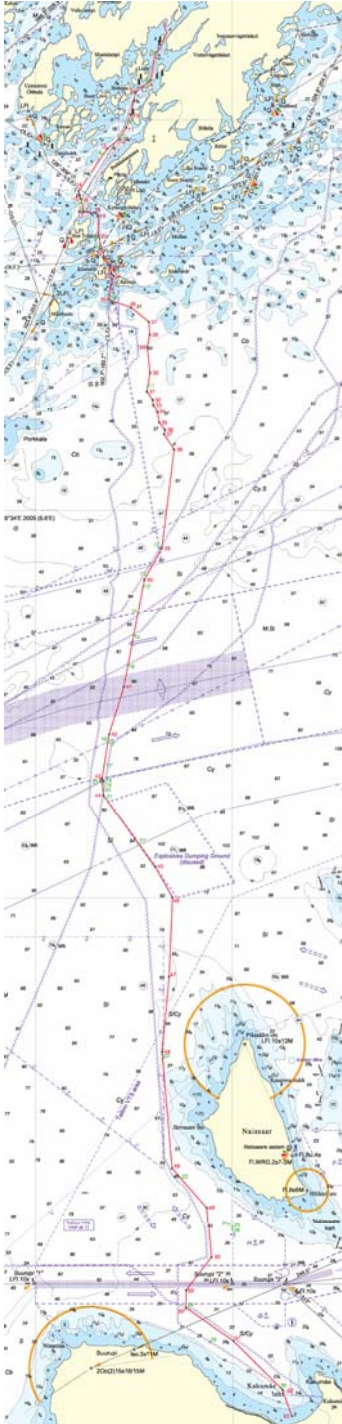


# The Estlink interconnection

**Indrek Aarna**  
*Managing Director*  
*AS Nordic Energy Link*

*"Interconnections make economical sense"*  
**McAllen, Texas**  
**October 11-12, 2007**

