CENTRAL ELECTRICITY REGULATORY COMMISSION

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Minutes of the Commission meeting held on 13th October, 2009

1.0 The following were present:

1. Dr. Pramod Deo, Chairperson **In Chair**
2. Mr. Rakesh Nath, Chairperson, CEA (Ex-officio Member, CERC)
3. Mr. R. Krishnamoorthy, Member
4. Mr. S. Jayaraman, Member
5. Mr. V.S. Verma, Member
6. Mr. Alok Kumar, Secretary
7. Mr. K.S. Dhingra, Chief (L)
8. Mr. K. Biswal, Chief (F)
9. Mr. Pankaj Batra, Chief (E)
10. Mr. Vijay Menghani, Jt. Chief (E)
11. Mr. Rahul Banerjee, Power Market Consultant
12. Mr. S.K. Soonee, ED, PGCIL

2.0 Item No. 1: Status of the pending decisions of the Commission in previous meetings.

The status was noted by the Commission.

3.0 Item No.2: Regulations on Congestion Charges

The proposal was approved with the certain modifications and the Commission directed that the final regulations along with Statement of Reasons may be submitted for approval accordingly.

4.0 Item No.3: Presentation on Congestion by System Operator.

A presentation was made by Shri S.K. Soonee, ED, PGCIL (copy enclosed) on Congestion.

5.0 Item No.4: Amendment to IEGC

The proposal was approved with the certain modifications and the Commission directed that the final regulations along with explanatory note may be submitted for approval accordingly.

6.0 Item No.5: Status of outstanding UI dues

After perusing the status, Commission gave directions for further action.

7.0 The meeting ended with vote of thanks to the chair.

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Congestion Management

Meeting at CERC

13/10/2009

Outline

- Congestion- Background
  - Definition, Types, Visibility
- Congestion in Indian context
  - Perceived reasons
- Congestion Management
  - Base line determination
  - Operational planning horizon
  - Real-time horizon
  - Regulatory initiatives
- Suggestions

Background

Congestion in Power System

"*Congestion is a situation where the demand for transmission capacity exceeds the transmission network capabilities, which might lead to violation of network security limits, being thermal, voltage stability limits or a (N-1) contingency condition*."

CIGRE_WG_5.04_TB_301

Table 2. Frequency, duration of congestion within countries with frequent congestion

	Frequency	Typical duration
France	Almost everyday (some part of network)	12 hours in the day during peak hours
Norway	Almost everyday, especially often in Summer	Approximately 8 - 10 hours a time
United Kingdom	Around 300 balancing actions a year	From transitory in nature to longer periods
PJM	Almost every day. Use of reliability "backstop" ("TLR") several times a week	Typical 1 - 2 hours per incident. Duration for reliability "backstop" would be in the 2 - 3 hours range.
IMO (Ontario)	One particular interface often congested, however the amount of congested capacity is insignificant	
Romania	50 times a year	8 hours (Values estimated for 2003)

Visibility of congestion

To be handled before-the fact

- Visible to the market players
  - "*If for a given interconnection, there is more demand for cross border capacity than commercially available, the interconnection is also treated as congested, meaning no additional power can be transferred. This congestion is visible for market players as a limit on their cross-border transactions*."- CIGRE_WG_5.04_TB_301
- Invisible to the market players
  - "*It is possible that even though the available commercial interconnection capacity is not fully allocated to market players, some lines, being internal or cross-border, become overloaded. This physical congestion is a problem of the System Operator and has to be dealt with by this entity*." CIGRE_WG_5.04_TB_301

To be handled in real-time

Congestion visible to the market

- "*The more transactions and the more meshed the network, the higher the chance for mismatch between commercial exchange and physical flows*." CIGRE_WG_5.04_TB_301
  - Congestion
    - Sign of growth and vibrant market
    - Natural corollary to Open Access
  - Existing transmission system was not planned with short-term open access in mind
  - Security margins have been squeezed
  - 'Pseudo congestion' needs to be checked

Congestion in real-time is a security threat

- Phenomenon common to large meshed grids
- Coupling between voltage and frequency accentuates the problem in a large grid

Real-time Congestion types

- Internal congestion (Intra-zonal)
  - Within a single System Operator's control area

Was not experienced
-Regional grids were small
-Trades were limited

- Cross-border (Inter zonal)
  - Also called seams issue
  - Several System Operators involved

Experienced occasionally under
- Grid Contingencies
- Skewed conditions in grid
Aggressive Open Access trades

Congestion in the Indian context

Perceived reasons for congestion

- Availability of fuel / resources
  - Natural distribution, Government Policy
- Physical network limitations
  - Vintage, Ownership, Transition
- Inadequate compliance to reliability standards
  - Protocols, Safety net
- Market Organization
  - Design, Market interplay, Behavior of players
- Declared Operating limits by System Operators
  - Assumptions, Evaluation principle, Reliability Margins

Base line determination a pre requisites for Congestion Management

Open Access Theory & Practice
Forum of Regulators report, Nov-08

"For successful implementation of OA, the assessment of available transfer capability (ATC) is very important. A pessimistic approach in assessing the ATC will lead to under utilisation of the transmission system. Similarly, over assessment of ATC will place the grid security in danger."

