



Utility Restructuring and Electricity Markets

EPCC 11 Market Functions Session

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Restructuring of Electric Utility Industry

▶ Goals of Deregulation /Restructuring

- ▶ Reduce overall cost of energy and operate efficiently
- ▶ Facilitate competition and trade of electricity between market participants
- ▶ Foster generation resources: renewables
- ▶ Maintain the security of supply

▶ Problems with “Competitive” Electricity

- ▶ Electricity is not easily stored – the market is “instantaneous”
- ▶ Grids have finite capacity to transport (*congestion issues*)
- ▶ Consumers see the same “quality” of delivered product
- ▶ Electricity is not easily labelled – loop flows
- ▶ Transportation losses

Electric Commodities

▶ Energy

- ▶ Generation and Demand

▶ Reserves (Ancillary Services)

- ▶ Frequency support/Regulation
- ▶ Short and long-term reserves (capacity)
- ▶ Voltage support
- ▶ Black start

▶ Balancing Energy (a version of short term reserves)

- ▶ Ability to relieve the mismatch between forecast/scheduled demand/generation and actual demand/generation in real-time

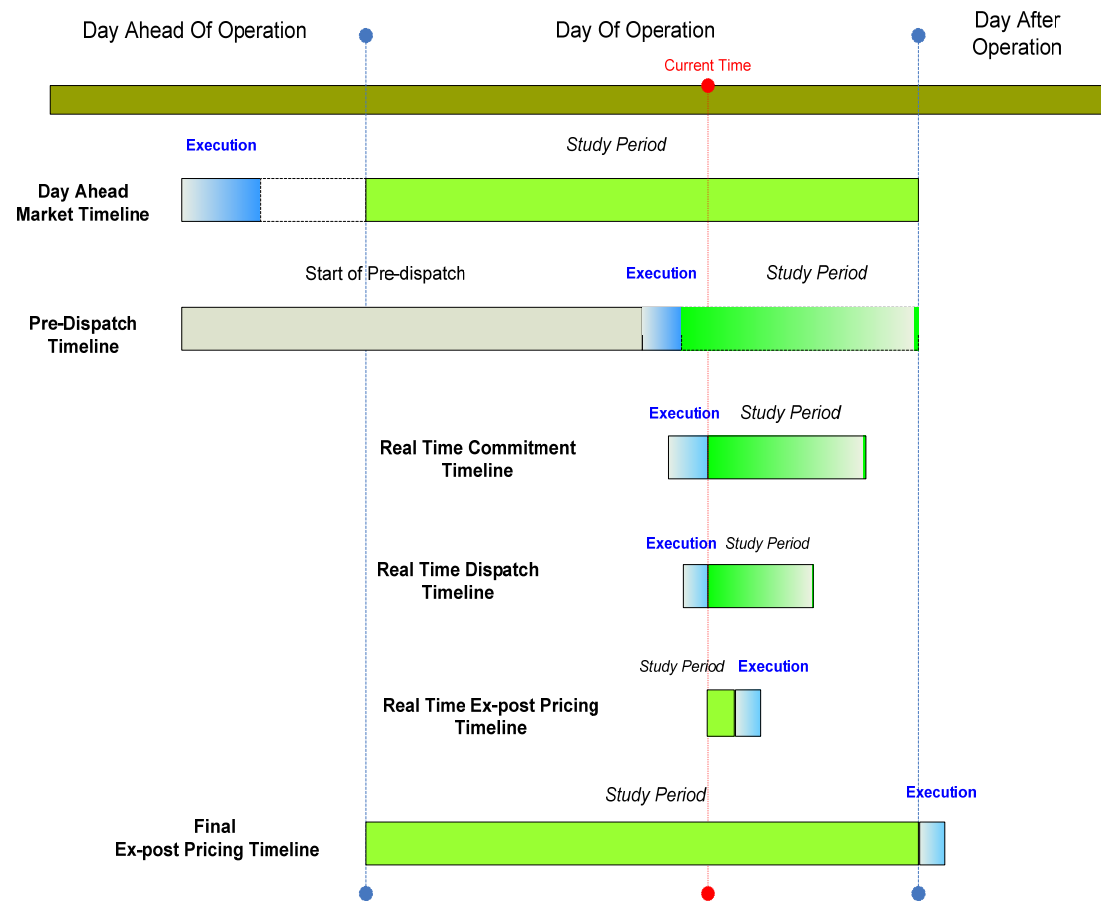
▶ Right to Use Transmission

▶ Trading/Scheduling Timelines:

