ORGANIZER

ISGF
India Smart Grid Forum

DISTRIBUTION UTILITY MEET
DUM 2023

Session :New Innovations Towards Net Zero Power Sector

Presented By

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Signals for Net Zero Transition

Meta trends 2023

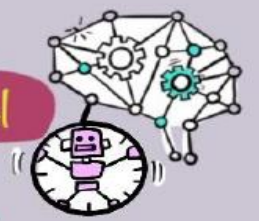
PermaCrisis

- Extended period of instability and insecurity
- Wars, divided world, Inflation, workplace disruptions, Climate change...
- Businesses should:
  - Listen closely to the crisis elements
  - Focus on vision and risk mitigation

A Passage to India

- India Opportunity - Projected 20% share of growth of world GDP
- Huge untapped potential (startups, young workforce, technology)
- Digital leader with homegrown stack (UPI, AEPS, ecommerce..)
- Rising soft power (Movies, Indian cuisine, leaders..)
- Huge domestic demand from tier 2 & 3 towns

AM-PM AI



- Everyday AI examples- Biometrics, chatbots, Maps, OTT platforms
- Generative AI- smart decision making & creative solutions (ChatGPT)
- Opportunities- writing, designing, composing skills
- Business should use AI in:
  - Gamification
  - Personalised engagement

Trough Times

- Global slowdown - will affect all as world is now closely connected
- Stagflation = High inflation + Low demand + Unemployment
- Ray of hope - Gulf & Indian economies
- Business should:
  - Focus on building strong & trustworthy brands
  - Try to understand the customer sentiments
  - Devise creative pricing strategies

Here Comes the Sun

- Renewable sources - responsible and cost effective
- Challenges- Reskilling, Technology adoption, Cost of conversion
- Opportunities around green energy:
  - Renewable energy - solar, wind ..
  - Green hydrogen (tremendous opportunity)
  - Electric mobility
- Business Focus:
  - Sustainable supply chains and ecosystem
  - Circular economy

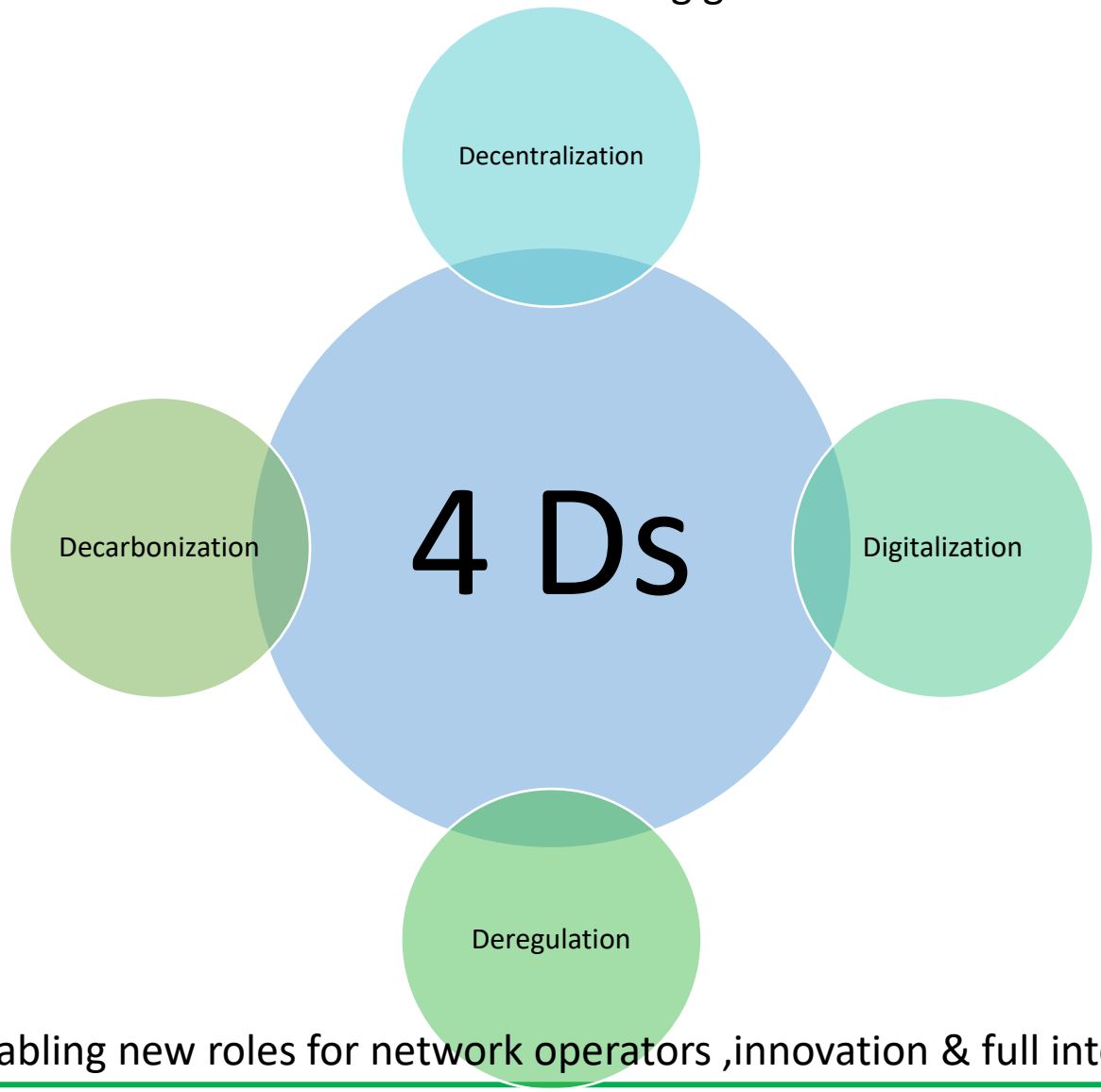
Goblin Mode

- Unapologetically self- indulgent behaviour at times
- Heavily annoyed by social media etiquettes and societal rules
- Business should:
  - Acknowledge the consumers' natural self (Eg: Snickers melodrama)
  - Avoid setting/ depicting model standards for the perfect person

4 Ds TOWARDS NET ZERO

Combining distributed generation with small-scale batteries to bring generation closer to demand, therefore reducing losses.

Carbon avoidance technologies r transformative , decarbonize without the added capital expenditure, water, energy and land.



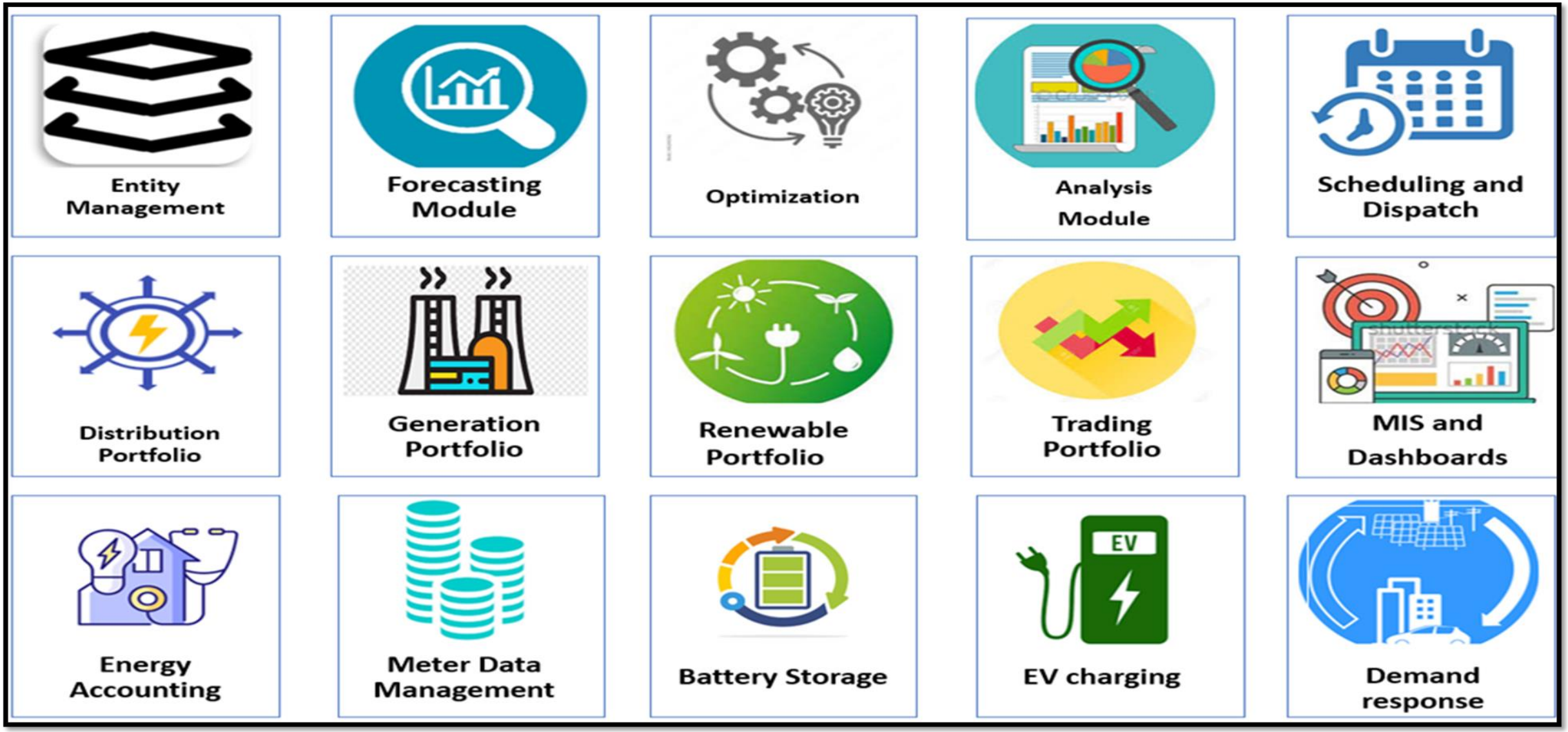
Use artificial intelligence (AI) for knowledge graphs to define relationships between business activities and datasets, speed up text processing and interrogation, enabling accurate analysis at granularity

