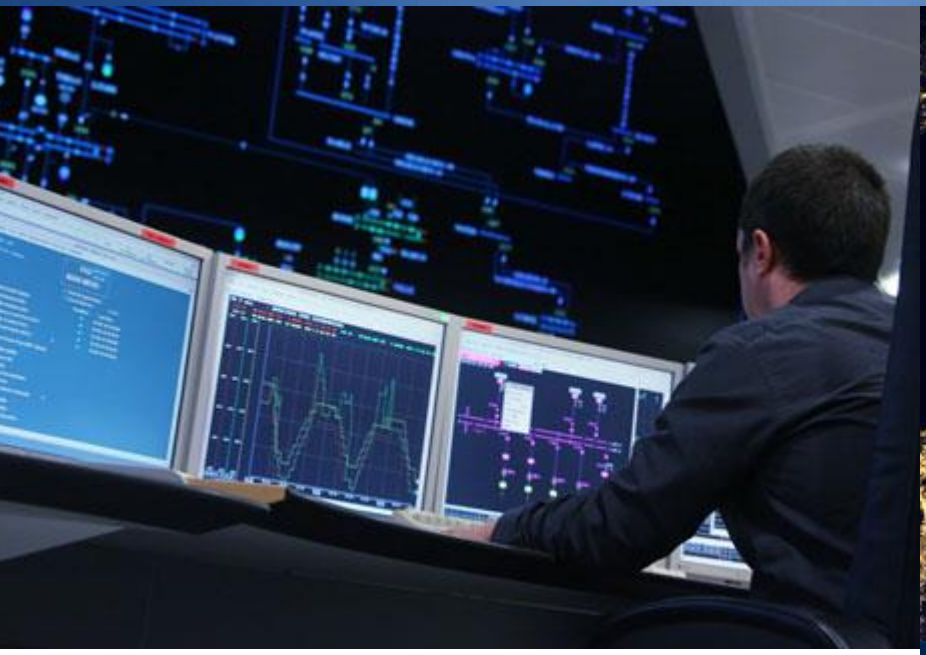




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Ramaswamy K V
Head- India Région



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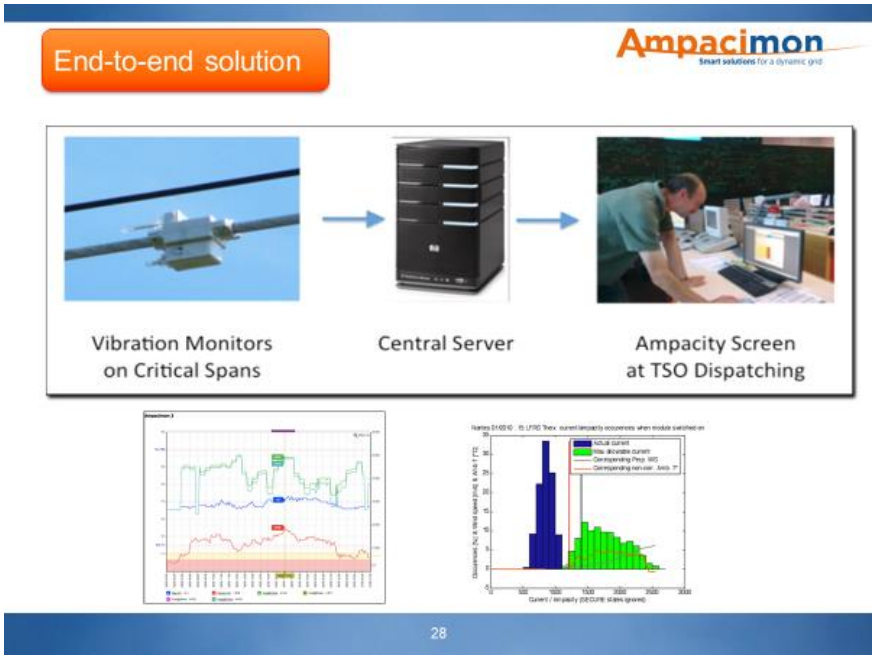
Role Of Grid Flexibility:

DYNAMIC LINE RATING(DLR)

- smart solution

for RE Integration

DLR Solution
features



- **Accurate measurement of Sag and Wind Speed done with Sensors on OHL - in Real Time**
- Optimized use of infrastructure & **No Compromise on any safety** feature.
- Its **sheer unlocking of the hidden capacity**
- **Reinforces Security framework** with RT visibility
- **Reduced Cost of Transmission** – benefits everyone !
- **Not a substitute** to Line extension – but **a facilitator**
- **Can Integrate with EMS / SCADA**

Contributes towards Clean Energy & Sustainability

Why do we need DLR ?

