Commission for Energy Regulation
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Utility Regulator
ELECTRICITY GAS WATER

SEM PLEXOS Model Validation

Public Workshop

RAs' Market Modelling Group

15:00, 13th June 2011, CER Office

Agenda

- Background to PLEXOS Validation Project
  - Andrew Ebrill

- Calibration of Backcast Model
  - Kevin Hagan & Thomas Quinn

- Validation of Forecast Model
  - James Curtin

- Next Steps & DCs
  - Andrew Ebrill

Background

- PLEXOS is used by RAs to model SMP & other outcomes in the SEM
- PLEXOS models DC quantities & prices, part of the RAs' market power mitigation strategy
- PLEXOS is regularly updated by its owner, Energy Exemplar
- In order to be used for modelling for the period to end 2012, incl. DCs for next tariff year, the RAs have
  - Calibrated a backcast PLEXOS model to ensure that the model configuration chosen is the best replication of SEM outcomes
  - Validated the PLEXOS model for new input data, using the calibrated model, including latest demand, generator technical data and outage patterns

Background

- This year the MMG carried out PLEXOS validation in-house with assistance from Energy Exemplar: MMG's work was audited by the MMU

- Main uses of a validated PLEXOS model are:
  - DC quantities and prices
  - Setting the reserve price for the PSO-related CfDs
  - Forecasting the SMP
  - Forecasting generator market share levels
  - Modelling to inform RA policy on the SEM

PLEXOS Backcast

- Key Changes
- Data
- Key issue
- Results
- Moyle
- SMP Results Summary
- Recommended Settings

Key Changes

- Move from PLEXOS 5 to PLEXOS 6
  - New interface
  - XML based
  - Much smaller solution files
- Move from WARM starts to “3 State” starts
  - Improvements to Rounded Relaxation algorithm
  - Exactly what the market software is given
  - Acceptable Run Time
- Dump Energy Added
  - Possibility of negative prices
  - Floor Price of -100 €/MWh

Data

- Half-Hourly
  - Load
  - Availability
  - Minimum Stable Level
- Daily
  - Price-Quantity Pairs
  - No-Load Cost
  - Start Costs (Hot/Warm/Cold)
  - Start Times
    - Incremental for PLEXOS
- Technical Offer Data
  - Ramp Up/Down Rates
  - Minimum On/Off Times

Data (2)

- Hydro Daily Energy
  - Exactly as given to the Market Software
  - Hydro Energy Limits and Metered Generation
- Turlough Hill
  - Target Reservoir Levels
  - “Inflow” file to fix discrepancies due to Rescheduled Days
- Hours Up/Down
  - Backcast can be started on any day with the same starting conditions as the Market
- Units Under Test
  - Fixed Load
- Hydro Unit Commitment
  - Minimum On/Off Times – included
  - Ramp Rates – not included
  - Start Costs – not included

Kilroot Coal

- Initial backcast period: January -> October 2010
- Kilroot Coal Units being over-scheduled - driving higher uplift
- Very high 'No Load Cost' Bids
  - Burning oil @ low output

- Comparison of Bid Structure vs Moneypoint Coal

K2 Coal	NO LOAD	QUANTITY	PRICE	TOTAL COST (/MWh)
1	3945	108	14.43	50.95
2	0	175	38.44	46.17
3	0	236	355.08	126.33
MP3	NO LOAD	QUANTITY	PRICE	TOTAL COST (/MWh)
1	727	195	41.66	45.38
2	0	278	42.06	44.39

Kilroot Coal (2)

- Rounded Relaxation does not cope well with units with very high 'No Load Cost'
- Commitment of Kilroot Coal units was fixed to match market
  - Confirmation that this was the cause of higher prices
- Backcast was extended out for November/December 2010
  - Kilroot GUA contracts ended
  - Started bidding in differently on Nov 1st 2010
    - AES carried out technical review of the units
    - Based on reviewed unit characteristics
    - Higher Minimum Stable Level
    - Lower 'No Load Cost'