Changes the rules of the game ,enabling new roles for network operators ,innovation & full integration of decentralized resources

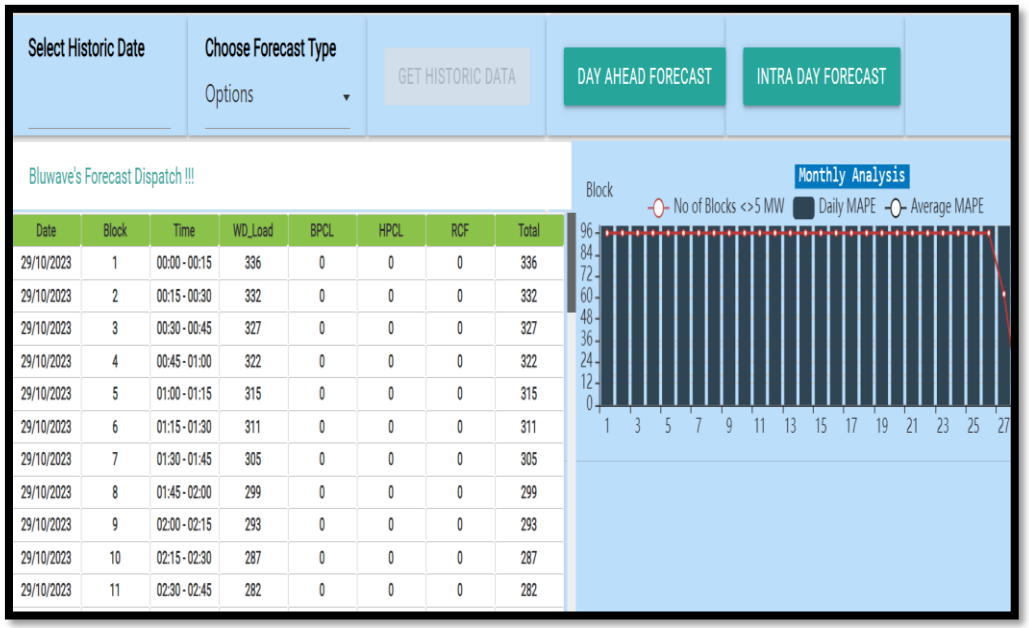
Integrated platform for Power Management for Energy Transition

Autonomous Operation a Reality

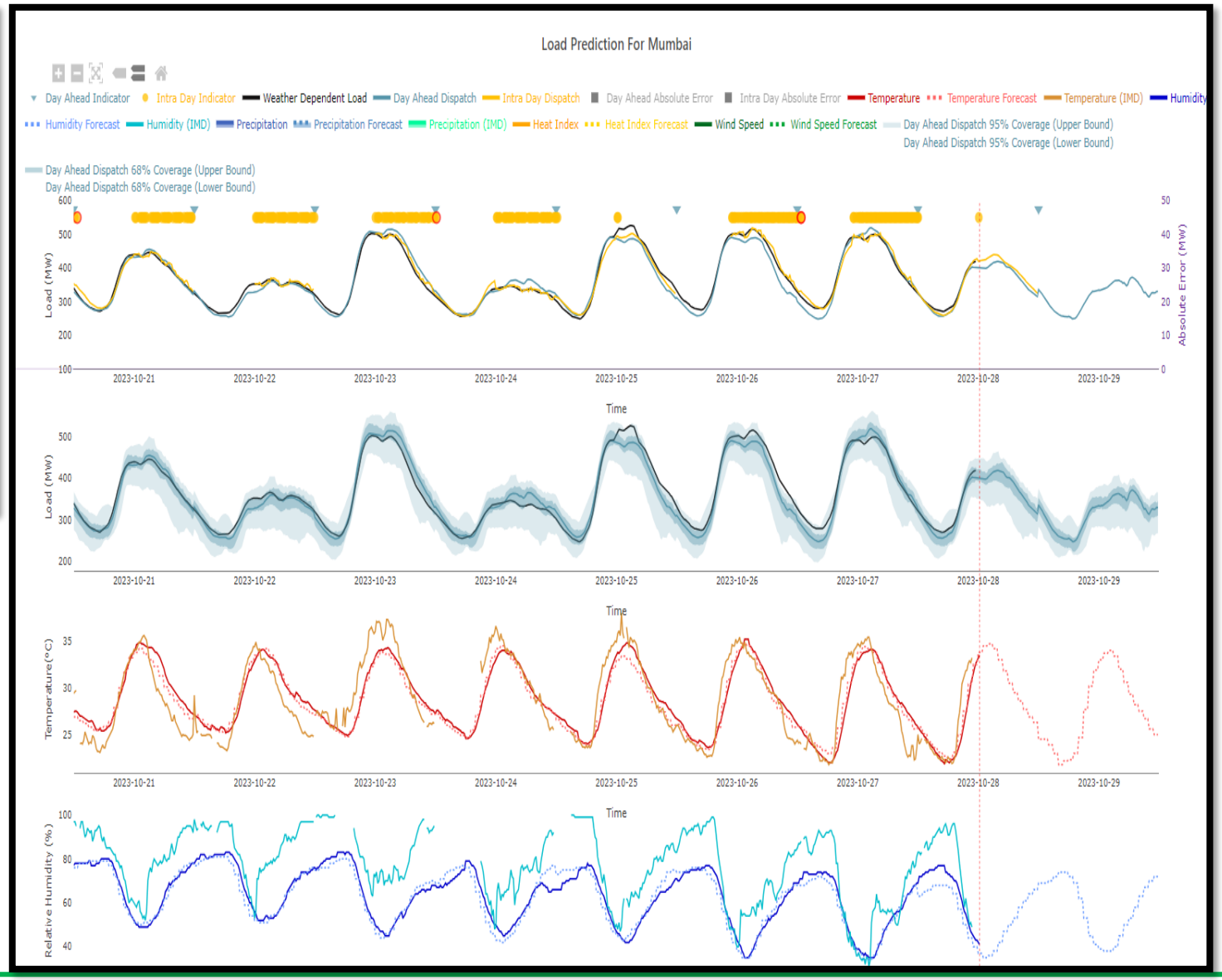
Journey Towards Net Zero - Autonomous Power Management Platform