Declaration of Security Limits

- "*In order to prevent the violation of security limits, System Operator SO must define the limits on commercially available transfer capacity between zones*." CIGRE_WG_5.04_TB_301

- "*System Operators try to avoid such unforeseen congestion by carefully assessing the commercially available capacities and reliability margins*." CIGRE_WG_5.04_TB_301

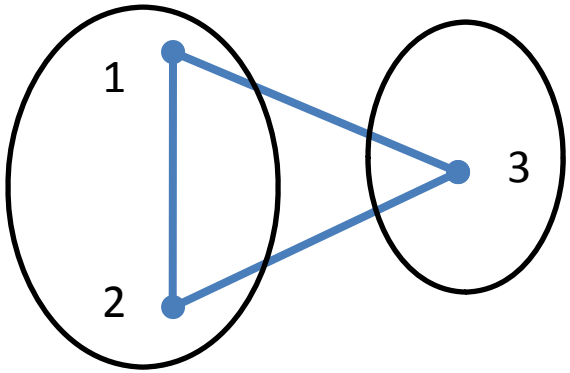
Transfer Capability Calculations must

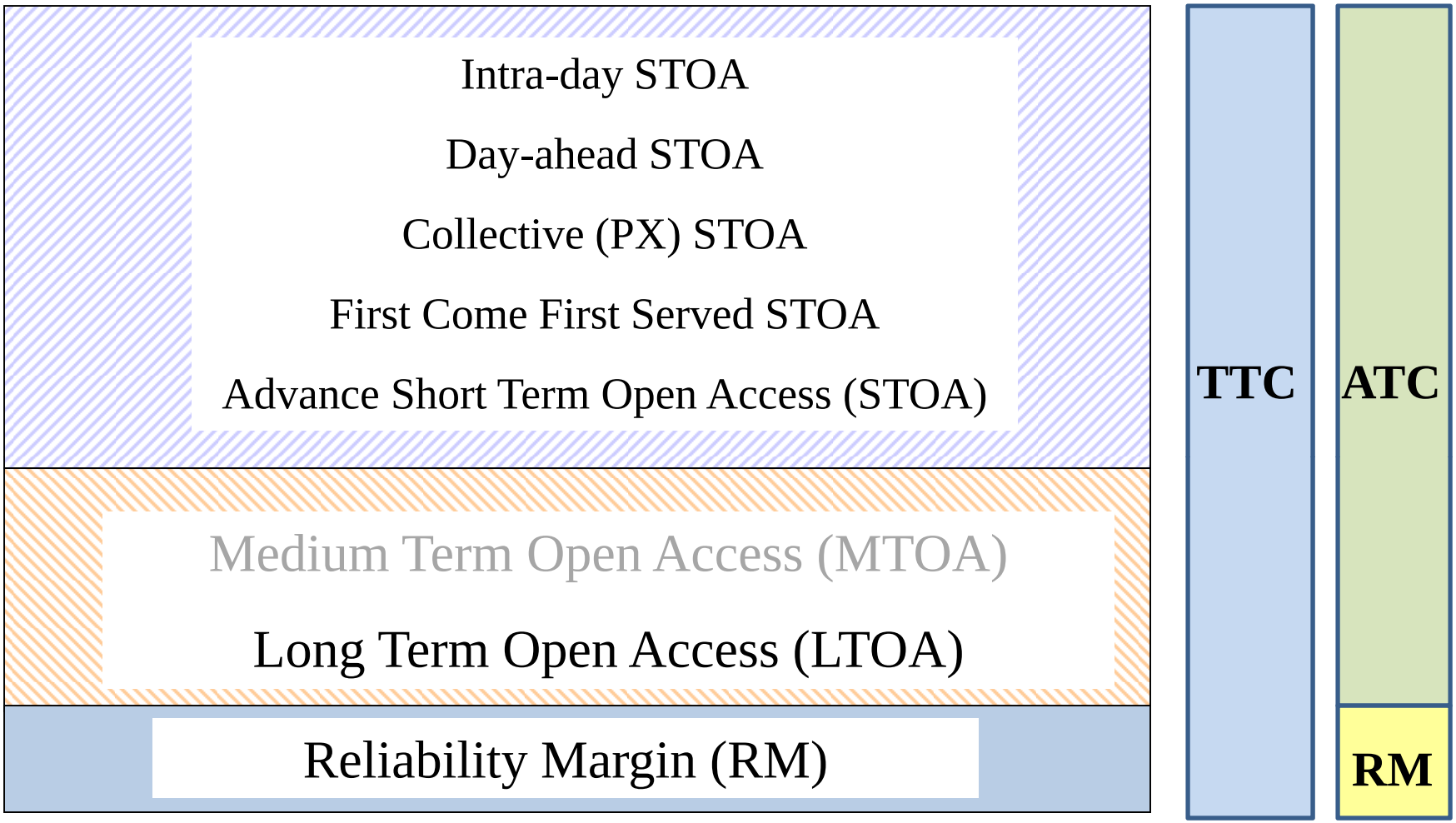
- Give a reasonable and dependable indication of transfer capabilities,
- Recognize time variant conditions, simultaneous transfers, and parallel flows
- Recognize the dependence on points of injection/extraction
- Reflect regional coordination to include the interconnected network.
- Conform to reliability criteria and guides.
- Accommodate reasonable uncertainties in system conditions and provide flexibility.