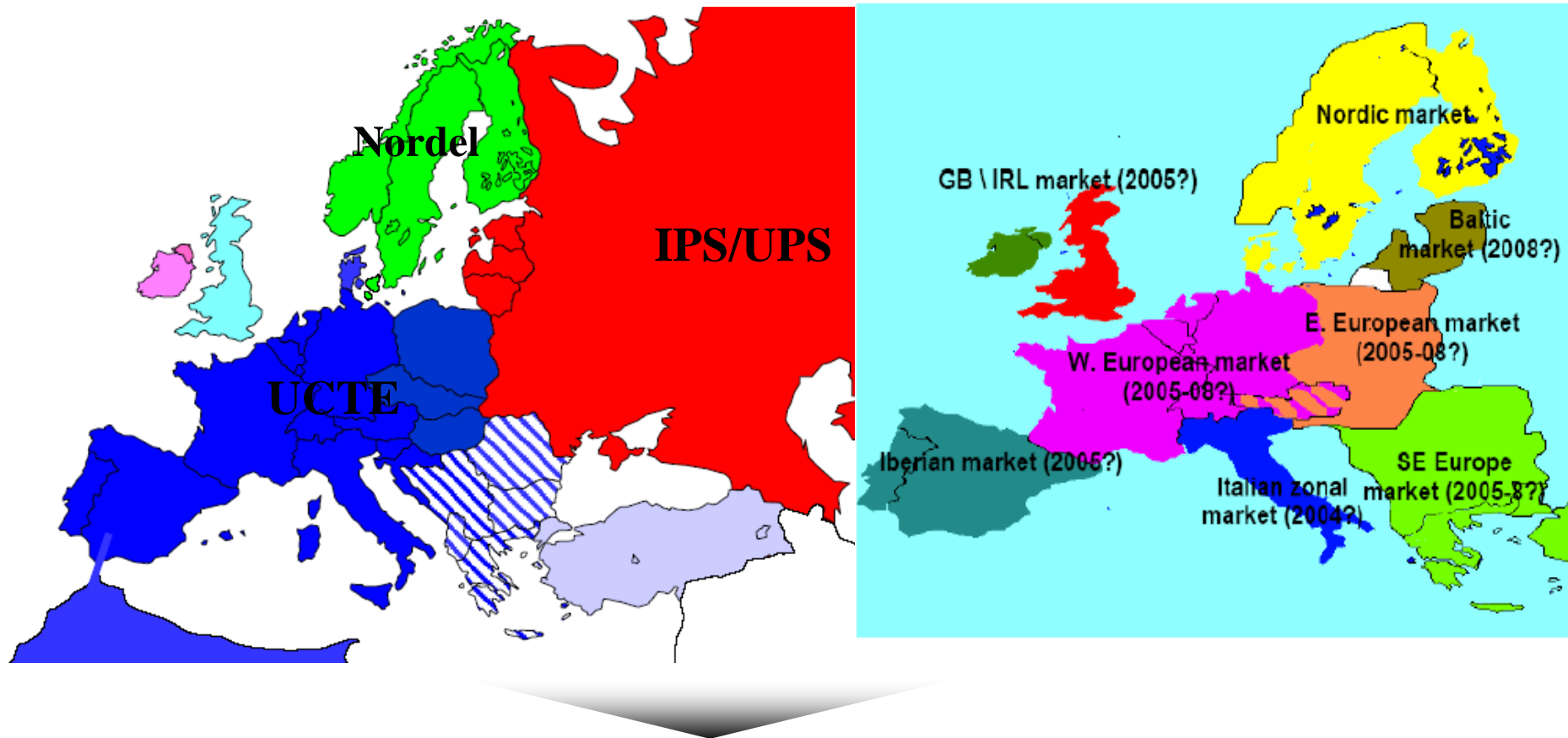




## Outline

- Overview of the Baltic Power System
- Estlink HVDC interconnector
- Effect of Estlink on security of supply and electricity markets
- Estlink in operation