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Jan-Oct 2010 Kilroot Free

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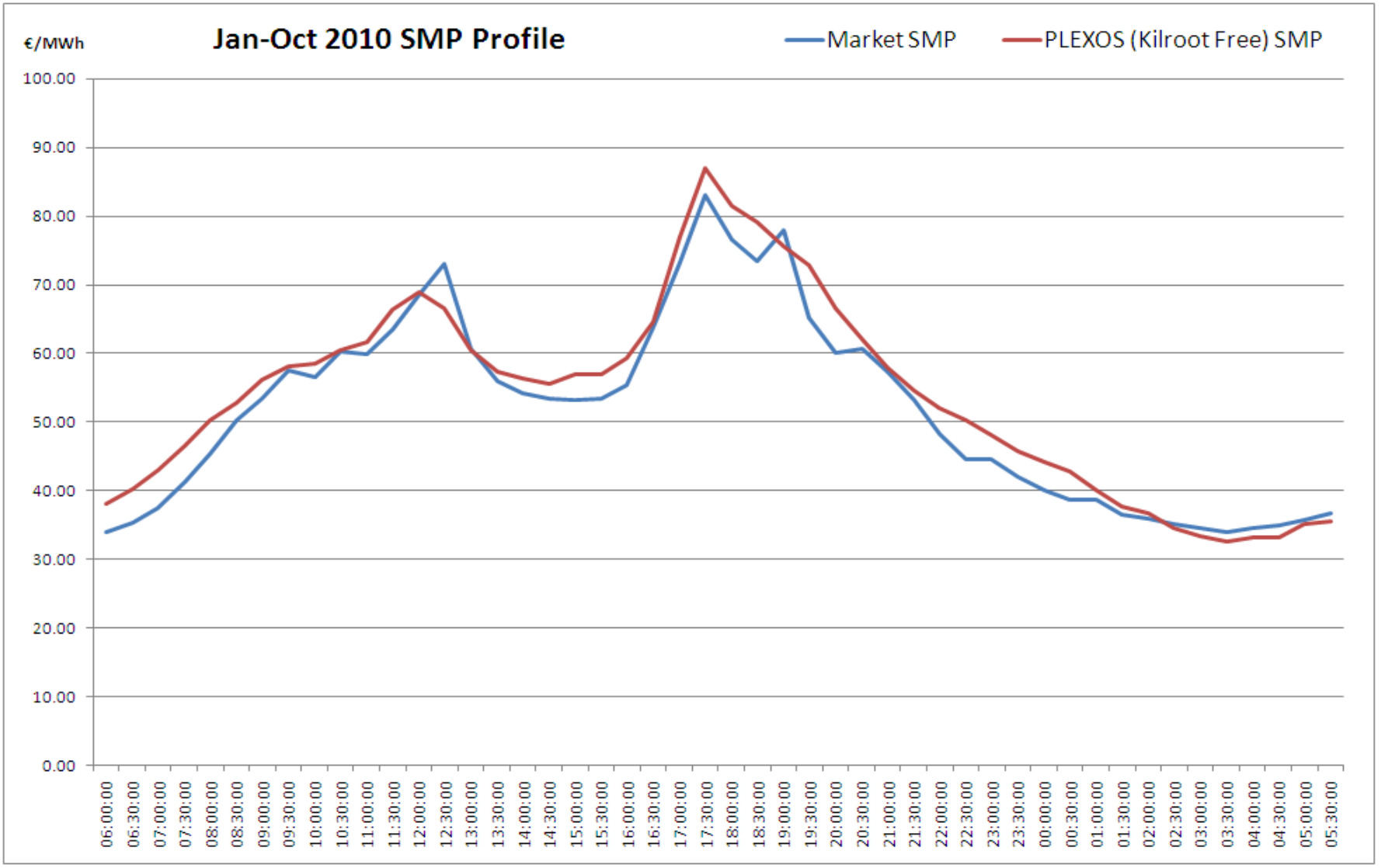