Courtesy: Transmission Transfer Capability Task Force, "Available Transfer Capability Definitions and Determination", North American Electric Reliability Council, Princeton, New Jersey, June 1996 NERC

Cross border capacity available for trade

- *"Physical capacity connecting zones A and B is sum of 1-3 and 2-3 physical line capacities. However, the cross border capacity available for commercial trade would be less or at most equal to the sum of capacities of cross border lines individually."* CIGRE_WG_5.04_TB_301

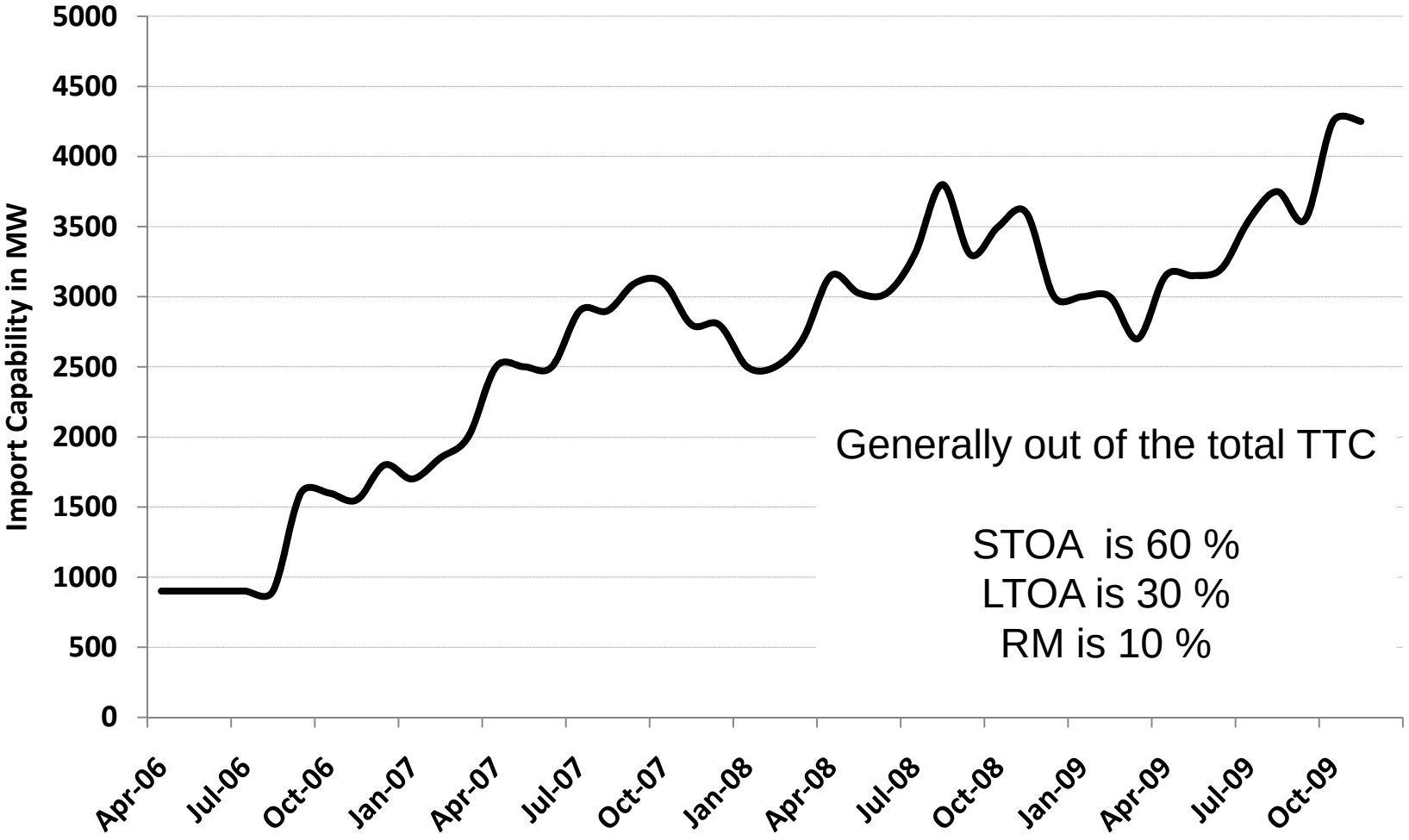