# The Baltic grid – part of North-Western Russian grid

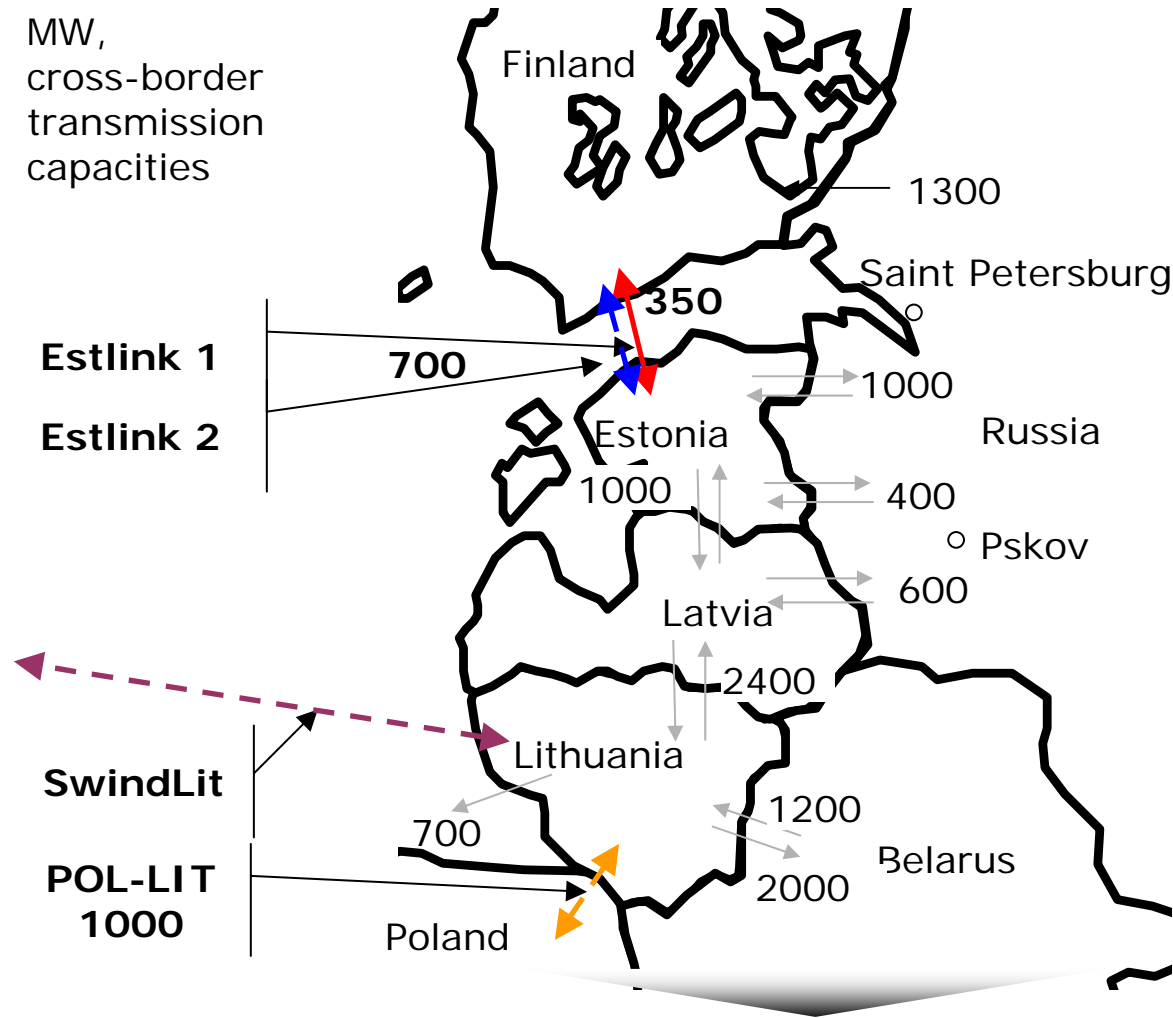


Estlink HVDC connects two non-synchronous AC systems and two regional electricity markets



# Baltic States need more interconnectors to other EU countries

MW,  
cross-border  
transmission  
capacities



- Baltic States are technically strongly connected to Russian power market
- Baltic States have strong cross-boarder interconnections
- Estonian network allows to import all power needed

To create an efficient electricity market, Baltic States need more connections to other EU countries

# Estlink construction completed in 19,5 month



## ABB's HVDC Light® technology:

Capacity: 350 MW

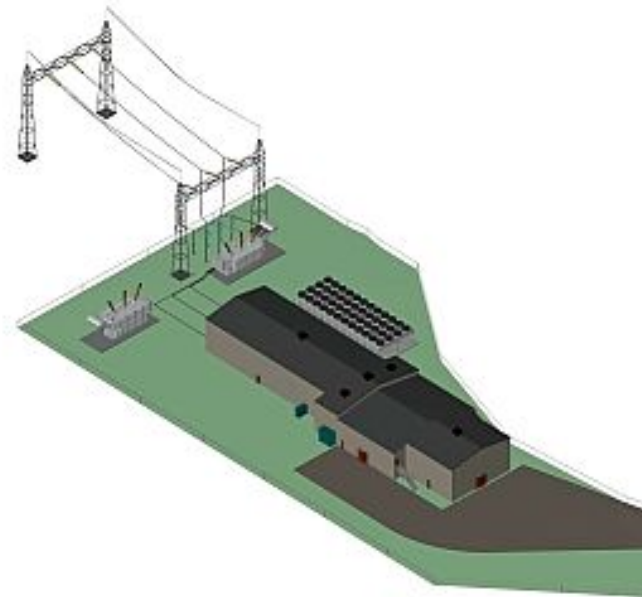
Length: 105 km

DC voltage:  $\pm 150\text{kV}$

Polymer insulated HVDC cables.

Sea cable is buried 1m into the seabed.

Over-load capacity 15 MW



NORDIC ENERGY LINK

# Estlink HVDC interconnector

- Estlink was taken into operation on January 4, 2007.
- Estlink is operated by Fingrid and Põhivõrk in half-year shifts;
- Regular maintenance is made by ABB Finland and ABB Estonia;
- Annual maintenance is performed by ABB Sweden;