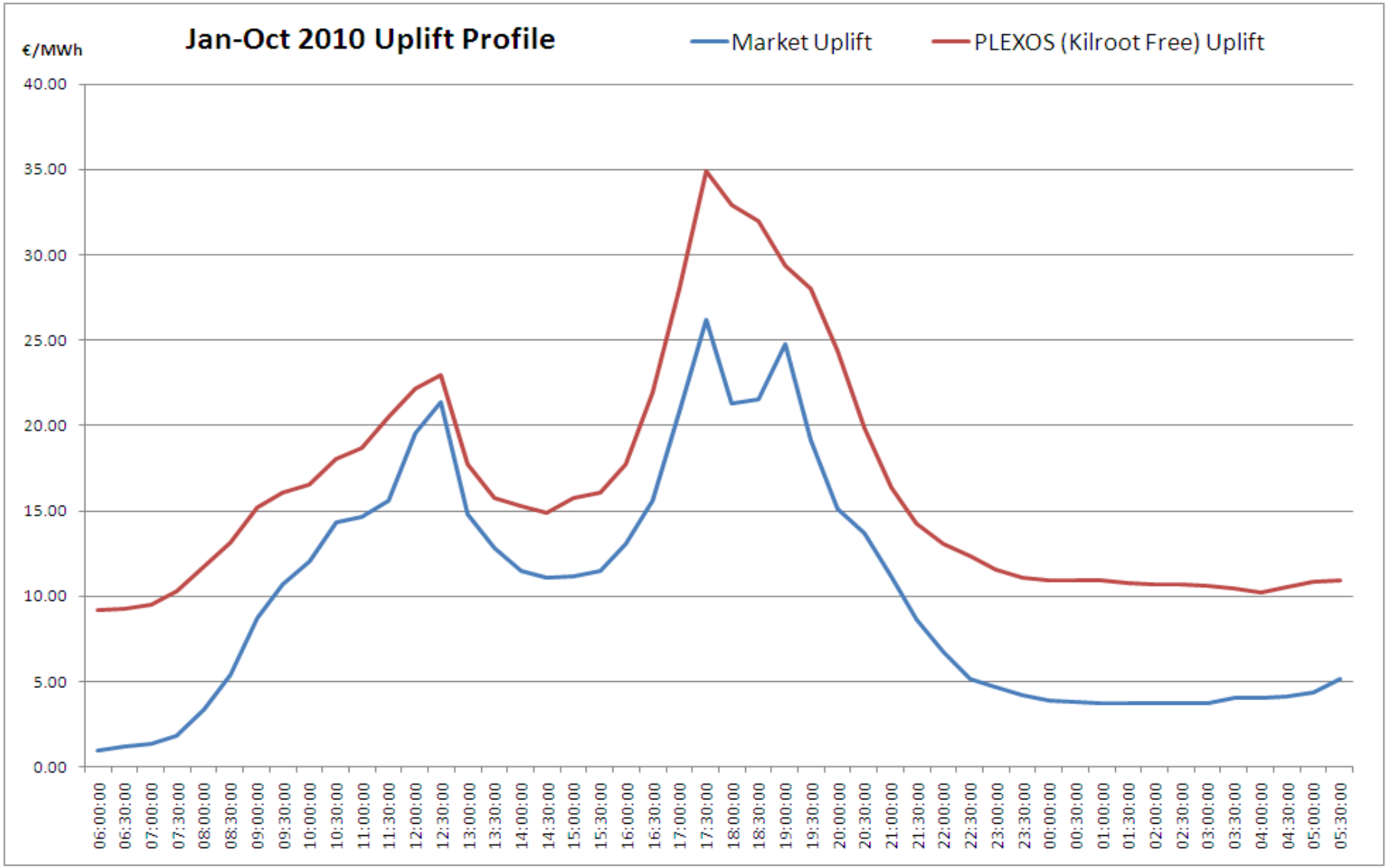
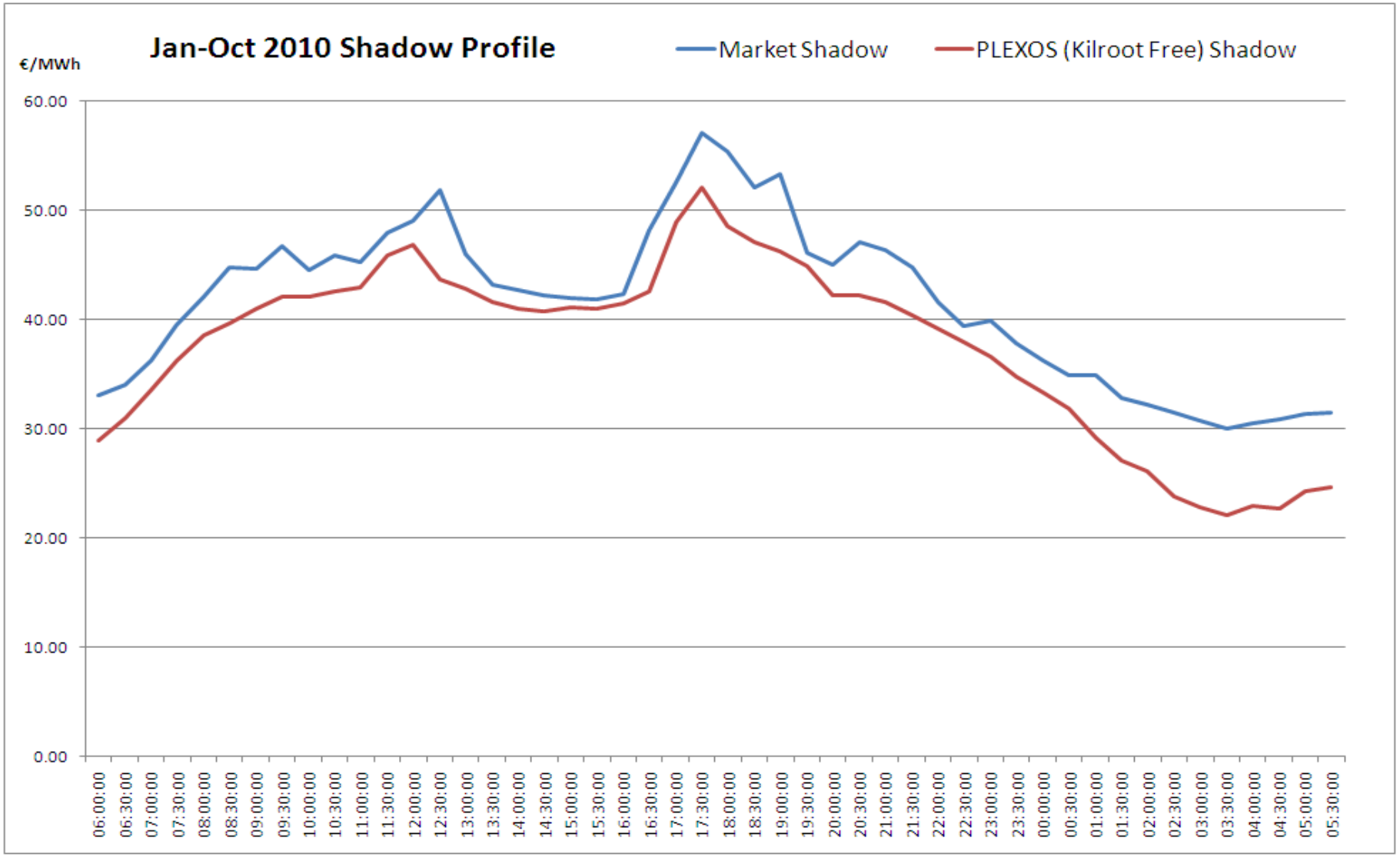