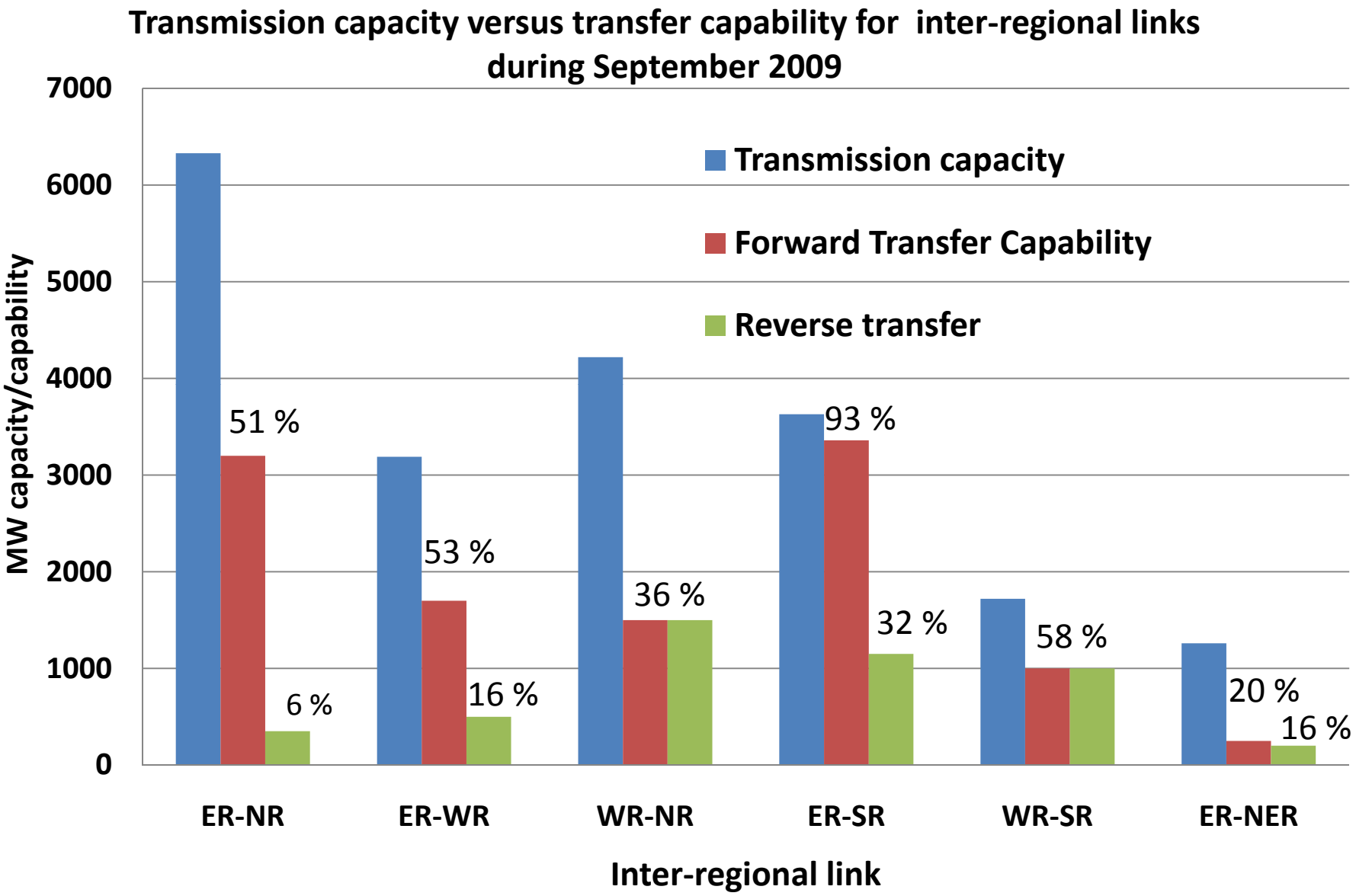


Available Transfer Capability is

Total Transfer Capability less Reliability Margin

Total Transfer Capability for import of power in Northern region




Transmission capacity versus transfer capability for inter-regional links during September 2009
MW capacity/capability
7000
6000
5000
4000
3000
2000
1000
0
Transmission capacity
Forward Transfer Capability
Reverse transfer
51 %
6 %
53 %
16 %
36 %
93 %
32 %
58 %
20 %
16 %
ER-NR
ER-WR
WR-NR
ER-SR
WR-SR
ER-NER
Inter-regional link

