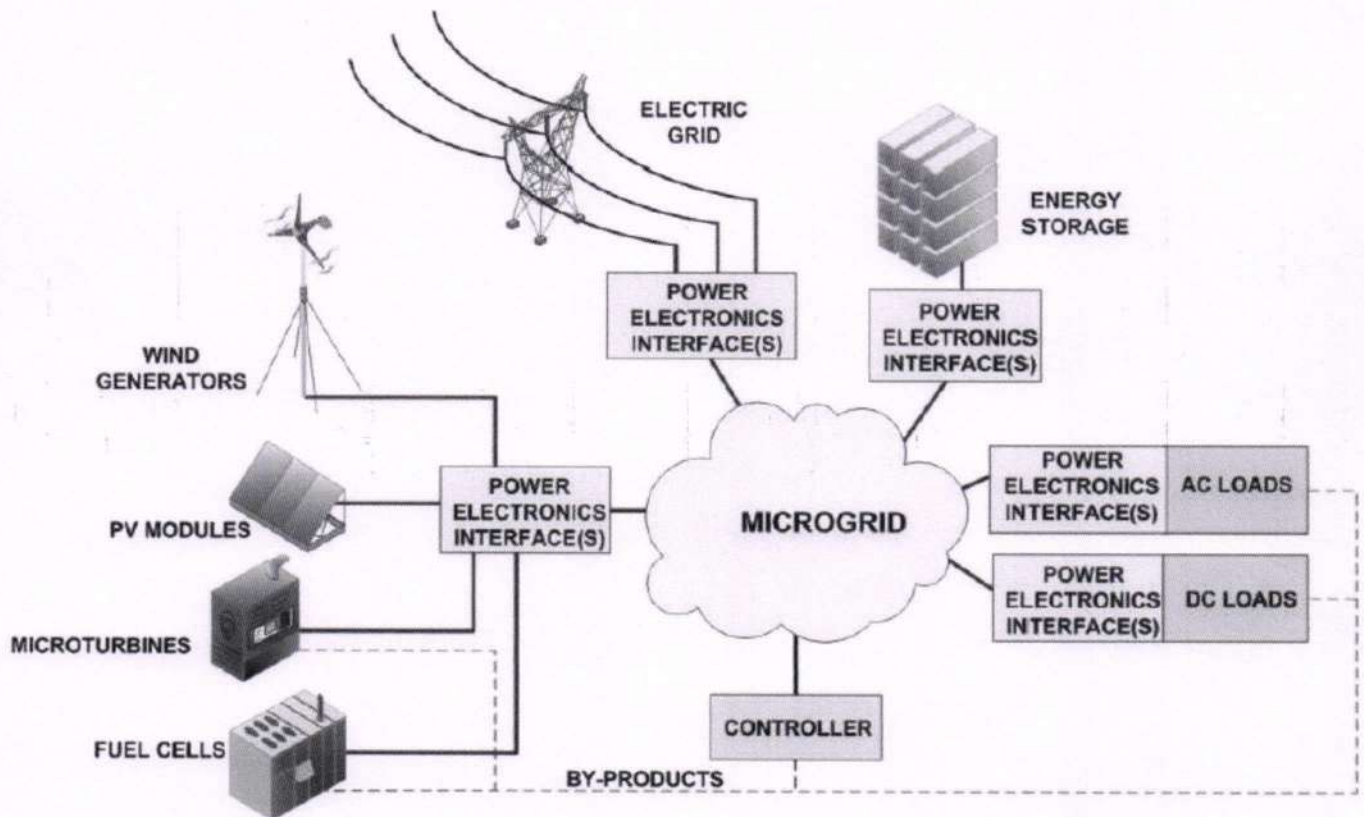


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Difficult to think of power system without power electronics at any voltage level



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Department of Electrical Engineering

NOTICE

Date: 17/05/2021

All the S.E., T.E. & B.E. students are hereby informed that Electrical Engineering Department is organizing an expert lecture on "Transmission line protection using synchrophasors in smart grid" by Dr. Trupti Hinge, JSPM Rajashri shahu COE, Pune on 18/05/2021 at 11:00 am.

All the students should present for expert lecture.

This is for strict compliance.