- **Access to Additional Reserve Capacities during Crucial Moments**
- **Immediate Relief, at fraction of cost.**
- **Visibility of dynamic capacities in RT reinforces Security framework, Confidence.**
- **Accurate Capacity Forecasts on P98 scale.**
- **Scheduling & Forecasting can be of Higher Resolution – with availability of RT transit capacity**
- **Manage Contingency/N-1, facilitates Energy Sec. & Mkt. for electricity**
- **Reduced Curtailment / faster integration of new resource**

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Gains in Reserve Capacity – as experienced by TSO in Europe.

Line		RT Ampacity average gain	RT Ampacity gain 90% of the time	D-2 Forecast P98 90% of the time
380.11.V	Herderen-Van Eyck	+ 38%	+ 30%	12%
380.23	Meerhout-Van Eyck	+ 36%	+ 26%	9%
380.25	Doel-Zandvliet	+ 56%	+ 42%	13%
380.80	Avelgem-Avelin	+ 32%	+ 21%	8%
380.19	Achene-Lonny	+ 43%	+ 30%	8%

Source: Elia

think SMARTGRIDS

Rte



Dynamic Line Rating

Field	HV & EHV Electricity Transmission
Country	France
Year	2017-2018
Budget	500 k€
Beneficiary	Transmission operator, Consumers, Community

DESCRIPTION

- **Issues:** allow for more renewable energies, augment line transit,
- **Project goal:** for the transmission operator: increase the capacity and service of existing infrastructure without investments on the grid.

IMPLEMENTATION

- Installation without interruption (live working) of ampacity controlling devices on the lines.
- Coupling with regional network control & operation system with integration of specially developed functions and software tools + data collection from environment (weather, …) and grid
- 3 lines equipped in France to date.
- Success factors: quick implementation. Immediate results.

IMPACTS

- +30% of transmission capacity at crucial moments of constraints.
- Time of return on investment of 8 month,
- Reduction of call to expensive peak generation, thus reducing tafiff costs. Less fossil fuel consumed. More capacity for renewables. No additional infrastructure.
- Future objectives: weather based allocation for transformers and high voltage lines,

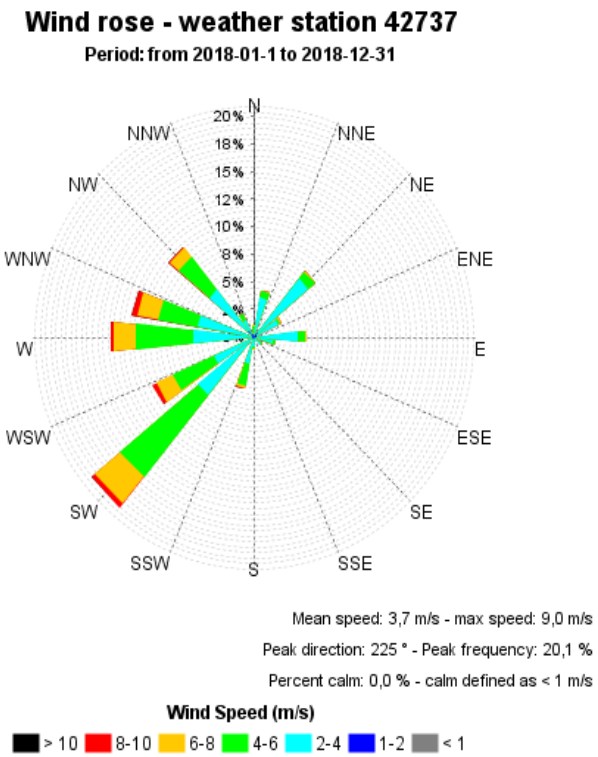
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Relevance of DLR in India's Context