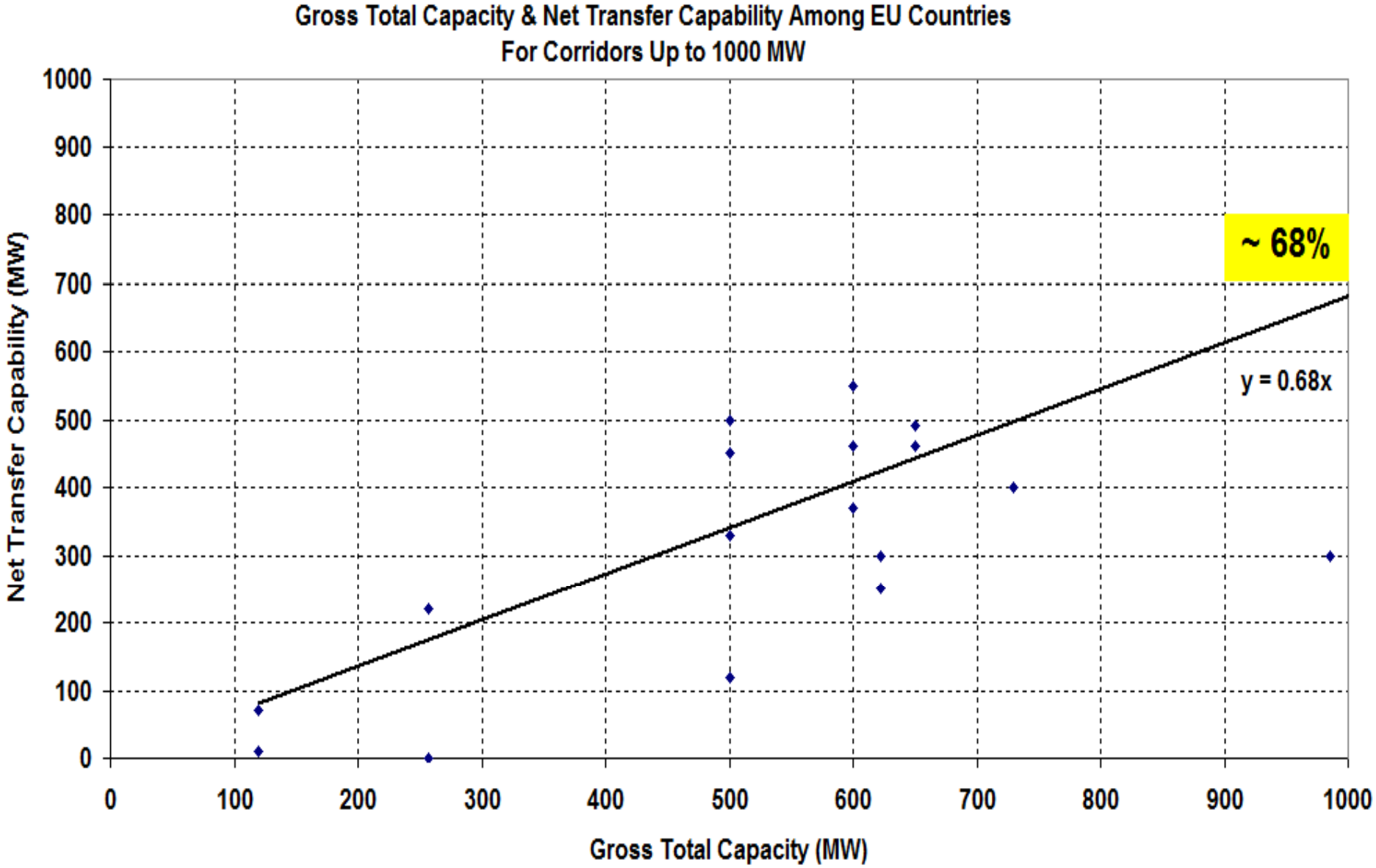
NTC map for season:
Winter 2008/2009

Gross Transmission Capacity (GTC) vis a vis Net Transmission Capacity (NTC) in Europe