Module 1 - Load Forecasting Module

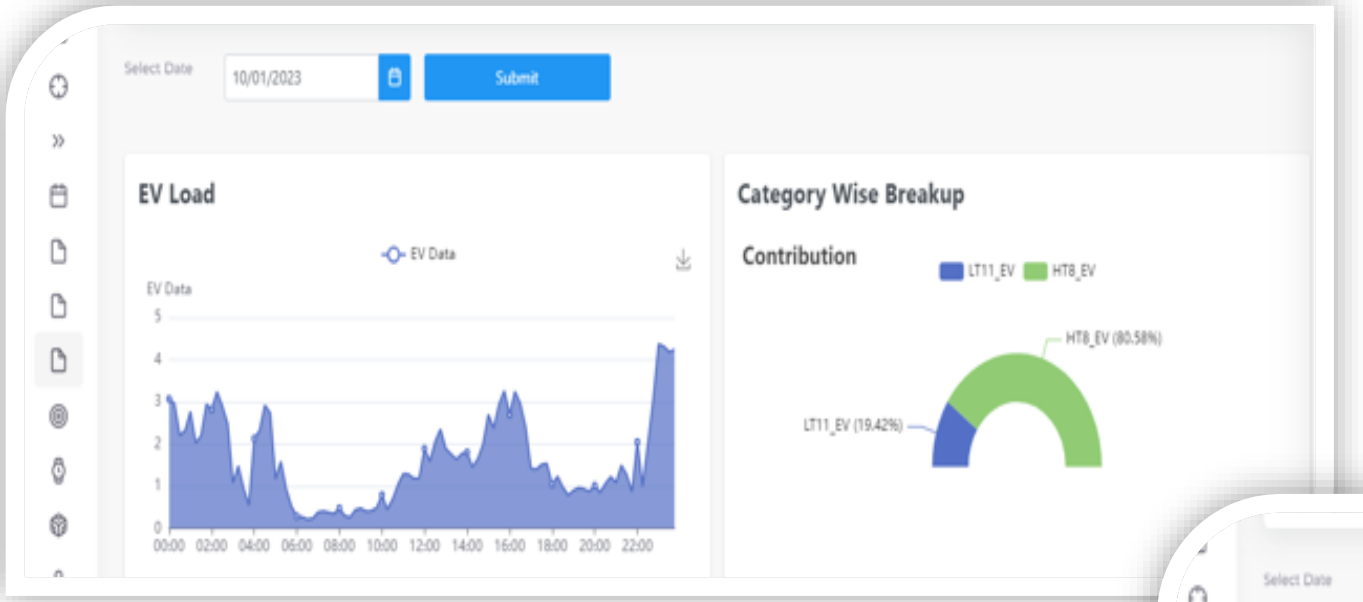


Date	Block	Time	WD_Load	BPCL	HPCL	RCF	Total
29/10/2023	1	00:00 - 00:15	336	0	0	0	336
29/10/2023	2	00:15 - 00:30	332	0	0	0	332
29/10/2023	3	00:30 - 00:45	327	0	0	0	327
29/10/2023	4	00:45 - 01:00	322	0	0	0	322
29/10/2023	5	01:00 - 01:15	315	0	0	0	315
29/10/2023	6	01:15 - 01:30	311	0	0	0	311
29/10/2023	7	01:30 - 01:45	305	0	0	0	305
29/10/2023	8	01:45 - 02:00	299	0	0	0	299
29/10/2023	9	02:00 - 02:15	293	0	0	0	293
29/10/2023	10	02:15 - 02:30	287	0	0	0	287
29/10/2023	11	02:30 - 02:45	282	0	0	0	282



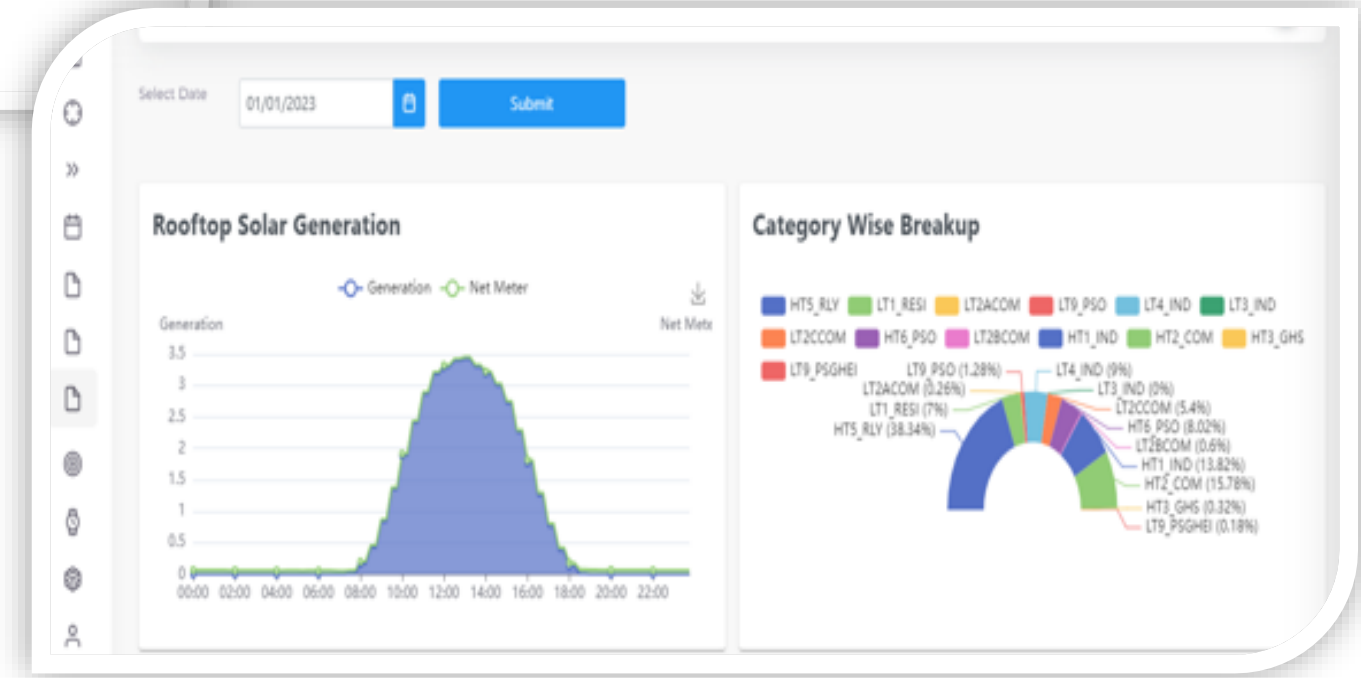
AI/ML based module for load forecasting on long-term/medium-term/day-ahead/intra-day basis, taking into consideration weather parameters

Inclusion of New Loads for Accurate Load Forecasting



Electric Vehicles Charging Pattern-Mumbai

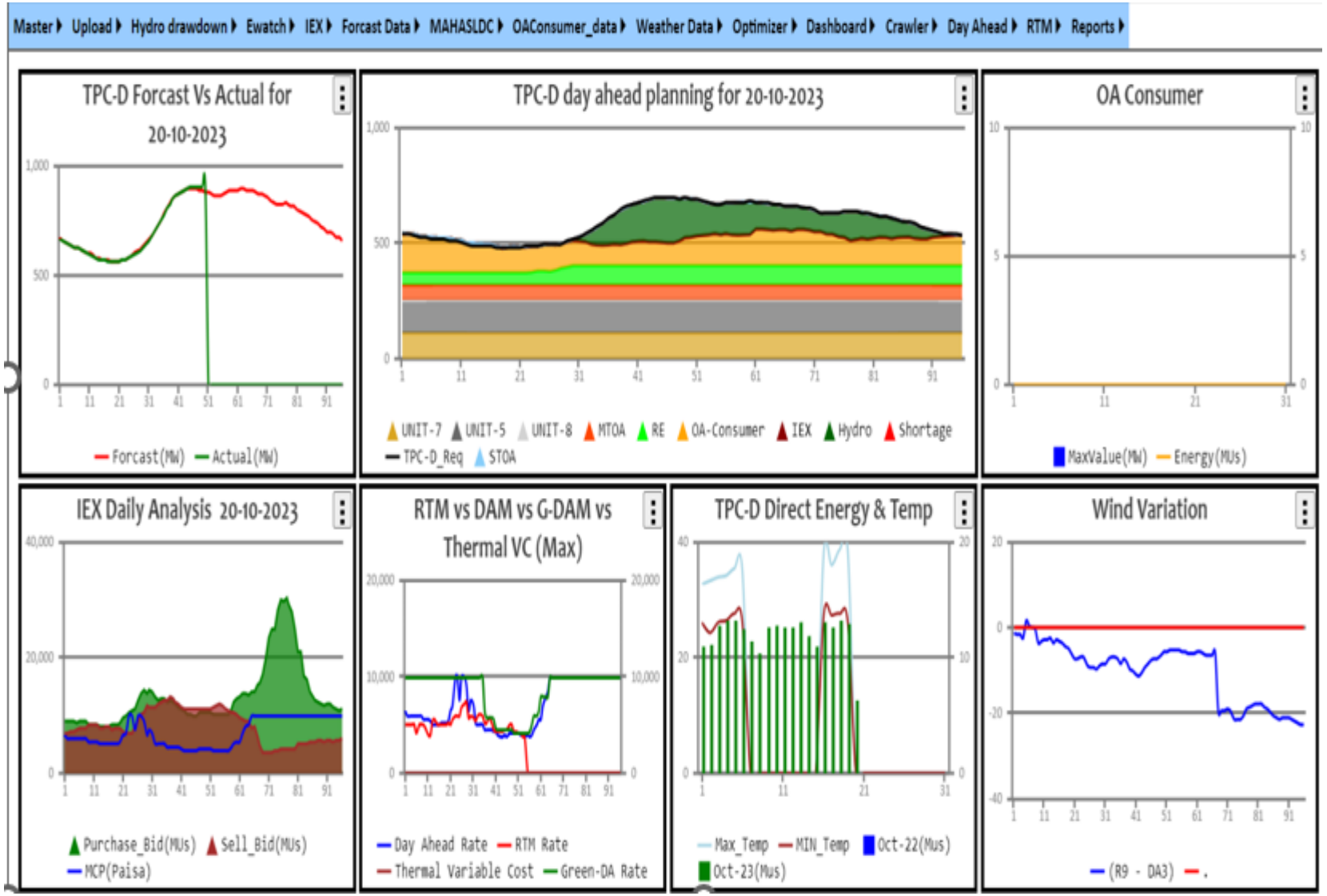
EV load is analyzed on daily basis with respect to total DISCOM drawal. Same used for load forecasting and power management