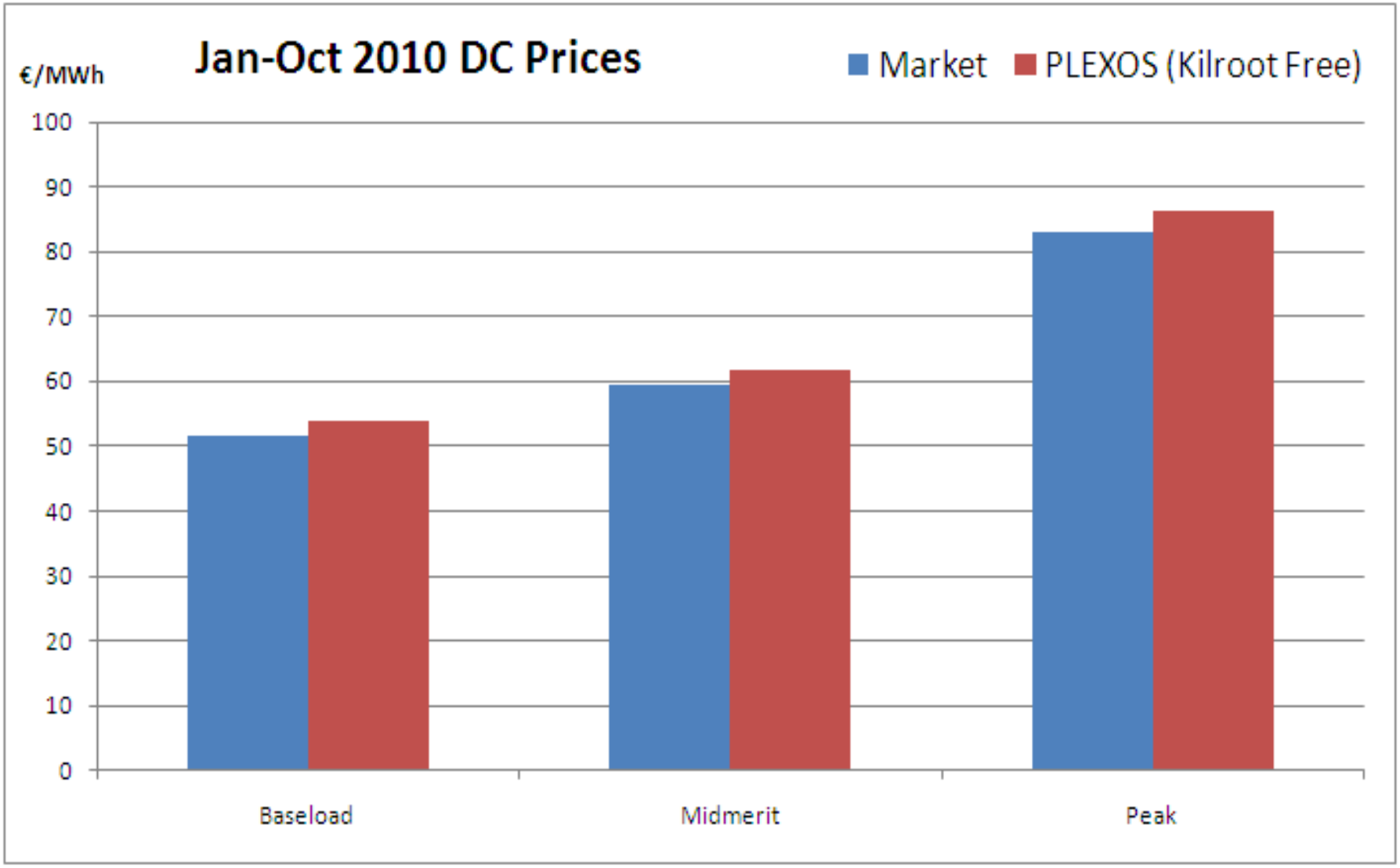
Jan-Oct 2010 Kilroot Free



Jan-Oct 2010
Kilroot Free