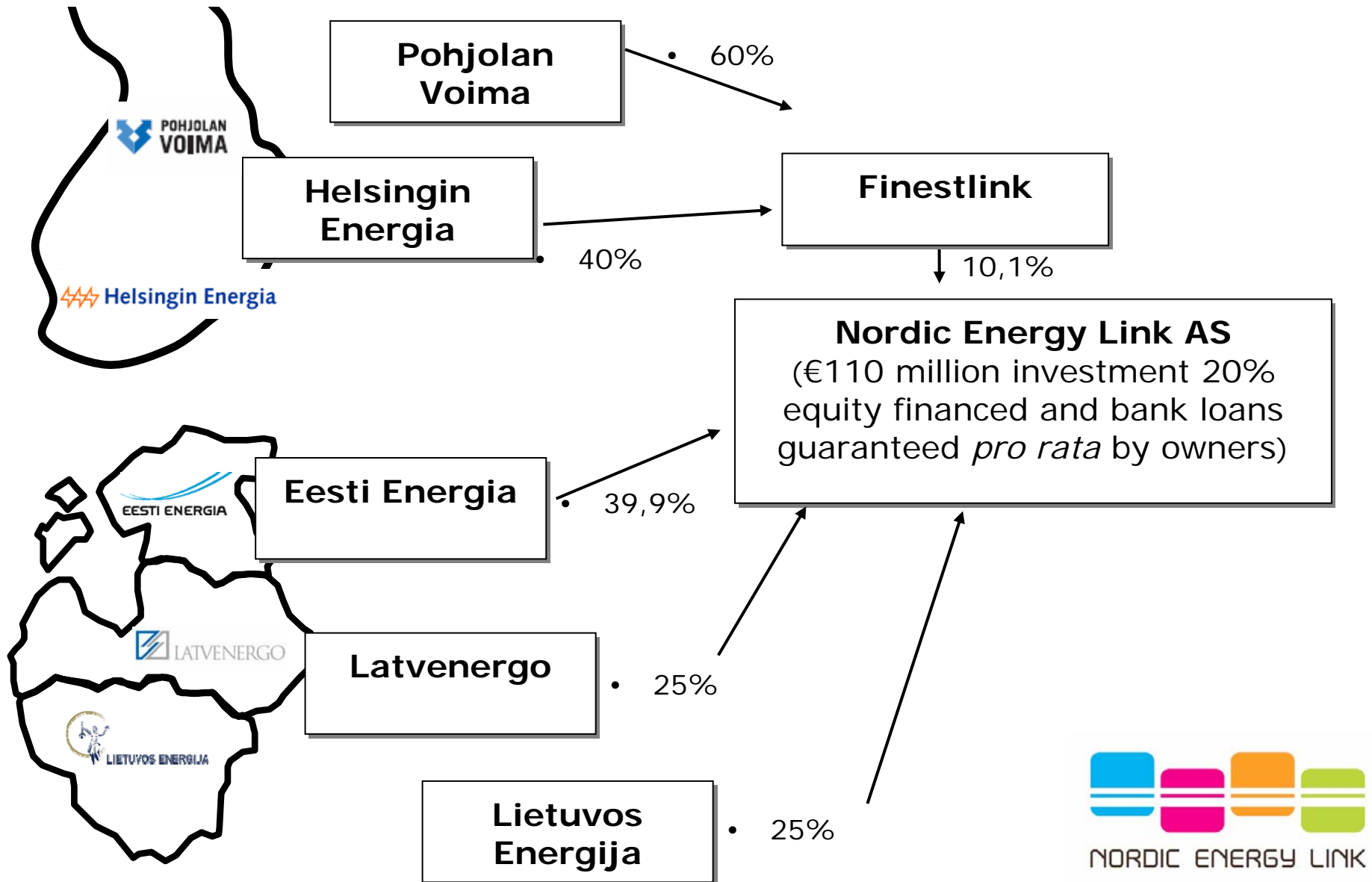
## System services:

- Basic control functions such as active power control, reactive power control, AC voltage control, emergency power control.
- **Black-start function** to aid restoration of the Estonian grid in the unlikely event of a complete network collapse;
- **Damping control function** in Finland for inter-area power oscillations;
- **Frequency control function** to adjust the active power for frequency control purposes in the frequency range of 47,0 to 53,0 Hz;