Rooftop Solar Generation Pattern-Mumbai

Rooftop solar generation and export to DISCOM is being analyzed. Same is forecasted to finalize day-ahead demand requirement

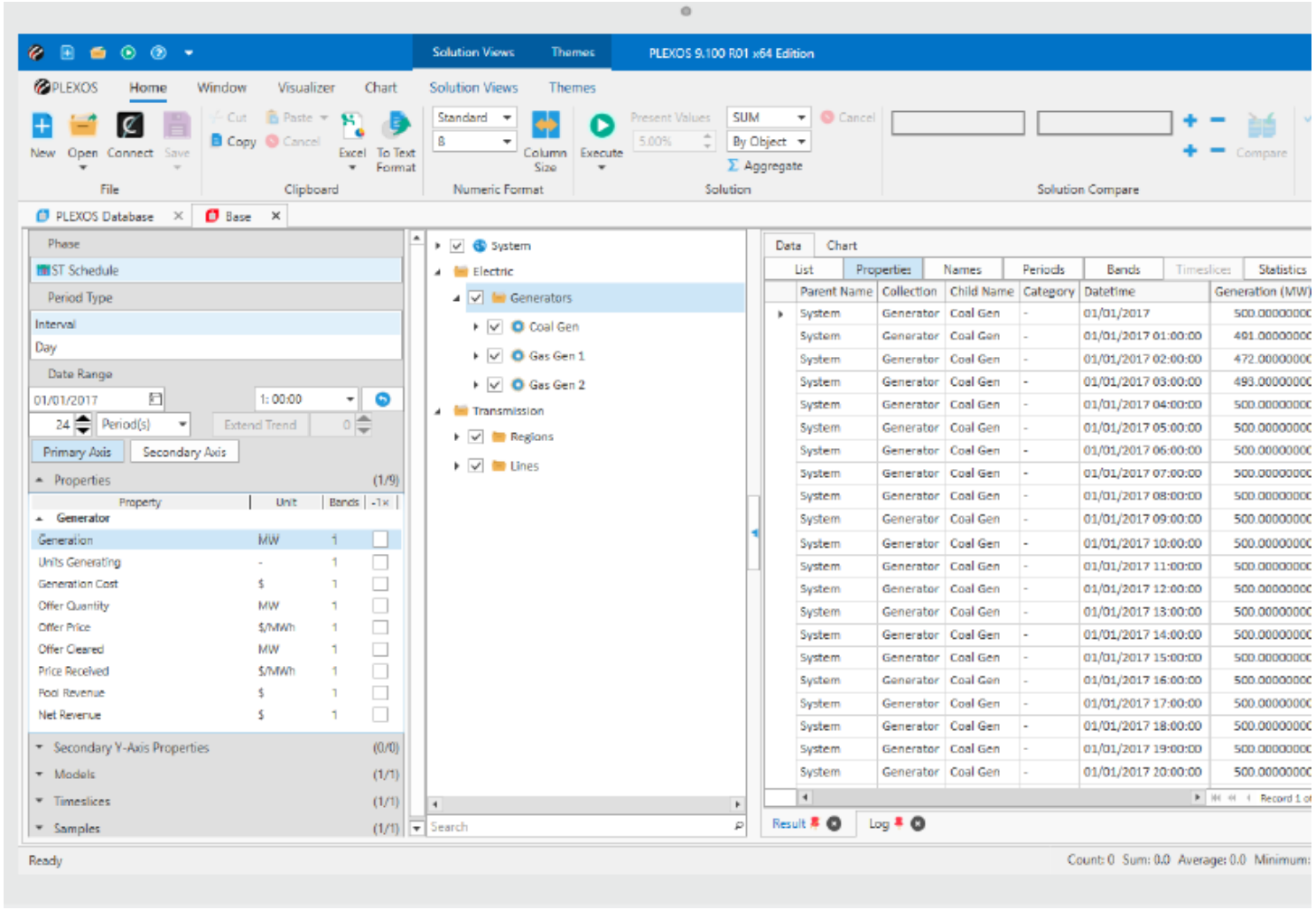
Module 2 - Power Planning and Real-Time Monitoring

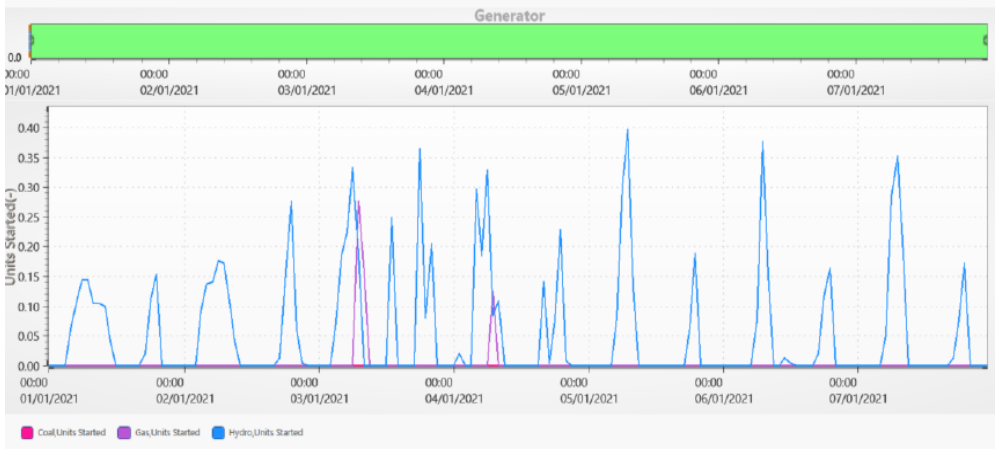


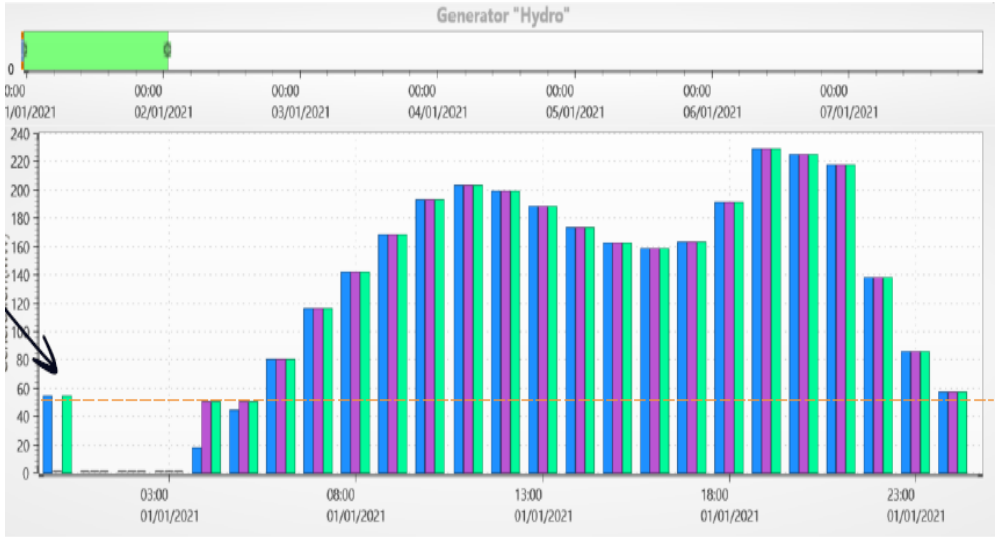
- Forecasting and Optimization platform is integrated with all T<>D interface meters, smart meters of important consumers and even EV and rooftop solar category meters for accurate forecasting and better optimization
- Day-ahead load forecasting is being done and fossil fuel based generation is optimized using in-house tool