Jan-Oct 2010 Kilroot Free



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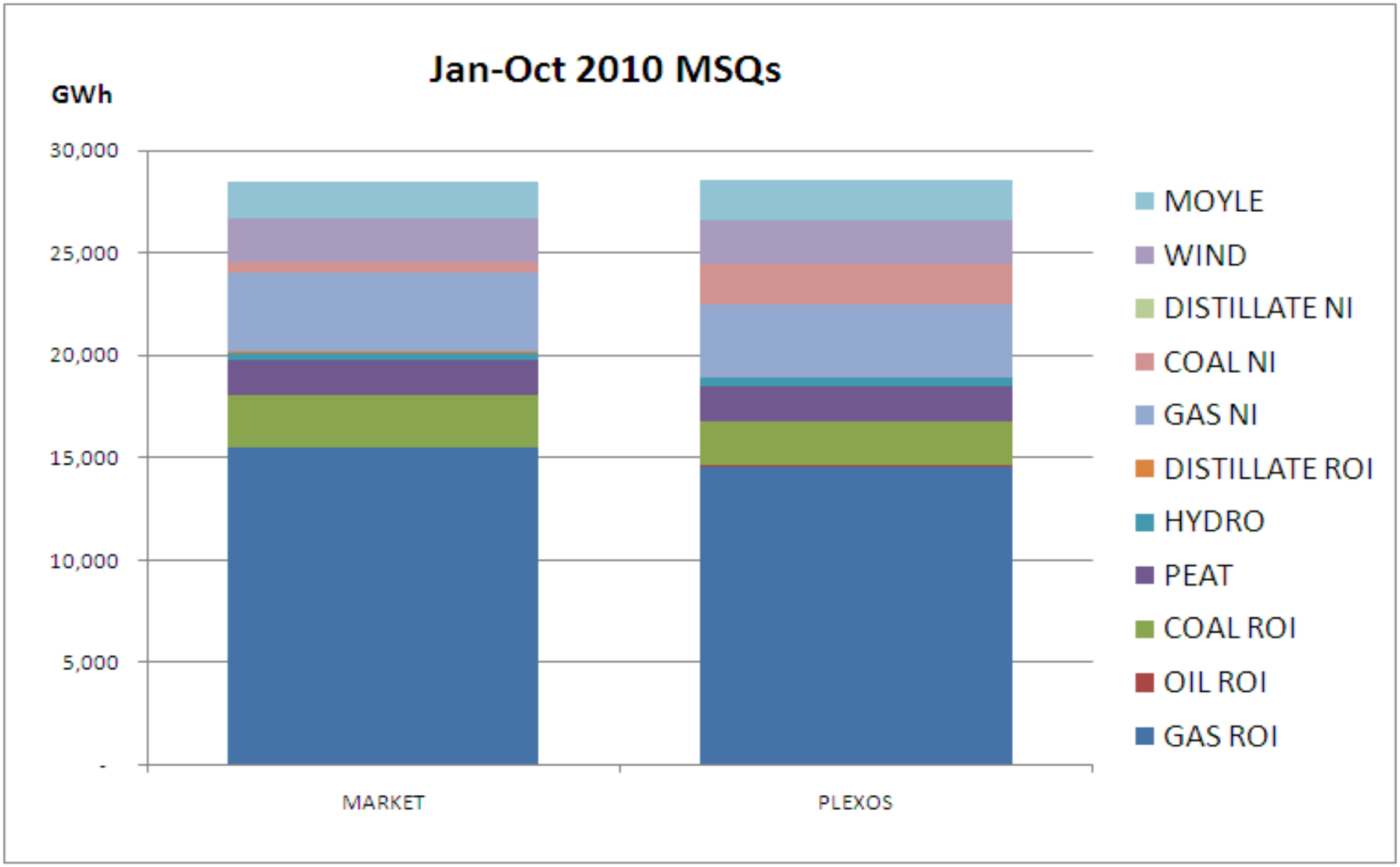