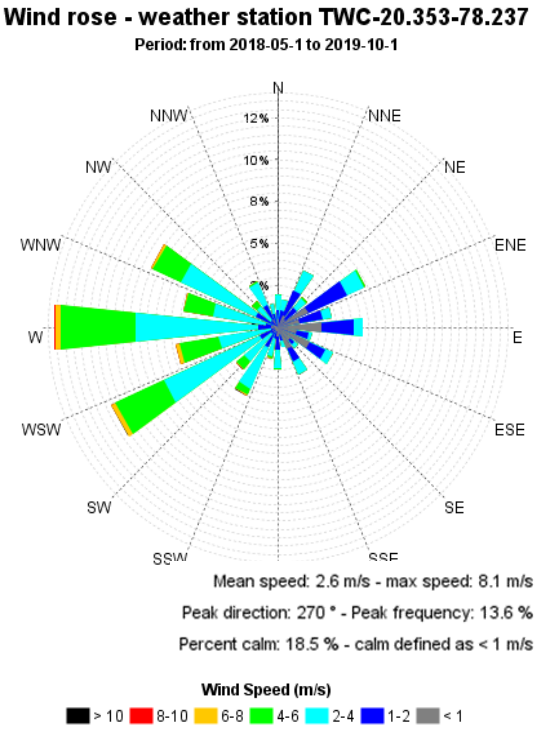
Case Studies

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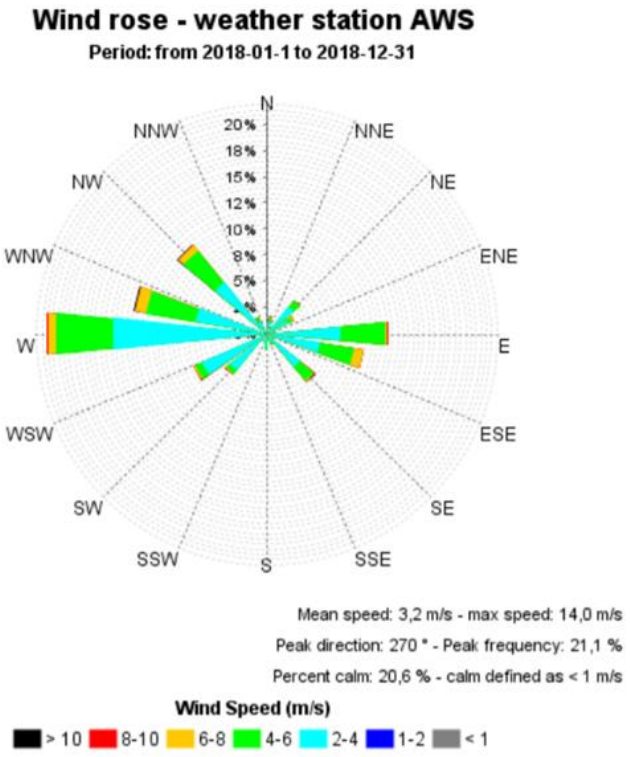
Wind Zone



Non-Wind- Central



Non-Wind -North



- Low Wind Speed always exists; hidden capacities certain & can be put to use
- Never any Lull moments at Wind Zones / states
- With higher Wind Speeds at Wind Zones , Gains only Increase!

Non Wind Zone

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Possible gains

220kv Zebra ambient temp.38.7C

Design limit 691A Existing limit 630A

Name	Average value	90% of the time value	95% of the time value	98% of the time value
Relative rating [%]	161.6%	140.7%	135.8%	131.7%
Relative ambient temperature rating [%]	152.2%	130.2%	126.5%	122.1%

The following table shows the gain of the dynamic rating for each season over the whole simulation period.

Name	Average value	90% of the time value	95% of the time value	98% of the time value
Rating ALL [A]	1022A	891A	859A	833A