- ▶ Year-ahead, Week-ahead, Day-ahead, Inter-Day, Hour-ahead, Real-time

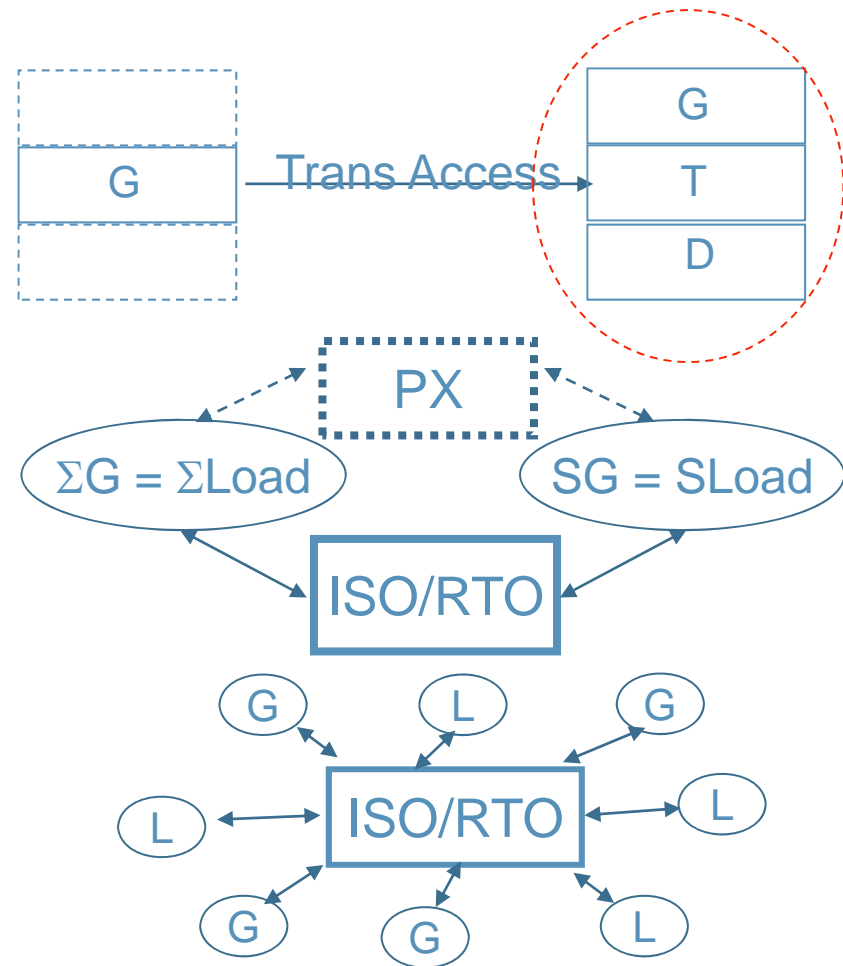
Typical Electricity Market Operation Time line