Module 3 - Resource Optimization Tool (PLEXOS)

It provides optimal solution for each sample considering applicable constraints with statistical analysis. It also provides optimal dispatch for hydro and firm plants







Module 3 - Resource Optimization To Meet Green Portfolio – Green Tool

It helps interested consumers to meet their specific or 100% demand on each 15 minutes basis by renewable sources, it suggests RE to be contracted with Estimated Landed Tariff

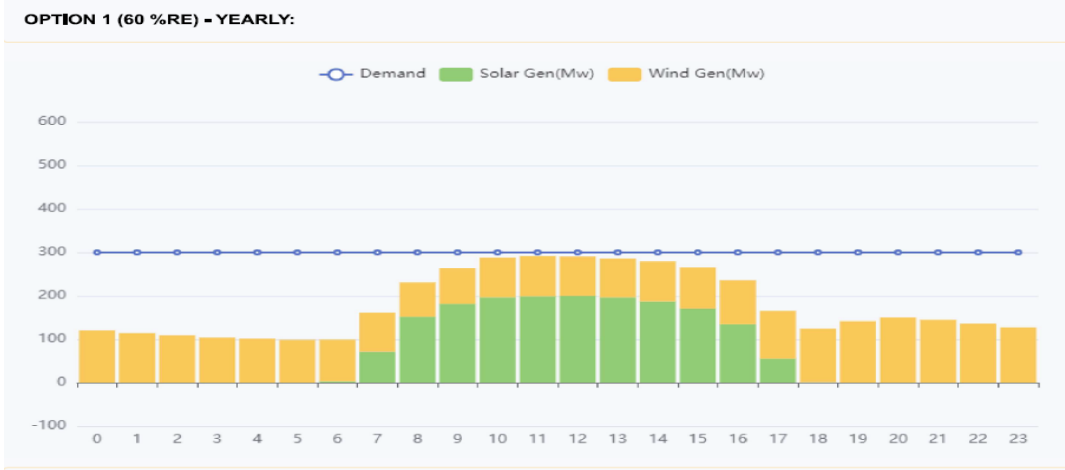
Proposed Solution:

Particulars	UOM	Option 1 (60% RE met)
Estimated Ex Bus Tariff	Rs PU	2.89
Estimated Landed Tariff	Rs PU	4.49
Estimated Energy Supplied	MU's	1525
Estimated % energy curtailed	%	3.298
% RE Demand Met	%	60
Minimum Demand for the period	MW	300
Maximum Demand for the period	MW	300

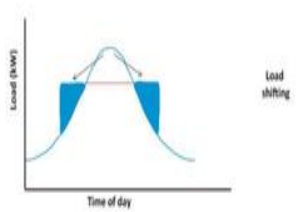
Proposed Capacities:

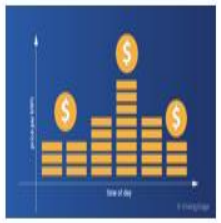
Type Of Source	UOM	Option 1 (60% RE met)
Solar	MW	242.4
Wind	MW	327.24
Battery	MW	0
Hydro	MW	0

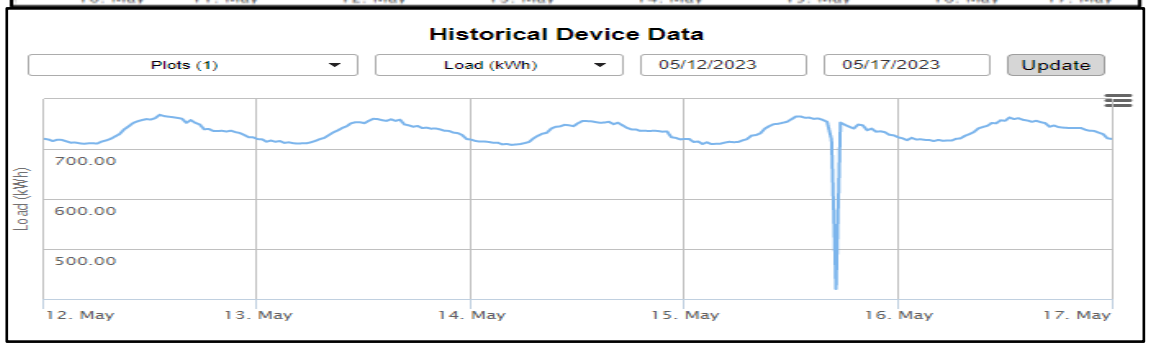
OPTION 1 (60 %RE) - YEARLY:



Module 3 - Resource Optimization Using DR







Module 4 – Green Energy Trading

Start

Green Power (In-firm) Open Access Consumers from Mumbai Distribution

Registration

Registration of sellers, buyers and TPC-D on the Blockchain platform

Generation

Energy generation from wind and solar power plants Contracted with OA consumers

Placing Bids

Seller to place bids on 15 minutes on day-ahead as well as intra-day basis, considering excess generation forecast

Dashboards

Periodic/monthly report indicating consumer-wise transactions done, total energy traded and commercial settlement

Accounting

Buyer will pay immediately to seller, Monthly accounting for seller based on credit notes

Trading

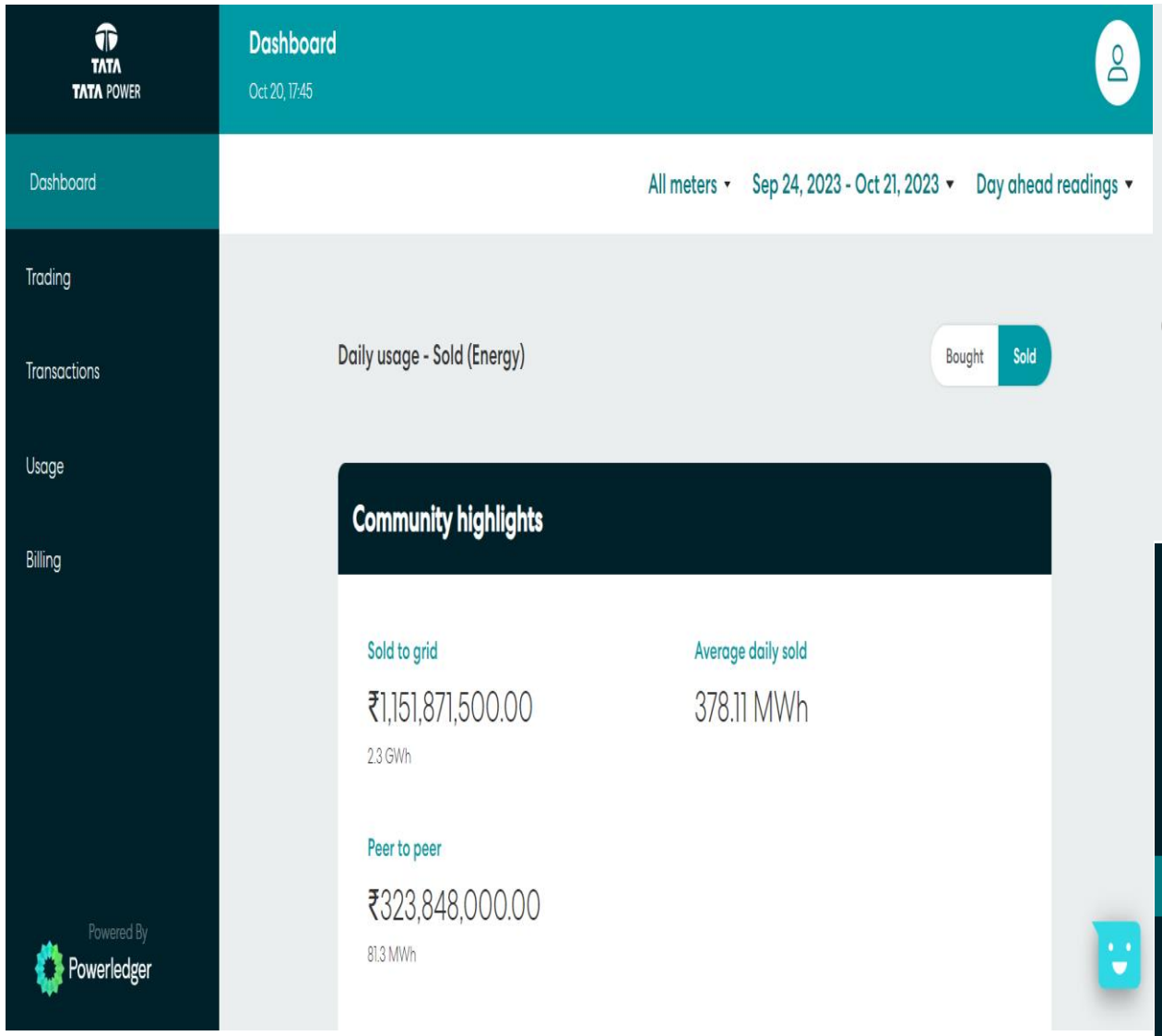
Matching the bids of buyer and seller for the requisitioned quantum and quoted price