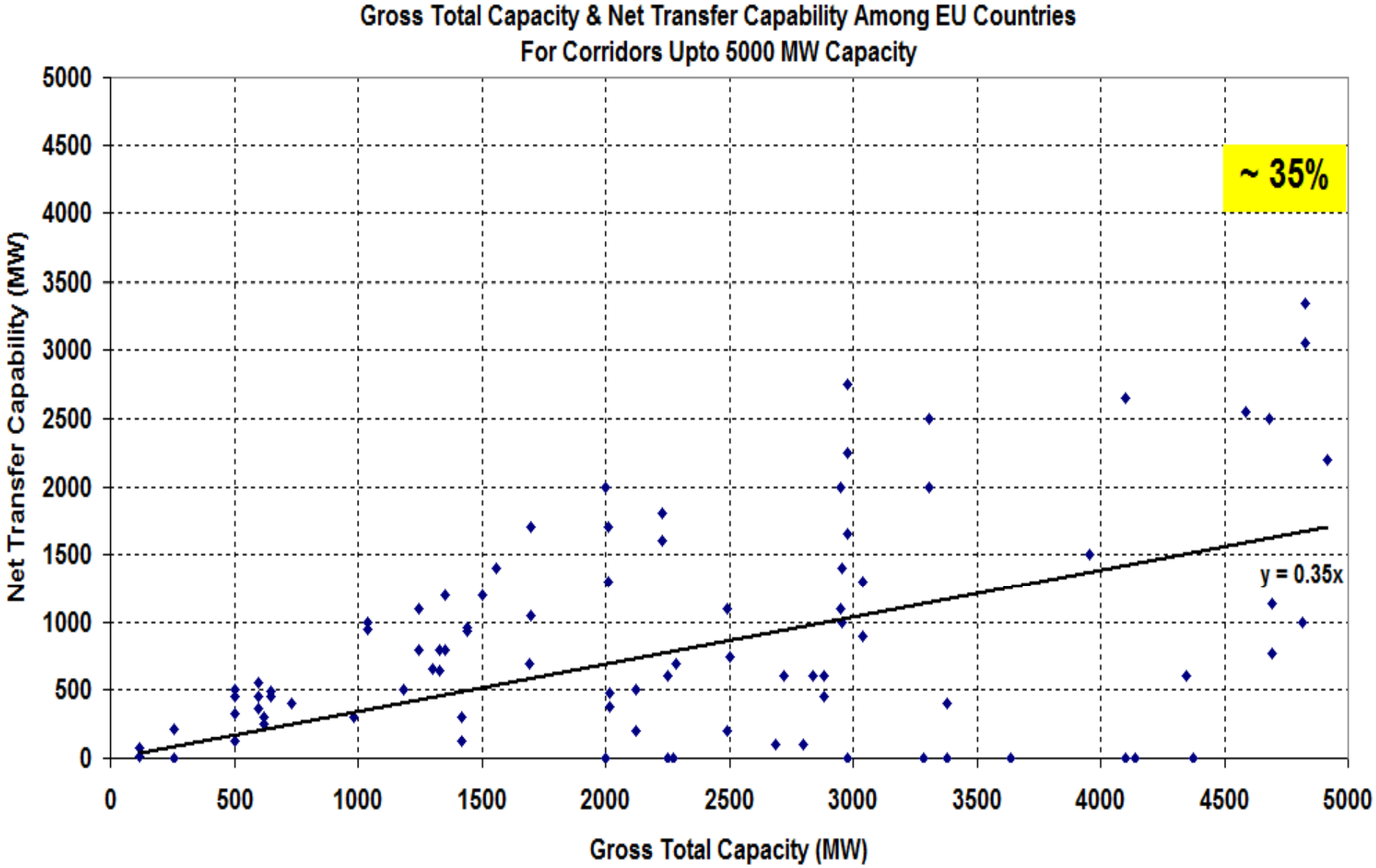
Corridor	GTC	NTC	Difference	NTC/GTC (%)
France to United Kingdom	2000	2000	0	100%
United Kingdom to France	2000	0	2000	0%
Denmark (East) to Sweden	2010	1700	310	85%
Sweden to Denmark (East)	2010	1300	710	65%
Italy to Slovenia	2017	480	1537	24%
Slovenia to Italy	2017	380	1637	19%
Austria to Hungary	2124	500	1624	24%
Hungary to Austria	2124	200	1924	9%
Sweden to Finland	2230	1800	430	81%
Finland to Sweden	2230	1600	630	72%
Czech Republic to Austria	2249	600	1649	27%
Austria to Czech Republic	2249	0	2249	0%
Italy to Austria + Slovenia	2274	0	2274	0%
Lituania to Kaliningrad	2287	700	1587	31%
Slovakia to Hungary	2492	1100	1392	44%
Hungary to Slovakia	2492	200	2292	8%
Poland to Slovakia	2504	750	1754	30%
Slovakia to Poland	2504	750	1754	30%