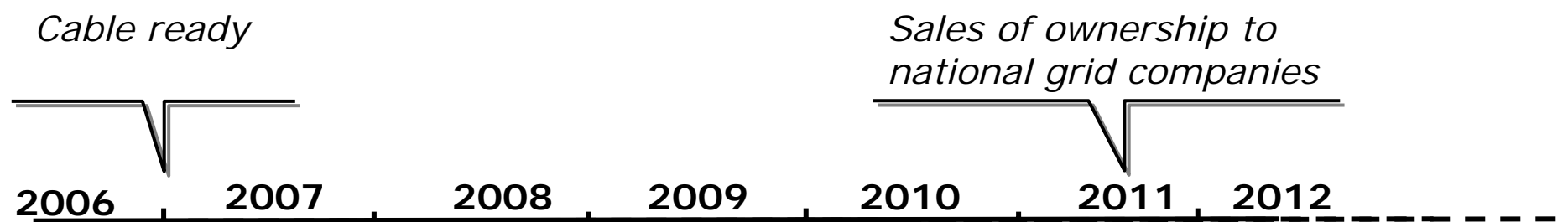


# Estlink - merchant interconnection

Exemption was granted by EU in April 2005 (Article 7 of EU Regulation 1228/2003)



## Operation of Estlink is planned in two phases



### **Commercial project 2006-2009 (2013)**

- Investors are traders; Exemption valid
- Project based investment, revenues from special fee paid by Estlink users
- Owners have privileged rights for capacity; use-it-or-lose-it

### **Infrastructure project earliest 2010 (latest 2013)**

- Investors are national grid companies
- Part of domestic regulated asset base, i.e, included in the domestic grid tariffs
- Open access for all market participants



# Positive impact of Estlink



## Security of supply:

- Increased grid reliability;
- Decreases dependence on the Russian electricity system;

## Electricity market:


- Significant effect on market development in the Baltic States (25% of Estonian peak load);
- Capacity is too small to have noticeable effect on the Nordic electricity market (2,5% of Finnish peak load);
- Entrance of new players on the Nordic market, enlargement of market area;
- Reference price to be provided by NordPool to the Baltic market – NordPool price area under development.



## Third party access – Estlink auctions

- Shareholders of NEL own all capacity in both directions
- Shareholders of NEL can sell their capacity at year, month and day auctions
- All unused capacity for next day will be offered to third parties at free capacity auction ([www.nordicenergylink.com](http://www.nordicenergylink.com))
- Every day there will be offered around 700 MW of free capacity for next day

Balti - Soome merekaabel



Uudised Huvitavat kaablist KKK Pildid ja videod Nordic Energy Link Lingid Auction System Kontakt