- ▶ Year-ahead
- ▶
- ▶ Day-ahead
- ▶ Intra-Day
- ▶ Hour-Ahead
- ▶ Real-Time

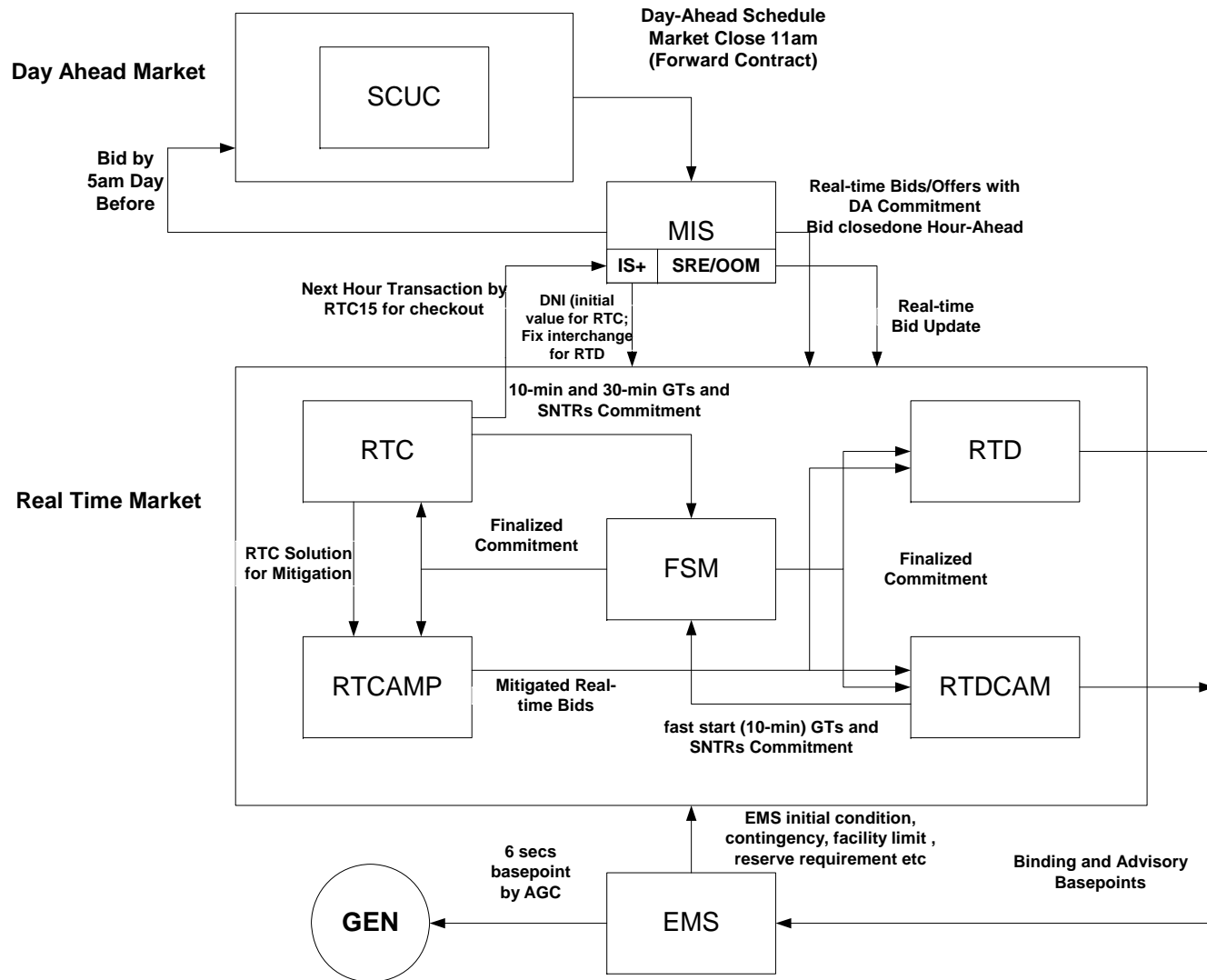


Restructuring of Electric Industry - NA / US Approach

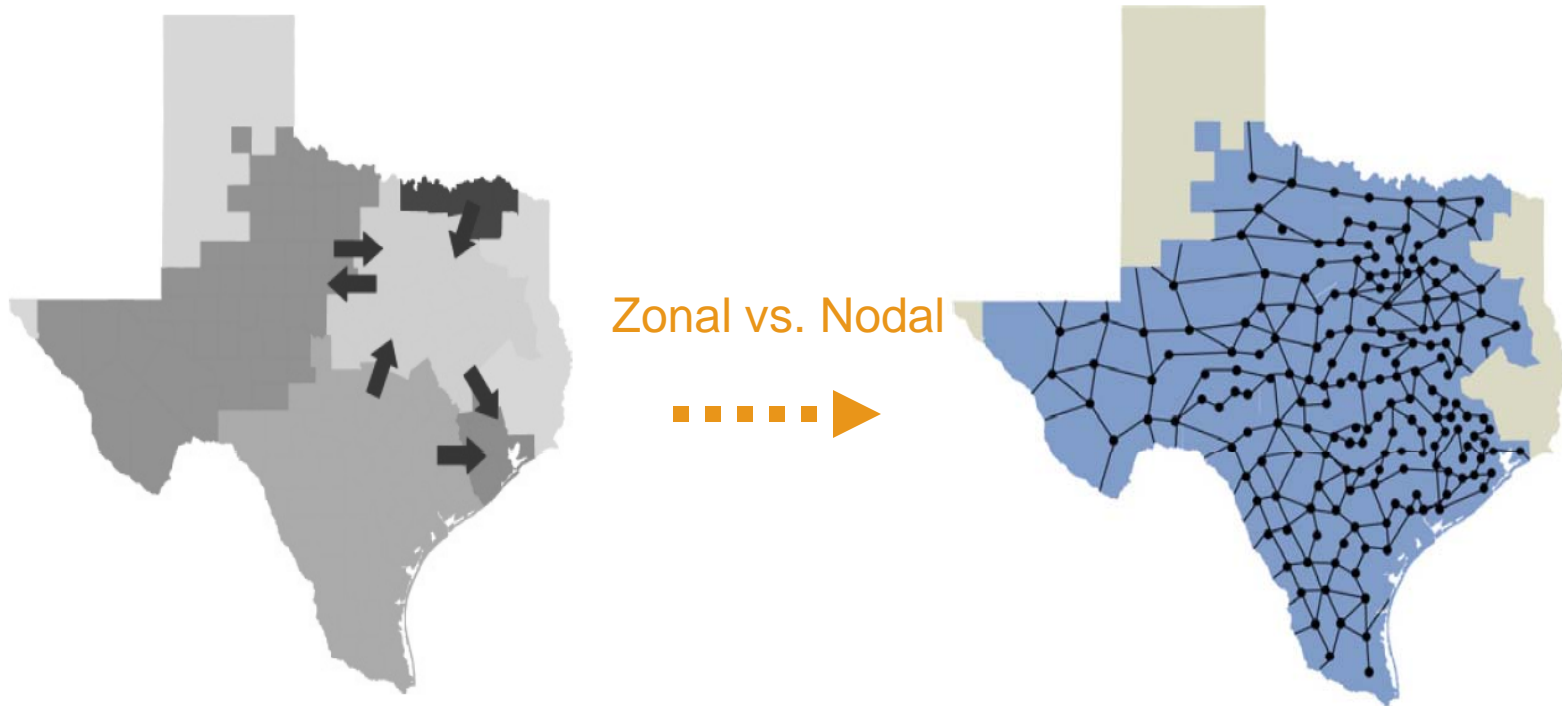
- Bilateral Trading and OASIS
 - FERC Orders 888 and 889
 - Did not remove discriminatory behavior
- Balanced Schedule Coordination
 - No discrimination
 - Congestion problems
 - e.g. , old ERCOT and CAISO
- “Standard Market Design”
 - Market and reliability
 - SCUC and SCED
 - NYISO, ERCOT nodal, PJM, etc.



Market Dynamic



Congestion Management - A Key Market Design Principle



European Approach

- ▶ **Internal European Market (IEM)**
 - ▶ From national, to regional, to a single market
- ▶ **Harmonization: trading and transmission allocation**
 - ▶ Long-term to “near real-time”
 - ▶ Removal of barriers to single IEM
 - ▶ Interoperability and consistent operation across IEM
- ▶ **Congestion Management**
 - ▶ Focus on cross border
- ▶ **Support the 2020 Renewable Energy targets**
 - ▶ Expect congestion aggravation
- ▶ **The Third Energy Package**

The Third Energy Package

▶ Unbundling:

- ▶ Full ownership unbundling
- ▶ Independent System Operator (ISO)
- ▶ Independent Transmission Operator (ITO)