Courtesy: ENTSOE

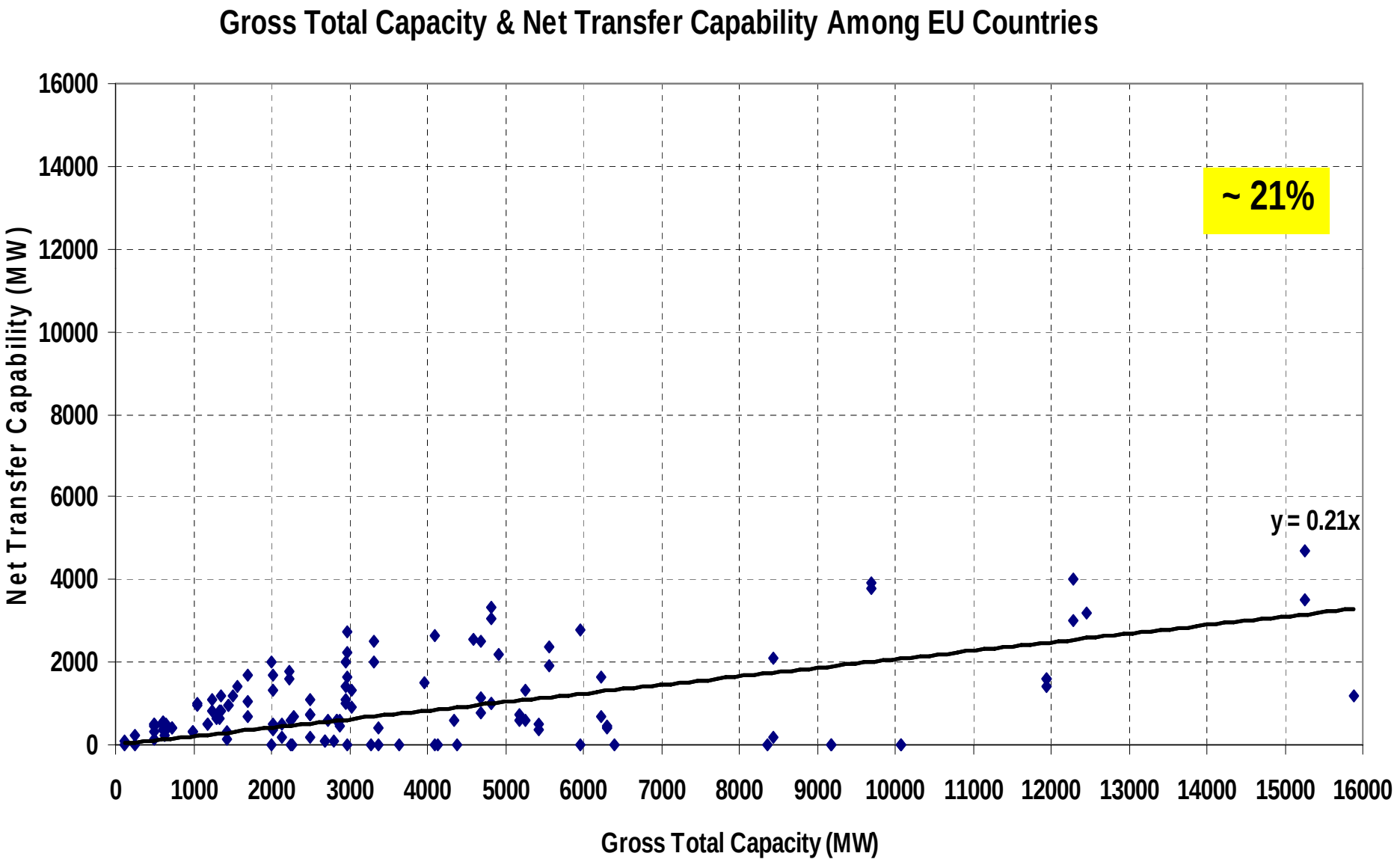
NTC Vs GTC Among EU Countries For Corridors Up to 1000 MW



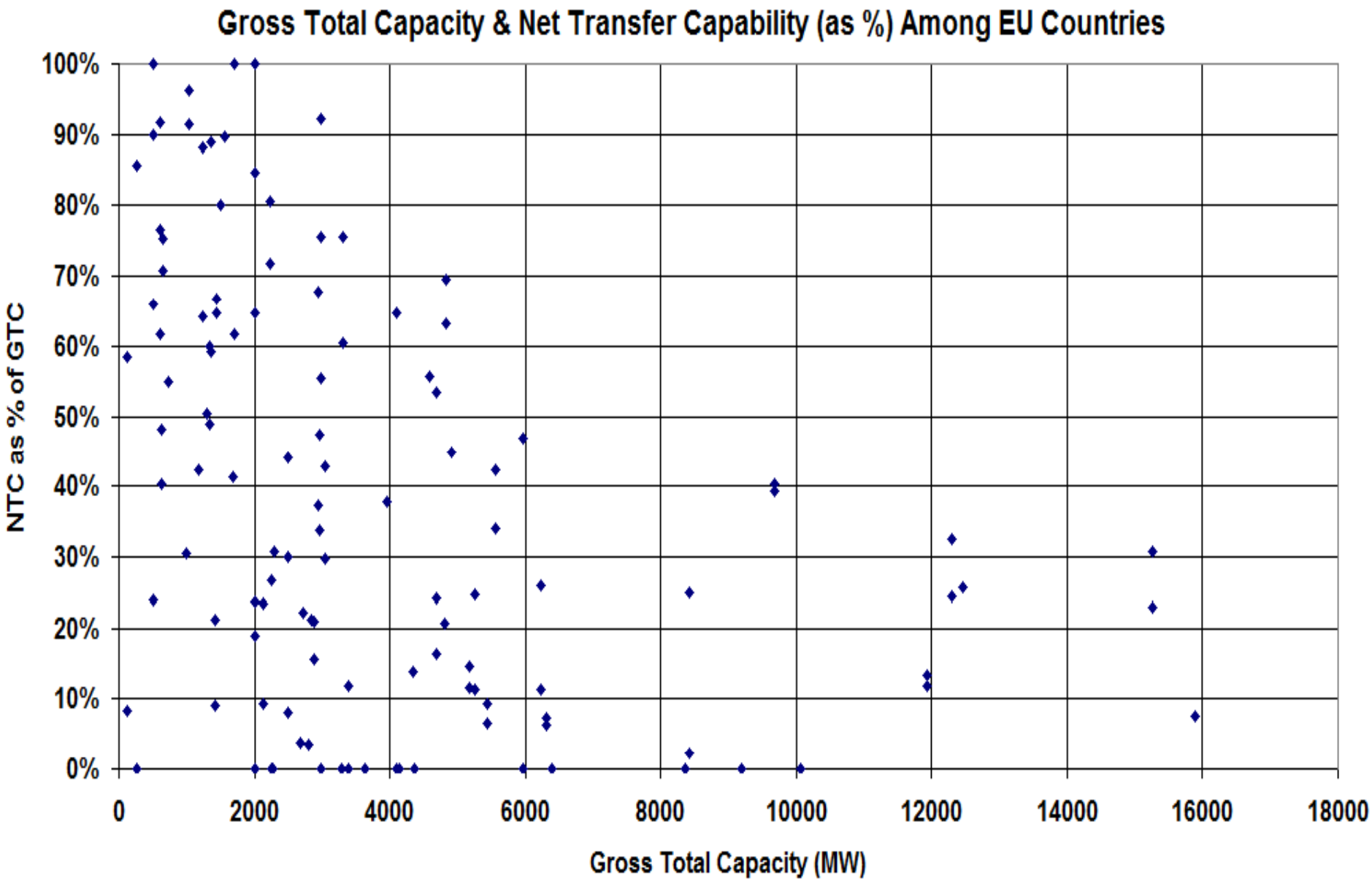
NTC Vs GTC Among EU Countries For Corridors Up to 5000 MW