ENTER THE AUCTION SYSTEM

Estlink User Guide Estlink Auction Rules  
Estlink User Agreement

Auctions Free Capacity Auctions Statistic

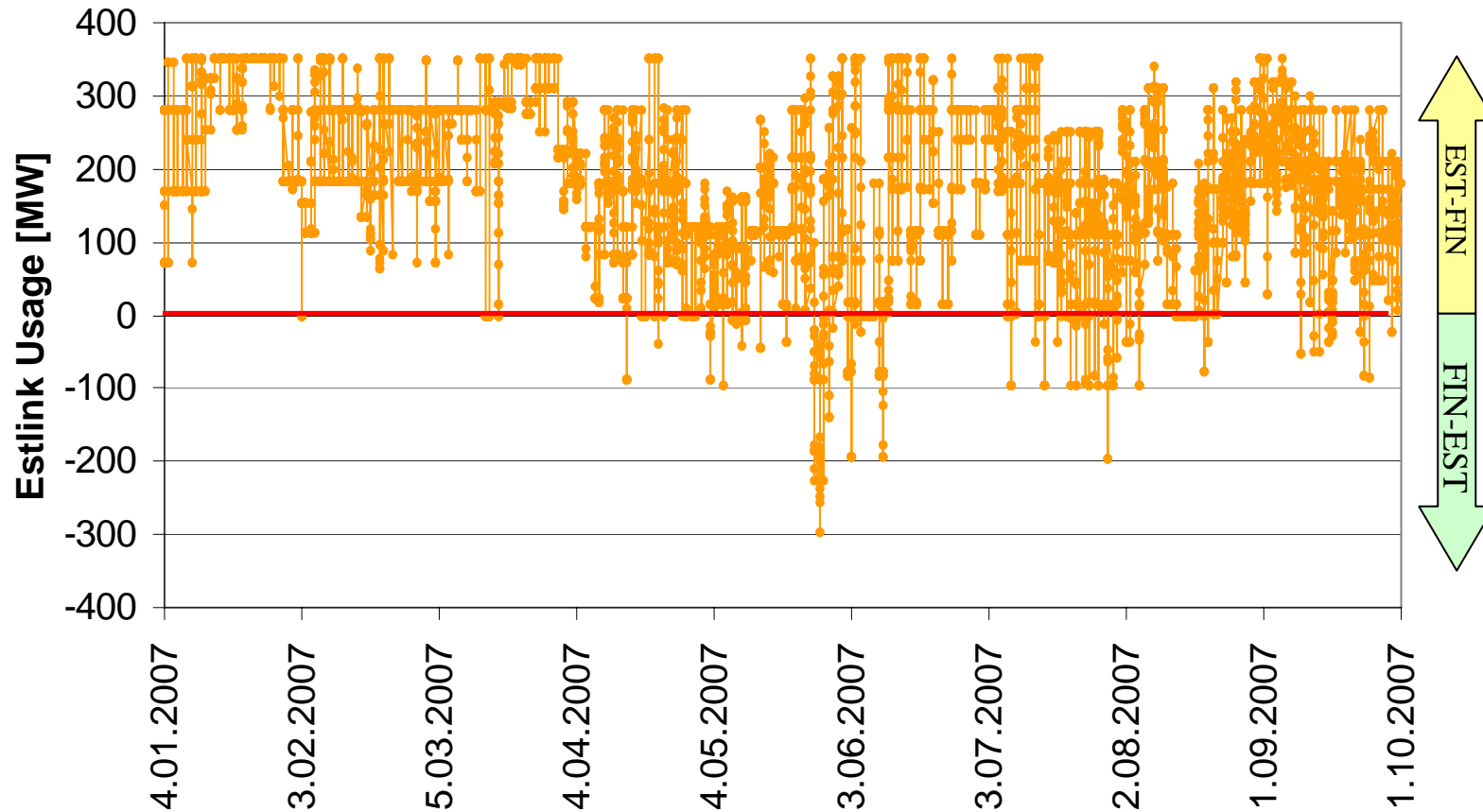
DAY/MONTH/YEAR SUMMARY BY PERIOD

Date 17 January 2007 Direction Both

SHOW

From Estonia to Finland				From Finland to Estonia			
Date of Auctions:				Date of Auctions: 16.01.2007			
Hours	Offered capacity (MW)	Sold (MW)	Price (EUR/MW)	Hours	Offered capacity (MW)	Sold (MW)	Price (EUR/MW)
00-01	0.0	0.0	0.00	00-01	699.8	0.0	0.00
01-02	0.0	0.0	0.00	01-02	699.8	0.0	0.00
02-03	0.0	0.0	0.00	02-03	699.8	0.0	0.00
03-04	0.0	0.0	0.00	03-04	699.8	0.0	0.00
04-05	0.0	0.0	0.00	04-05	699.8	0.0	0.00
05-06	0.0	0.0	0.00	05-06	699.8	0.0	0.00
06-07	0.0	0.0	0.00	06-07	699.8	0.0	0.00
07-08	0.0	0.0	0.00	07-08	699.8	0.0	0.00
08-09	0.0	0.0	0.00	08-09	699.8	0.0	0.00
09-10	0.0	0.0	0.00	09-10	699.8	0.0	0.00
10-11	0.0	0.0	0.00	10-11	699.8	0.0	0.00
11-12	0.0	0.0	0.00	11-12	699.8	0.0	0.00
12-13	0.0	0.0	0.00	12-13	699.8	0.0	0.00