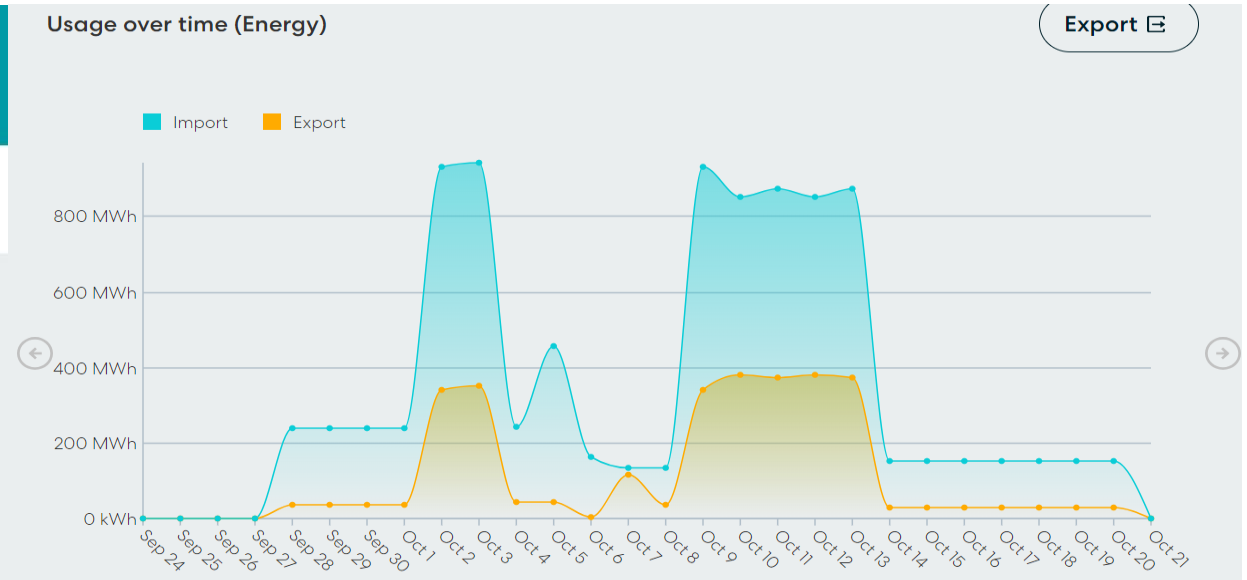
Results sharing

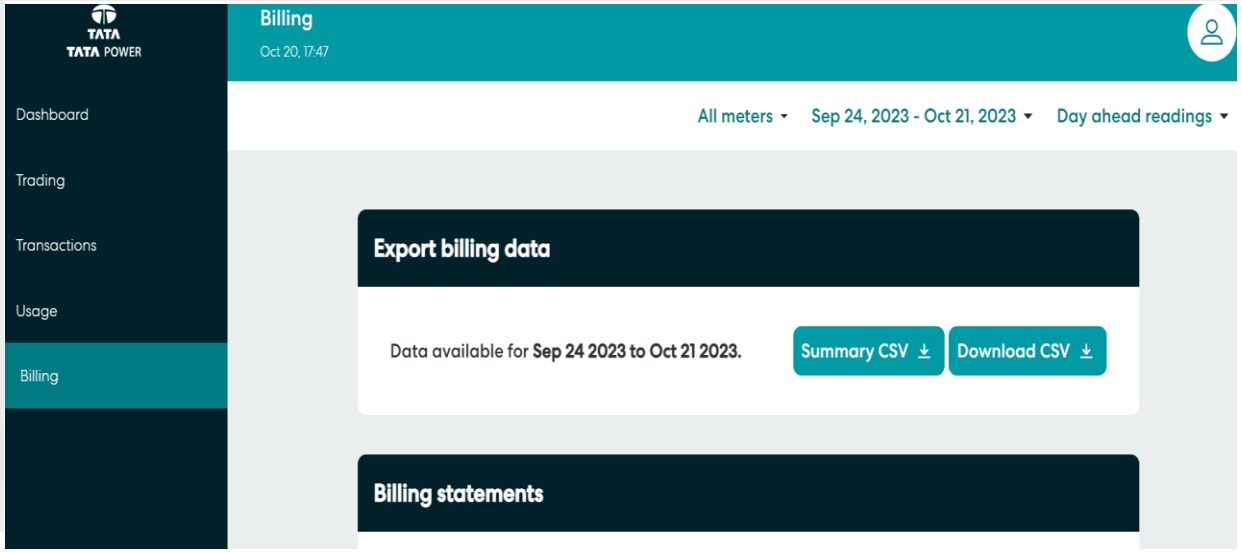
Presentation to regulatory bodies if pilot results are satisfactory

- Blockchain based trading module
- Enable infirm open access consumers to sell excess / unutilised renewable energy
- Open access and DISCOM consumer smart meters, RE scheduling software integrated for trading and billing settlement purpose
- Facilitates day-ahead as well as intra-day trading

Snapshots – Energy Trading by OA Consumers







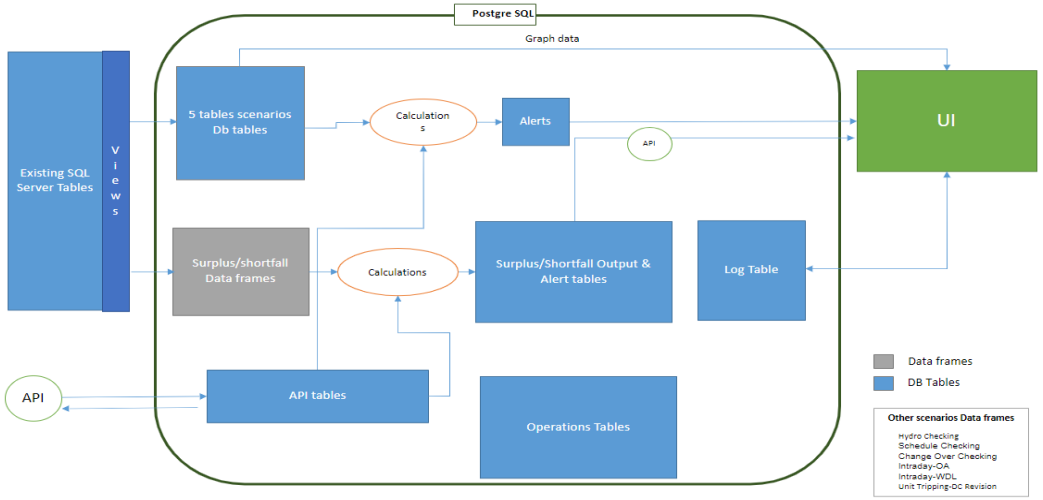
Next Step…AI (BOT) Based Power Management

The AI based BOT is an **Automated Application** to manage power management functions on its own without manual intervention.

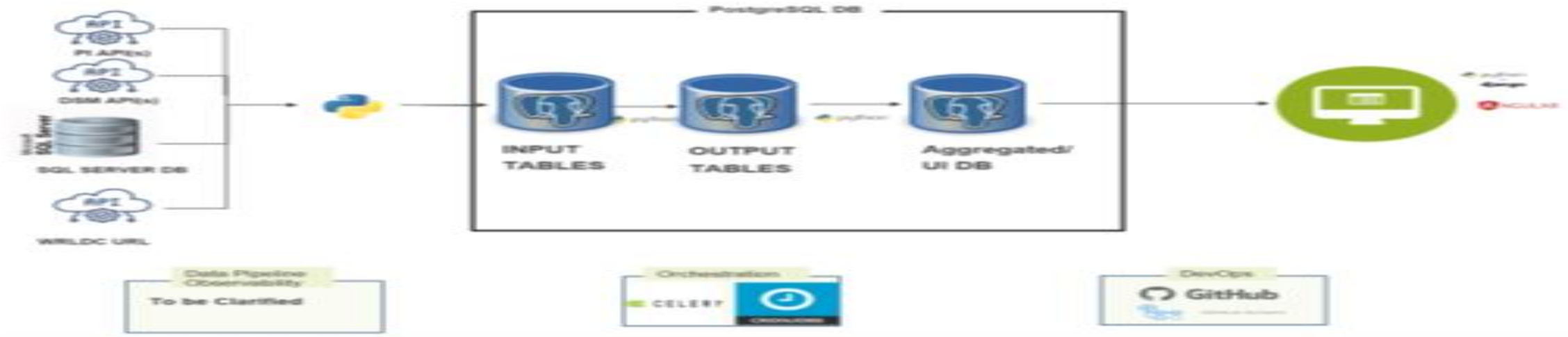
It is integrated with many internal/external technologies like:

- Power planner software-SQL database
- OSI PI system
- Third party load forecasting software
- SLDC, NRLDC, and WRLDC websites

Data Flow Diagram



Technology Architecture



AI (BOT) Based Real Time Power Management

TATA POWER | w/o VSE | w/ VSE | Ewatch | Scada | Variables | Logs | Download | Manage Users | Logout

Block No: 60 | Inst.Frequency: 49.98 | Inst.DSM Rate: 1.93 | ACP Rs: 4.81 | Highest Input Cost: 5.49

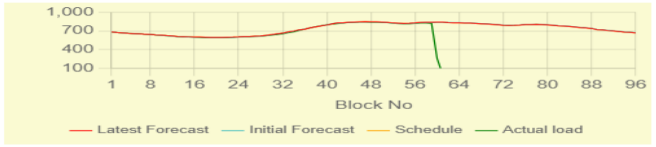
Date	Block	Time	Forecast	Change over	Schedule Drawl	Actual Drawl	REMC/ RTM	Frequency/ DSM Rate	Correct Factor (Ewatch)	Schedule OD/UD	Actual OD/UD	Total Hydro Schedule/ Actual	Hyd (Acl-Sch)	Hydro VSE for State	TPCD Share of Hydro	TPCD Share of U5/U8	DC of U5/U8/U7 apm/U7 napm	TPCD Share of U7 apm/U7 napm	DC of Hydro	Diff b/n Initial & Demand Forecast
2023-10-28	54	13:15 - 13:30	823	245	823	815	136/0	/8		0	7	100/98	-1	0	40	126/75	470/228/77/98	37/0	433	0
2023-10-28	55	13:30 - 13:45	824	246	824	816	134/14	/8		0	8	101/101	0	0	21	126/75	470/228/77/98	37/0	433	-1
2023-10-28	56	13:45 - 14:00	829	249	829	819	132/14	/8		0	9	99/101	1	0	19	126/75	470/228/77/98	37/0	433	0
2023-10-28	57	14:00 - 14:15	835	252	835	827	128/14	/8		0	7	106/106	0	0	26	126/75	470/228/77/98	37/0	433	-1
2023-10-28	58	14:15 - 14:30	838	252	838	827	122/14	/8		0	11	117/117	0	0	37	126/75	470/228/77/98	37/0	433	-1
2023-10-28	59	14:30 - 14:45	839	251	839	828	117/0	50/5.01		0	11	141/139	-1	0	61	126/75	470/228/77/98	37/0	433	0
2023-10-28	60	14:45 - 15:00	841	252	841	833	111/0	50.06/0		0	8	161/158	-3	0	81	126/75	470/228/77/98	37/0	433	-1
2023-10-28	61	15:00 - 15:15	841	252	841		105/0	/		0		164/	0	0	84	126/75	470/228/77/98	37/0	433	-1
2023-10-28	62	15:15 - 15:30	833	250	833		98/0	/		0		160/	0	0	80	126/75	470/228/77/98	37/0	433	-7
2023-10-28	63	15:30 - 15:45	830	251	830		90/-36	/		0		145/	0	0	65	162/100	470/228/77/98	37/0	433	-6
2023-10-28	64	15:45 - 16:00	829	251	829		82/-108	/		0		154/	0	0	74	203/125	470/228/77/98	37/0	433	-6
2023-10-28	65	16:00 - 16:15	828	250	828		74/0	/		0		106/	0	0	26	162/100	470/228/77/98	37/0	433	-7
2023-10-28	66	16:15 - 16:30	826	251	826		66/0	/		0		136/	0	0	56	126/99	470/228/81/93	39/0	433	-7

Hydrochecking
pickup hydro generation by-10.24 MW from hydro total Drop hydro generation by 148.7 MW from bhivpuri Pickup hydro generation by -12.17 MW from bhira
Acknowledge

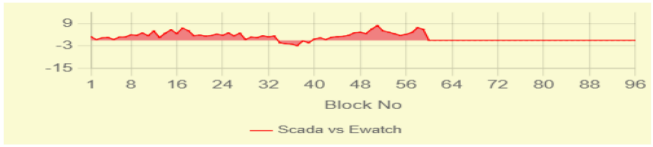
Intraday_WDL
Attention! Load variation of weather dependent load. Would you like to see the graph?
No | Yes

Pipiline Failure
Attention! There is a pipeline failure of various API and DB tables
No | Yes

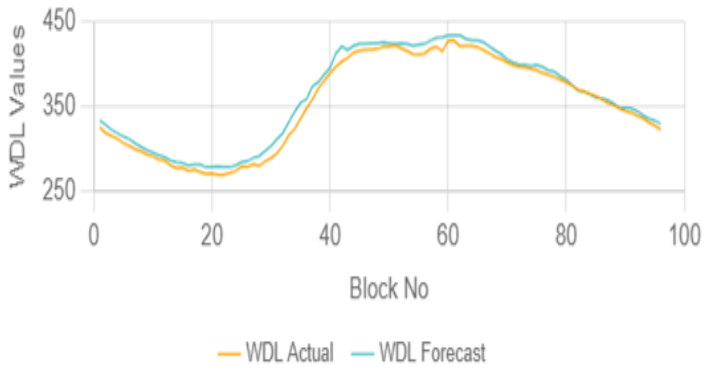
TPCD Curve Graph



Scada VS Ewatch Graph



Shift	DSM	ADSM (Count)	Gain/Loss
10:00 PM - 07:00AM	3.88	0 (0)	3.13
07:00AM - 02:00PM	4.03	0 (0)	1.7
02:00PM - 10:00PM	0.02	0 (0)	-0.1



Block No	HPCL Forecast	BPCL Forecast	RCF Forecast	Change Over	Bluewave WDL	Total Forecast	Dsm Latest Forecast	Difference
61	87	25	18	252	428	837	842	-5
62	87	25	18	251	421	828	834	-5
63	87	25	18	251	422	830	831	-1

Unique features of BOT:

- Constraints Analysis
- Suggesting all probable decisions
- Considers multiple scenarios
- Voice based alerts for abnormalities

Experience So Far….

- New technologies and Innovations are key to achieve arguably one of the greatest challenge, the transition to net zero

- Different IT applications need to be integrated and need to work together as a whole to accelerate the sharing of information, cut down operational costs and make solutions scalable

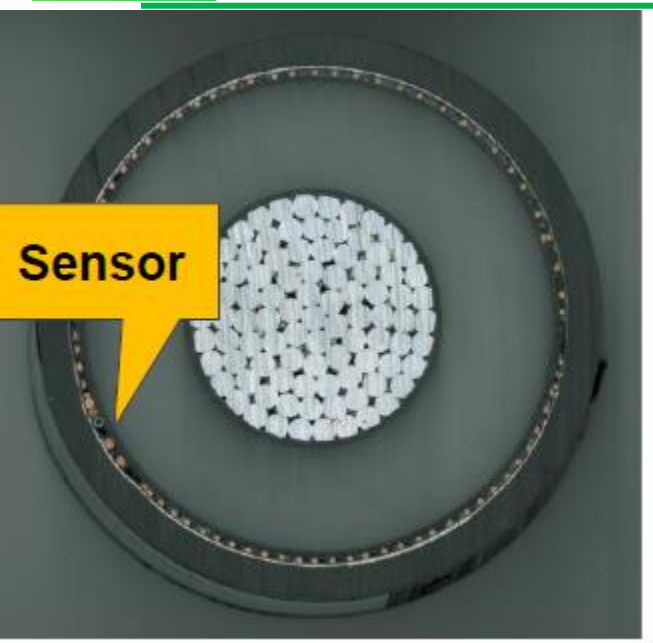
- As RE share goes up, effective grid management becomes critical. This is where smart-grid technologies step in, enabling efficient balance of demand and supply paving the way for virtual power plants, long duration energy storage solutions, automatic DR etc..