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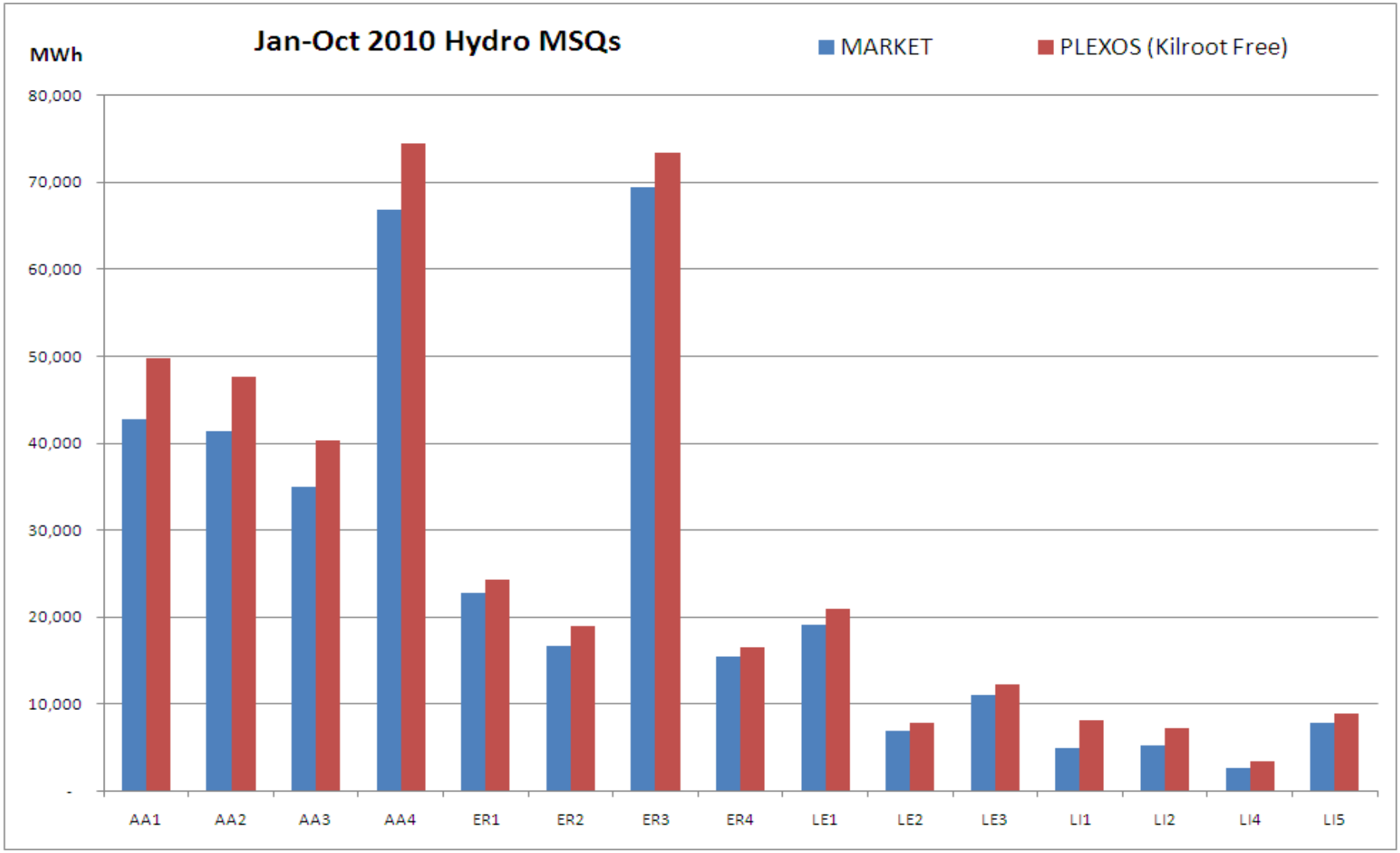