# Estlink in operation

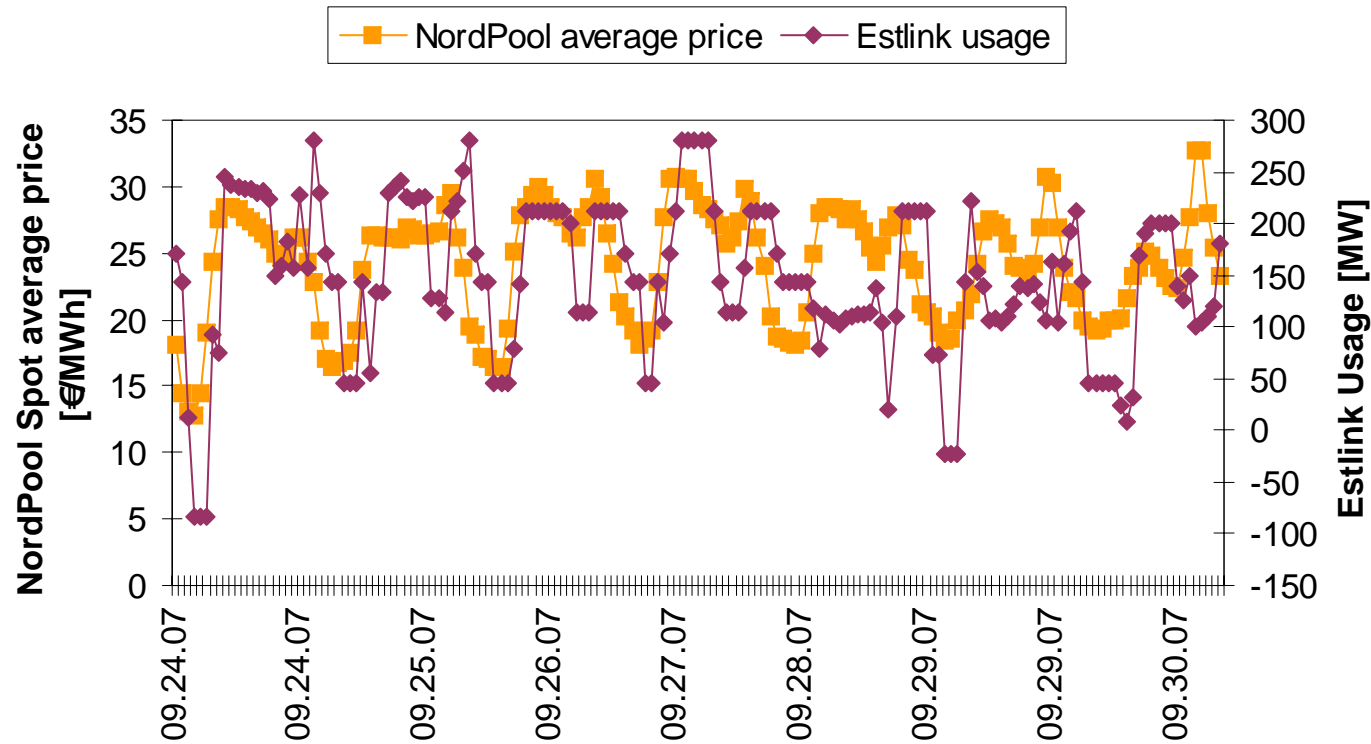


- Estlink has been in operation since January 4, 2007;
- Estlink has been used in both directions, but mainly in direction from Estonia to Finland;
- Average capacity usage during first 9 month has been 67,5%.