Prof. S.K. Shaikh

Event Coordinator


Prof. S.A. Markad

H O D




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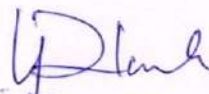
॥ न हि ज्ञानेन मर्त्यं पवित्रमिह विद्यते ॥
Dr. Vithalrao Vikhe Patil Foundation's
Dr. Vithalrao Vikhe Patil
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Report of Webinar

Topic	Transmissian Li ne Protection Using Synchro phasors in Smart grld
Date:	18/05/2021
Speaker	Dr. Mrs. TruPti P. Hinge Associate Professor Department of Electrical Engineering
college:	JSPM's Rajarshi Shahu College Of Engineering, Pune Email : tru ptiHINGE-elec@jspmrscoe.edu. in
Time	11:00 am – 12:00 pm
No. of Participants	90
Venue	Electrical Department
Event In charge	Prof. A.R. Laware




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Aniket Raut	" ✓ "	11.00	11.00
Aniket Waghmare	" ✓ "	11.00	11.00
Ankita Shinde	" ✓ "	11.00	11.00
Ashwini Sanap.	" ✓ "	11.00	11.00
Atish Bhalerao	" ✓ "	11.00	11.00
Bajrang Varade	" ✓ "	11.00	11.00
Bhagyashri Jadhav	" ✓ "	11.00	11.00
Datta Admane	" ✓ "	11.00	11.00
Dhanashree Landage	" ✓ "	11.00	11.00
Dipa Lokhande	" ✓ "	11.00	11.00
Divya Sonawane	" ✓ "	11.00	11.00
Ganesh Murade	" ✓ "	11.00	11.00
Ganesh Shirsat	" ✓ "	11.00	11.00
Gaurav Varute	" ✓ "	11.00	11.00
Gauri Lahange	" ✓ "	11.00	11.00
Gayatri Dhabadgaonkar	" ✓ "	11.00	11.00
Gopal Ubale	" ✓ "	11.00	11.00
Harshal Mhaske	" ✓ "	11.00	11.00
Jaydeep Musmade	" ✓ "	11.00	11.00
Jyoti Jha	" ✓ "	11.00	11.00
Kajal Shinde	" ✓ "	11.00	11.00
Kiran Harihar	" ✓ "	11.00	11.00
Krushna Maske	" ✓ "	11.00	11.00
Madhavi Nerkar	" ✓ "	11.00	11.00
Maresh Shinare	" ✓ "	11.00	11.00
Mangesh Mundhe	" ✓ "	11.00	11.00
Mansi Shinde	" ✓ "	11.00	11.00
Mayur Baviskar	" ✓ "	11.00	11.00
Monali Thombare	" ✓ "	11.00	11.00
Mu Irfan Nijamudeen	" ✓ "	11.00	11.00
Nehru Usare	" ✓ "	11.00	11.00
Nikita Kamble	" ✓ "	11.00	11.00
Niks Warade	" ✓ "	11.00	11.00
Omkar Swami	" ✓ "	11.00	11.00
Onkar Konge	" ✓ "	11.00	11.00
Pandurang Waghmare	" ✓ "	11.00	11.00
Pooja Ghugare	" ✓ "	11.00	11.00



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Pooja Karampuri
Poonam Pagare
Pradip Shirsath
Prajakta Zanje
Pranav _____ Raut
Prasad Gunjal
Priyanka Ghugarkar
Priyanka Wavhal
Rajesh Zambare
Rohit Salve
Rupesh Walekar
Rushikesh Karale
Sadhana Mate
Samsher Sheikh
Sanjay Joshi
Sanket Ekam
Sanket Puri
Sarthak Bankar Patil
Satish Markad
Satyaajeet Kokare
Saurav Gayke
Sayali Narsale
Sayara Tamboli
Shalini Pandit
Sheetal Patekar
Shital Darade
Shivpriya Daspute
Shubhada Bhambare
Shubham Surve
Sneha Awege
Snehal Ohol
Srusruti Sali
Sumit Shalgar
Supriya Zine
Surbhi Shinde
Sushmita Kavade
Swapnil Gaik
Tejaswini Aher
Trupti Hinge
Trupti Narute
Vaishnavi Goski
Vaishnavi Shelke
Vaishnavi Shinde
Vishal Rathod
Vishal Vyavahare
Vrushali Shinde
Yash Sharma

[illegible]

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