NTC Vs GTC Among EU Countries For Corridors Up to 16000 MW



NTC As % of GTC Among EU Countries



Transmission Capacity (TC) vis-à-vis Available Transfer Capability (ATC) in Brazil

TRUNK	TC (MW)	ATC (MW)		ATC/TC (%)
North - Southeast/Midwest Interconnection (from North to Southeast)	4200	n-1	3400	81
		n-2	1700	40
		WITH SPS	4100	98
North - Southeast/Midwest Interconnection (from Southeast to North)		n-1	3000	71
Foz do Iguaçu – Ivaiporã 765 kV trunk	6450	n-2	3600	56
		WITH SPS	5300	82
Southeast/Midwest - South Interconnection	17180	n-2	9500	55
440 kV trunk feeding São Paulo	14500	n-2	9600	66
		WITH SPS	10200	70

Courtesy: ONS Brazil

Congestion Management

Operational planning horizon

Congestion Management

- Priority based rules
- Pro-rata rationing
- Auctioning
  - Explicit Auction
  - Implicit Auction
  - Hybrid
- Market splitting
- Market coupling

Congestion Management
Lessons learnt in Indian context

- Firmness in STOA schedules
  - "Use it or Lose it"
- Valuing transmission instead of pro rata
- Market splitting

Congestion Alleviation Methods

Real-time horizon

Congestion Alleviation instruments

- **Classical**
  - Compliance to Standards and Grid Code
  - Topology change
  - Re-dispatch
  - Curtailment
- **Market based**
  - Commercial signals (Congestion Charge)
  - Ancillary Market
    - Out of merit generation scheduled to pool
    - Reactive power charge- synchronous condenser operation

Congestion Alleviation Methods

- Counter trading
- Re-dispatching (Out of merit generation)
- Locational Marginal Pricing (LMP)

  $\lambda_{node} = \lambda_{\text{deviation price}} + \lambda_{\text{congestion charge}} + \lambda_{losses}$
- Transmission Loading Relief (TLR)

  All these methods would result in significant rise in total cost.

  "Price for system security"

Regulatory initiatives

- **Modifications in Grid Code & other regulations**
  - Frequency band tightening
  - Cap on UI volume, Additional UI charge
  - Inclusion of new definitions (TTC, ATC, Congestion)
- **Congestion Charge Regulation**
  - Congestion Charge Value, Geographical discrimination
  - Procedure for Assessment of Transfer Capability
  - Procedure for Implementation of Congestion Charge

Geographical Position	Status	Congestion Charge	Options		
		Polarity	A	B	C
Up stream of congested axis	Over drawal	(-)	100 %	0	50 %
	Under injection	(-)	100 %	0	50 %
	Under drawal	+	100 %	100 %	100 %
	Over injection	+	100 %	100 %	100 %
Down stream of congested axis	Over drawal	+	100 %	100 %	100 %
	Under injection	+	100 %	100 %	100 %
	Under drawal	(-)	100 %	0	50 %
	Over injection	(-)	100 %	0	50 %

Graded congestion Charge w.r.t duration and degree of congestion

Thank you for your attention !