# Estlink in operation



Estlink usage during week 39

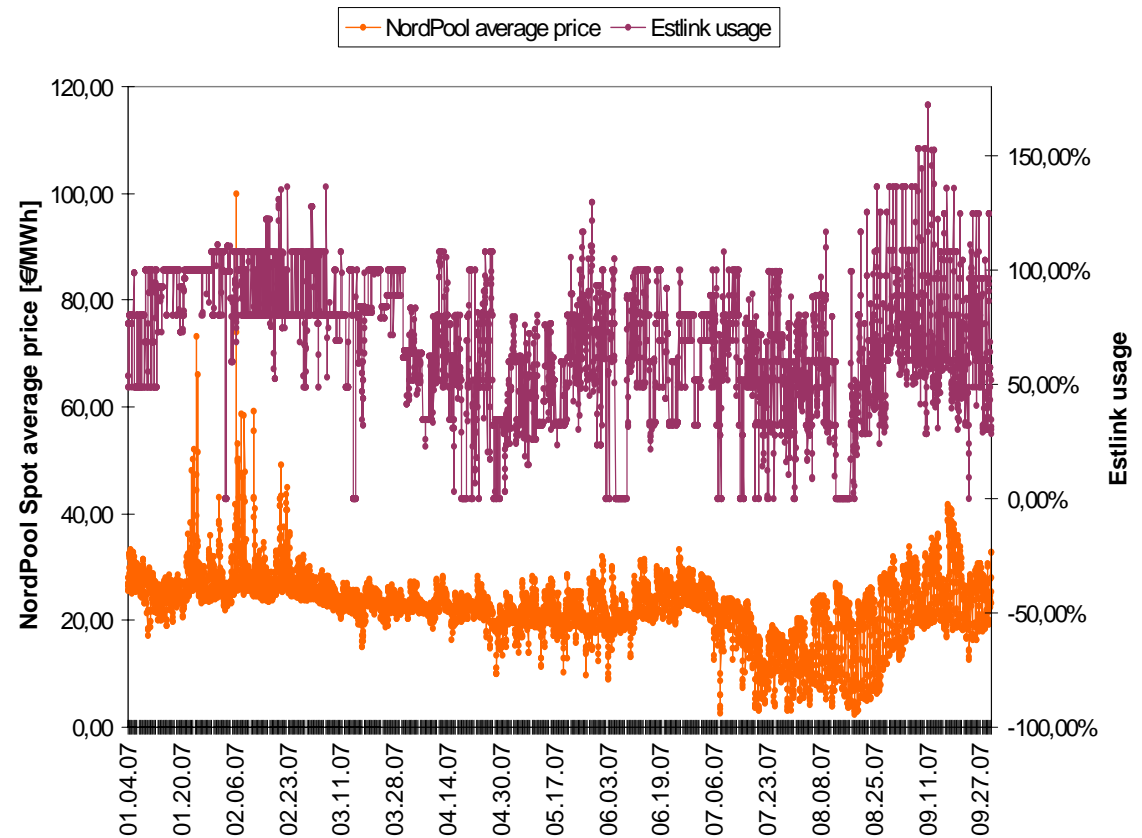


- Estlink usage is in good correlation with prices at NordPool Spot;

# Estlink in operation



- During some hours Estlink capacity usage has been over 100%;
- Estlink availability has been 94,6%;
- Estlink has been out of operation for 350 hours:
  - 2 interruptions: 9 hours;
  - Annual maintenance: 35 hours;
  - Repair works: 72 hours;
  - Testing of system services: 76 hours;
  - Rectification works of land cable: 86 hours;
  - Rectification works at TSO's AC yard: 72 hours.



## Summary

- Estlink is the first connection from Baltic States to other EU countries
- Estlink increases security of supply in the Baltic States
- Estlink has already had positive impact on electricity market development in the Baltic States
- Third party access has been enabled
- Availability of Estlink has been lower than expected due to testing of system services



## Voimajärjestelmän tila

Tiedot päivitetty: 17.01.2007 09:51



### Kulutus ja tuotanto Suomessa

Kulutus	11510 MW
Tuotanto	10134 MW
- vesivoima	1919 MW
- ydinvoima	2722 MW
- lauhdevoima	1201 MW
- kaukolämpövastapaine	2310 MW
- teollisuuden vastapaine	1906 MW
- muu tuotanto (arvio)	76 MW
Tuonti/vienti (netto)	1376 MW

### Sähkön hinta Suomessa

Elspot hinta-alue Suomi	27.51 e/M
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### Tehotasapaino

Suomen tuotantoyli/alijäämä	-52 MW
Tuotantoyli/alijäämä kumulatiivinen	-80 MW
Hetkellinen taajuusmittaus	50.07 Hz
Aikapoikkeama	-9.82 s

Lämpötilat Suomessa: Helsinki +1°C, Jyväskylä +3°C, Oulu -3°C, Rovaniemi -9°C

For more information:

AS Nordic Energy Link

[www.nordicenergylink.com](http://www.nordicenergylink.com)

Laki 24, 12915 Tallinn, Estonia

Phone: +372 715 2301

Fax: +372 715 2200

E-mail: [info@nordicenergylink.net](mailto:info@nordicenergylink.net)