MODERN UNDERGROUND CABLE LAYING & DIGITAL TWIN OF THE UNDEGROUND ASSET

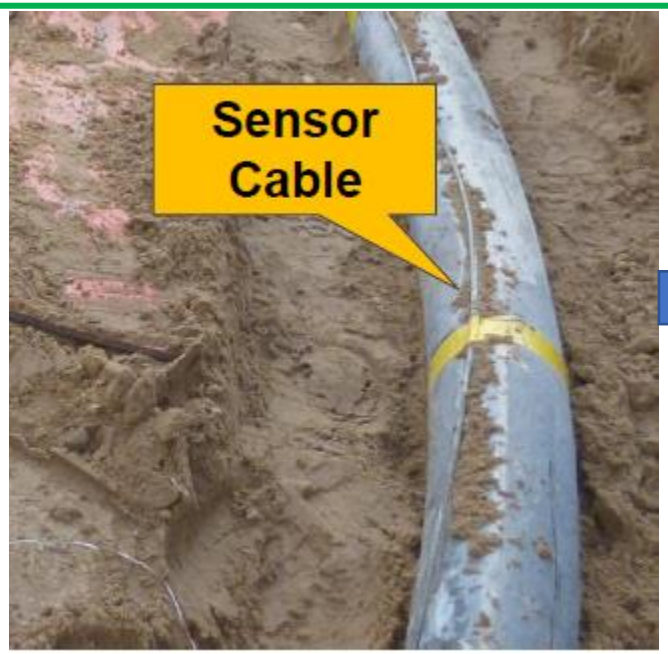
UG CABLE ASSET MANAGEMENT- INTERACTIVE DIGITAL MAPPING

- With the rapid conversion of OH to UG Power circuits as an effect of Urbanization and even otherwise ,its important to manage these UG Assets effectively
- With the Modern UG cable laying practices ,technology is deployed to map these assets exactly and able to locate these from Overground efficiently .
- Use of RF ID markers along the length of UG Cable and further their positive identification with intelligent information of critical attributes is now possible .
- This is further getting integrated to the Geographical Information System of the utility

UG CABLE ASSET MANAGEMENT- DIGITAL CONDITION MAPPING

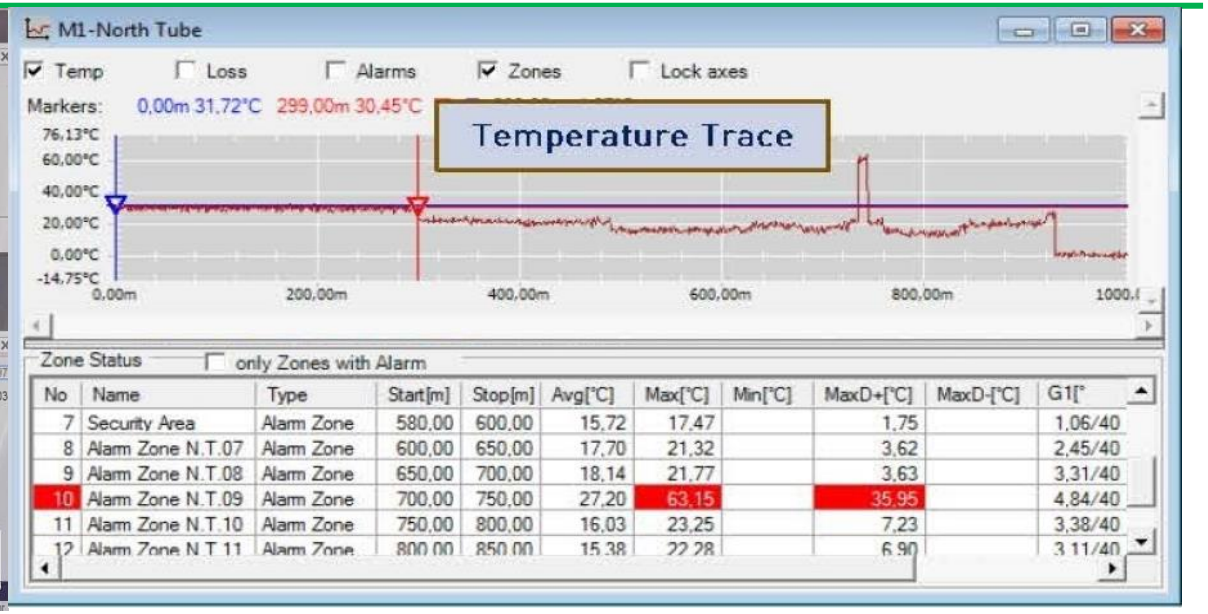


OR

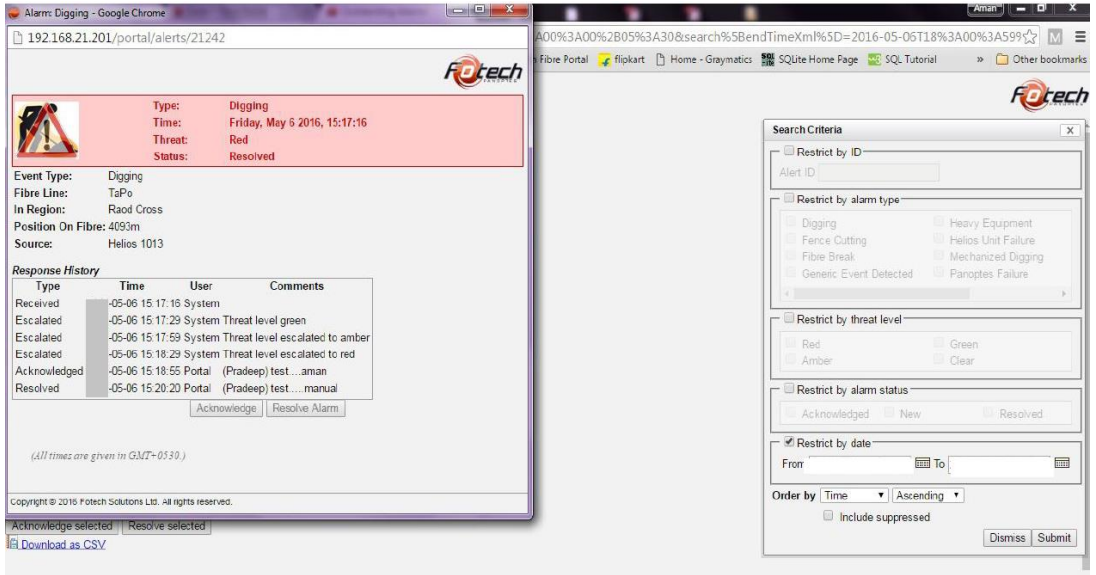


- Underground Power Cables and Fiber Optic cables are normally laid as two distinct activities and sometimes in isolation
- Modern Day UG systems plan for a composite Power and Fiber UG Cable or at least FO cable laid along the Power Cable for varied benefits
- One direct benefit is additional excavation ,reinstatement and cost associated with the same is obviated
- Condition Based Monitoring is a distinct advantage wherein the properties of Fiber Optic cable are actually used in for ascertaining the temperature profile along the length of the UG Cable using a technology
-

UG CABLE ASSET MANAGEMENT- DIGITAL CONDITION MAPPING



No	Name	Type	Start[m]	Stop[m]	Avg[°C]	Max[°C]	Min[°C]	MaxD+[°C]	MaxD-[°C]	G1[°
7	Security Area	Alarm Zone	580,00	600,00	15,72	17,47		1,75		1,06/40
8	Alarm Zone N.T.07	Alarm Zone	600,00	650,00	17,70	21,32		3,62		2,45/40
9	Alarm Zone N.T.08	Alarm Zone	650,00	700,00	18,14	21,77		3,63		3,31/40
10	Alarm Zone N.T.09	Alarm Zone	700,00	750,00	27,20	63,15		35,95		4,84/40
11	Alarm Zone N.T.10	Alarm Zone	750,00	800,00	16,03	23,25		7,23		3,38/40
12	Alarm Zone N.T.11	Alarm Zone	800,00	850,00	15,38	22,28		6,90		3,11/40



- Properties of Fiber Optic cable are actually used as :
- “Power Line Intrusion Detection (PLDS) “ is used to detect an activity in the vicinity of an UG cable to forewarn for preventing damage to the UG Cable.
- “Digital Temperature Sensing” for ascertaining the temperature profile along the length of the UG Cable using a technology

TRANSITION TOWARDS NET ZERO

- An integrated approach towards achieving Net Zero Targets is the order of the day since approach in Silos may not fructify in the long run
- Regulatory interventions in terms of facilitating Net Zero is a critical aspect more so at the interface of the Grid and Consumer .
- New roles to transition from the conventional roles to the roles of Distribution System Operator ,Distribution Service Providers ,Energy Efficiency Service Providers etc.
- Real Time data combined with Historical data for CBM ,Predictive Analysis for averting any shutdowns is the order of the day .

THANK YOU

For discussions/suggestions/queries email: ***dum@indiasmartgrid.org***

www.isuw.in

Links/References (If any)

ORGANIZER

ISGF
India Smart Grid Forum

DISTRIBUTION UTILITY MEET
DUM 2023

THANK YOU

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Links/References (If any)