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WIND ZONE

Possible gains

220kv- Zebra ambient temp. 40.6C

Design limit 500A Existing limit 600A

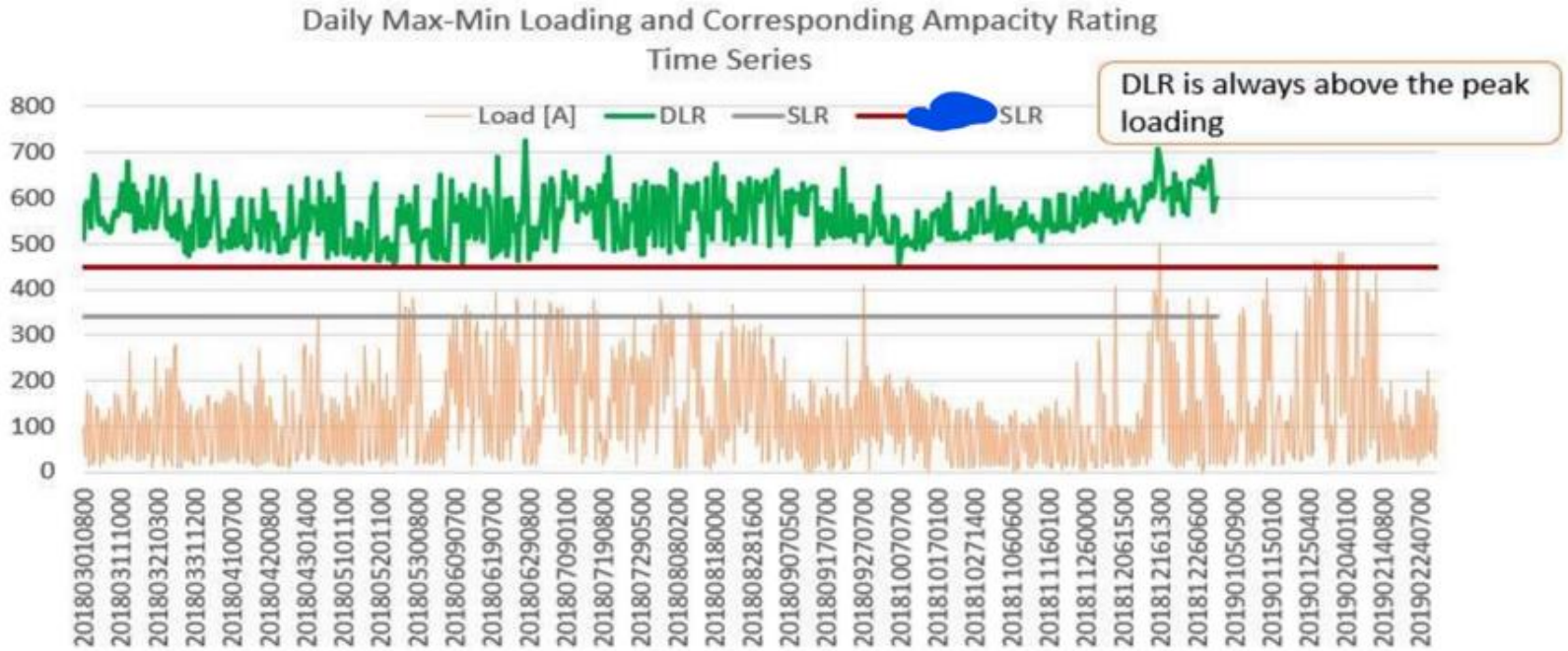
Name	Average value	90% of the time value	95% of the time value	98% of the time value
Relative rating [%]	153.2%	135.6%	131.6%	127.9%
Relative ambient temperature rating [%]	139.2%	121%	117.9%	115.2%

The following table shows the gain of the dynamic rating for each season over the whole simulatio period.

Name	Average value	90% of the time value	95% of the time value	98% of the time value
Rating ALL [A]	919A	813A	790A	767A

Real Time correlated DLR values

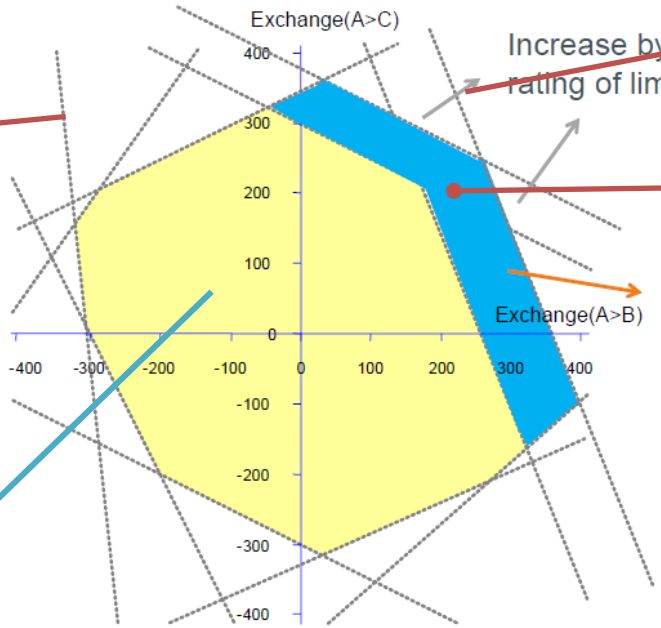
Wind Zone in India



- Actual line rating considering ambient cooling including wind, we see that there are NO INSTANCES of overloading. The daily maximum loads are comfortably accommodated.