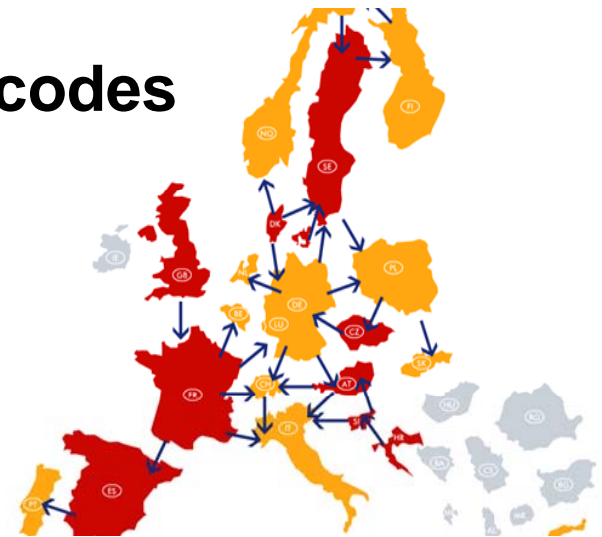
▶ Transmission Enhancement

▶ Framework guidelines and network codes

- ▶ ACER and ENTSO-E

▶ Coherent framework

- ▶ Target Model



Target Model For Market Integration

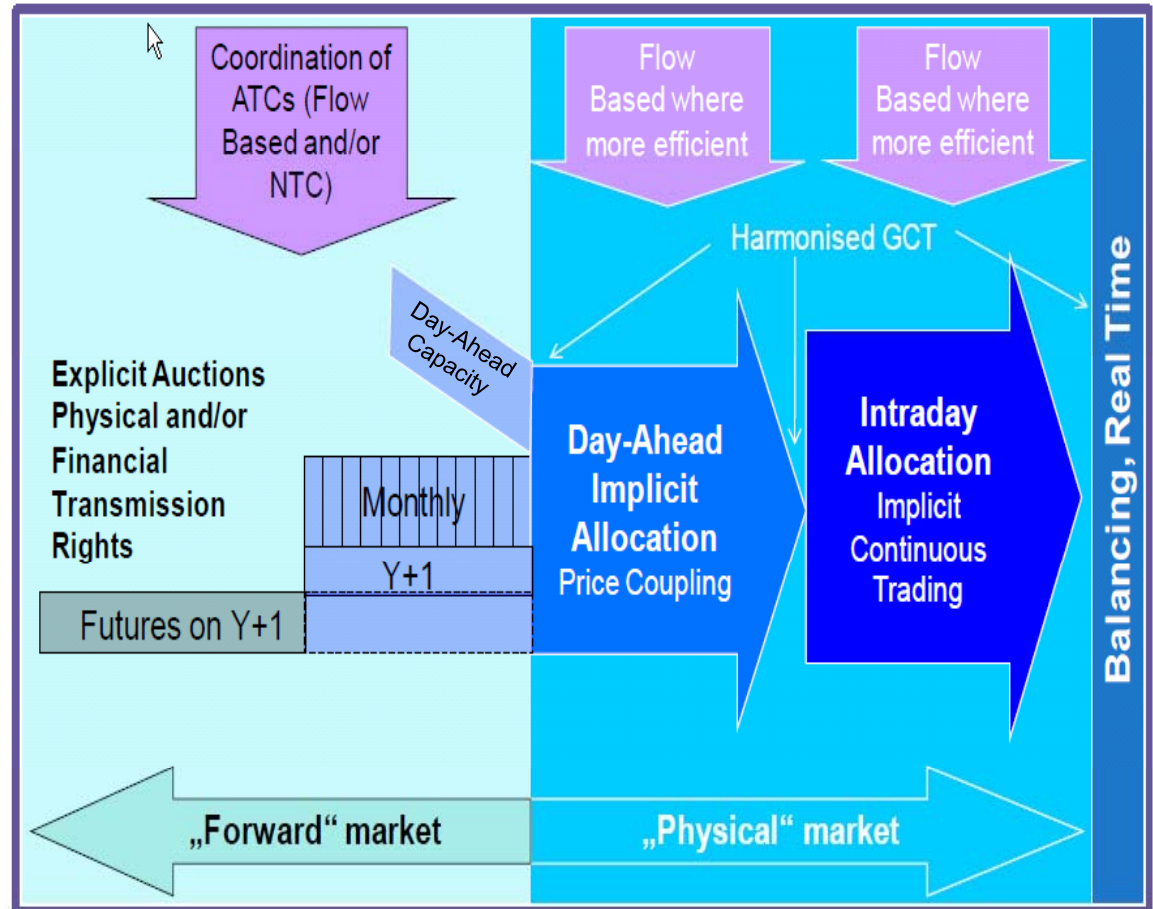
▶ Cross border capacity

- ▶ Calculation
- ▶ Allocation

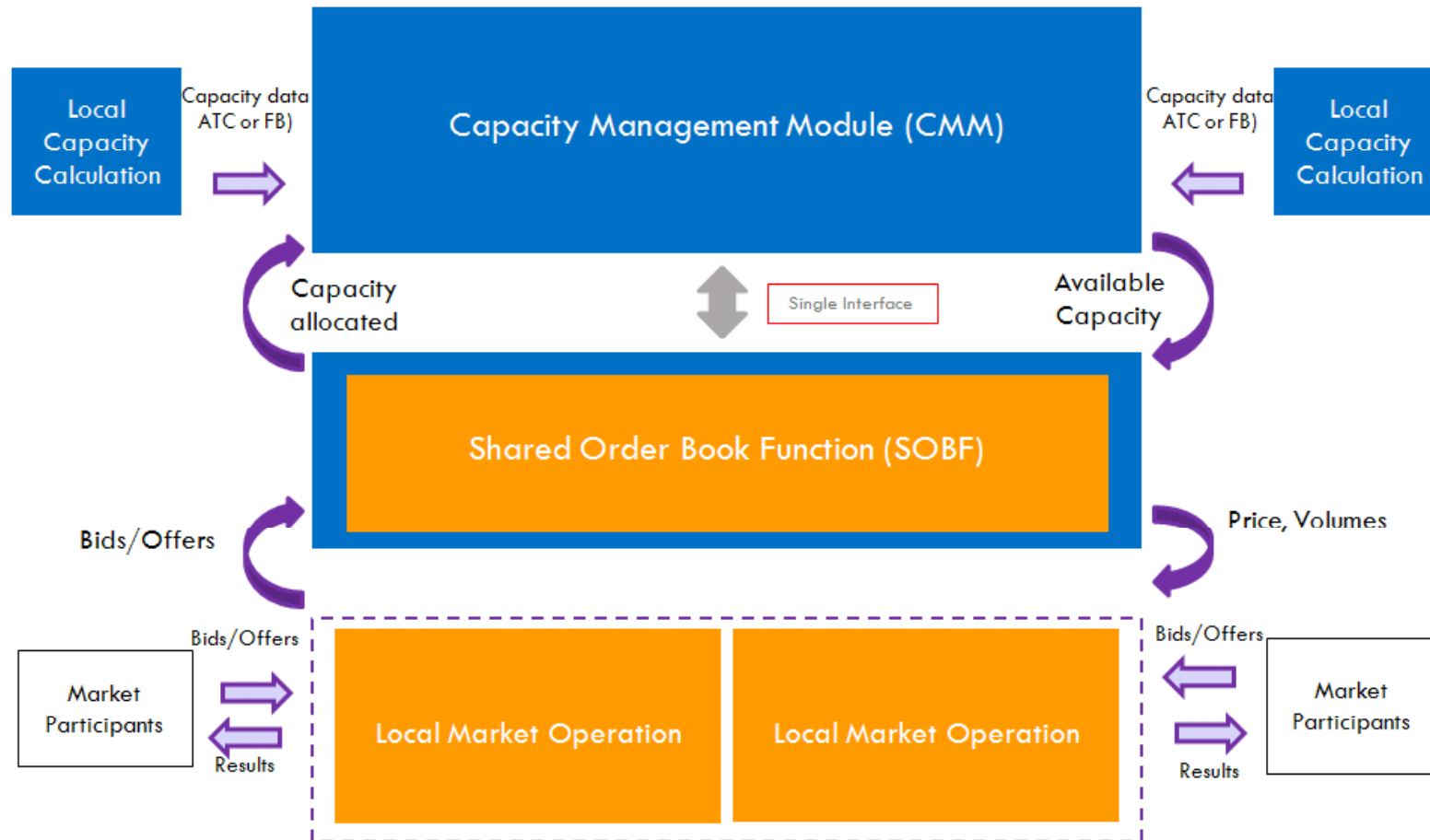
▶ Market Model:

- ▶ Forward
- ▶ Day-ahead
- ▶ Intra-day
- ▶ Balancing

▶ Targeted for 2015



Target Model Intra-Day Solution






























Florence Forum - 2010



Observed Trends

- ▶▶ US markets are evolving:
 - ▶ From “bilateral” to “centralized or pool”
 - ▶ “Balancing” to “grid security based LMP model”
 - ▶ “Regional”
- ▶▶ It is speculated that similar evolution takes place in Europe
 - ▶ European characteristic
 - ▶ Wind power growth
 - ▶ Sub-hourly/ real-time commitment
 - ▶ Less predictable power flow patterns
 - ▶ Increased congestion
 - ▶ The more congested the grid the more rigorous network and security modeling required in market clearing

Recent Study Result

	Dispatch adjusted during day	Balancing requirements / provision adjusted during day	Flexible use of individual conventional power stations	International integration of intraday / balancing markets	Integration of demand side response services	Effective monitoring of market power possible
UK system				N/A		
German system		N/A				
Nordpool						
Spanish system				N/A		
Nodal pricing system						

* Balancing and Intraday Market Design: Options for Wind Integration -- Climate Policy report, January 2011