RTM for Electricity
DLR increase of 3% on CNE leveraged 22% trade volume
-Role of Enabler

Impact of DLR on flow based (capacity allocation)



Constraints by CNEs

Increase by 3% the rating of limiting lines

Constraints by CNEs relieved by DLR

Increase in safe trade capacity due to DLR

Increase by 22% the available volume for the market

Ex:19/2/2015, market limited by Belgian lines. By using the 2-day ahead forecast, less constrain. During only 4 hours, the gain on the CWE welfare has been computed to 247.250 €

Portion of Fmax for traders

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DLR
is the smarter way
to handle RE Integration
amidst capacity bottlenecks

- **Economic Benefits** arising out of **deferring costly investment /capex** in line infrastructure
- **Wind / Solar hybrid projects** need to be encouraged – **optimization of evacuation infrastructure**.
- **Off Shore Wind Project-** Can be **part of Road map for integrating Wind Farm out put / infeed into Grid**
- **DLR gains can be added to static rating** (loading limit) & load flow calculations done **like in Germany- better informed Grid Planning !**

DLR a 'Reliable concept'

Enables 'well informed' network planning

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The Regulatory impetus in Europe

ACER
Agency for the Cooperation of Energy Regulators

DECISION No 02/2019
OF THE AGENCY FOR THE COOPERATION OF ENERGY REGULATORS

of 21 February 2019

on the Core CCR TSOs' proposals for the regional design of the day-ahead and intraday common capacity calculation methodologies

THE AGENCY FOR THE COOPERATION OF ENERGY REGULATORS,

Having regard to the Treaty on the Functioning of the European Union,

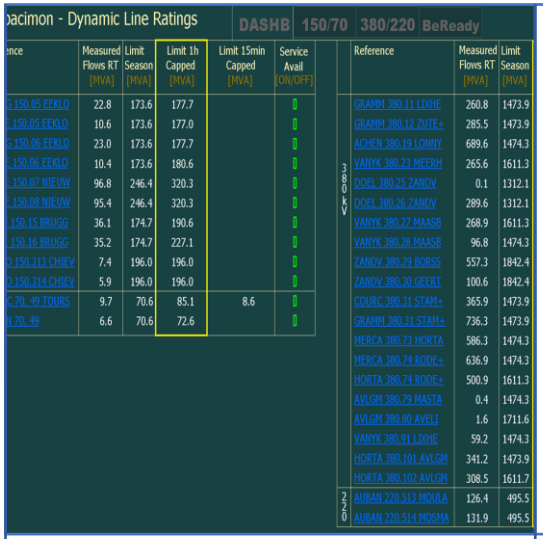
Having regard to Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators[1], and, in particular, Articles 8(1) thereof,

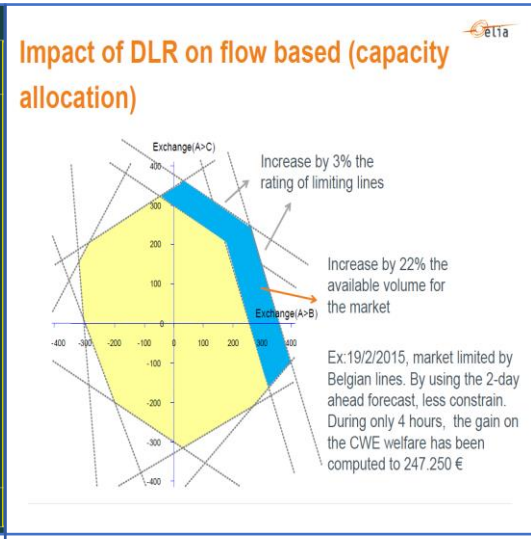
(68) When defining I_{max}, the Agency limited possible options to calculate it only to three, and grouped the approaches associated to a fixed limit in the Amended Proposals into one category to which only those elements that are both not sensitive to ambient conditions and installed in the primary power circuit are eligible. The Agency excluded secondary equipment from this category. As a principle, secondary equipment should not limit I_{max}, as the costs of replacing such equipment are low, in particular in comparison with the expected gain from replacing them.

(69) The Agency further clarified that, as a consequence of a temporary limit applied to a CNE, various CNECs associated with the same CNE may have different values for I_{max}. The Agency also rephrased and clarified the assumption on the power factor $\cos(\varphi)$.

(70) In order to maximise the available capacity on the CNECs, the Agency reinforced the obligation for the Core TSOs gradually to replace the seasonal limits to calculate I_{max} with a dynamic limit, which ensures that I_{max} represents the maximum current under expected ambient conditions for a given market time unit. In order to ensure an efficient implementation of this requirement and to fulfil the objectives set in Articles 3(b) and 3(d) of the CACM Regulation, (i.e. respectively ensuring an optimal use of the transmission infrastructure and optimising the calculation and allocation of cross-zonal capacity), TSOs should focus on the most limiting CNEs and compare the costs and benefits of installing the equipment needed to implement dynamic limit on those CNEs. When benefits outweigh costs, TSOs should install such equipment within three years.

How’s DLR used in Europe?







Real-time data in SCADA

Forecast data in market trading

Statistics data for grid planning

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Proven

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