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Jan-Oct 2010
Kilroot Free

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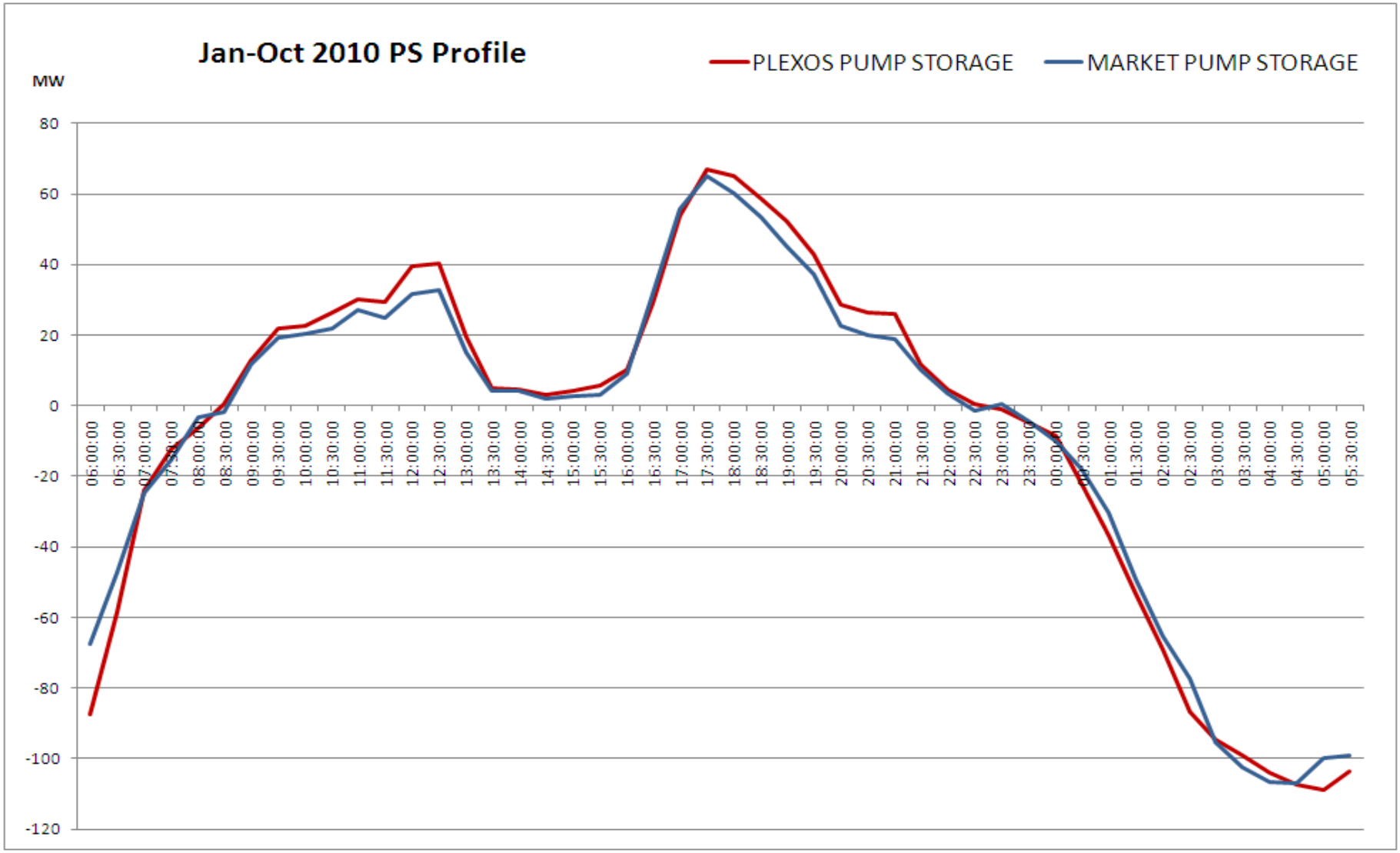

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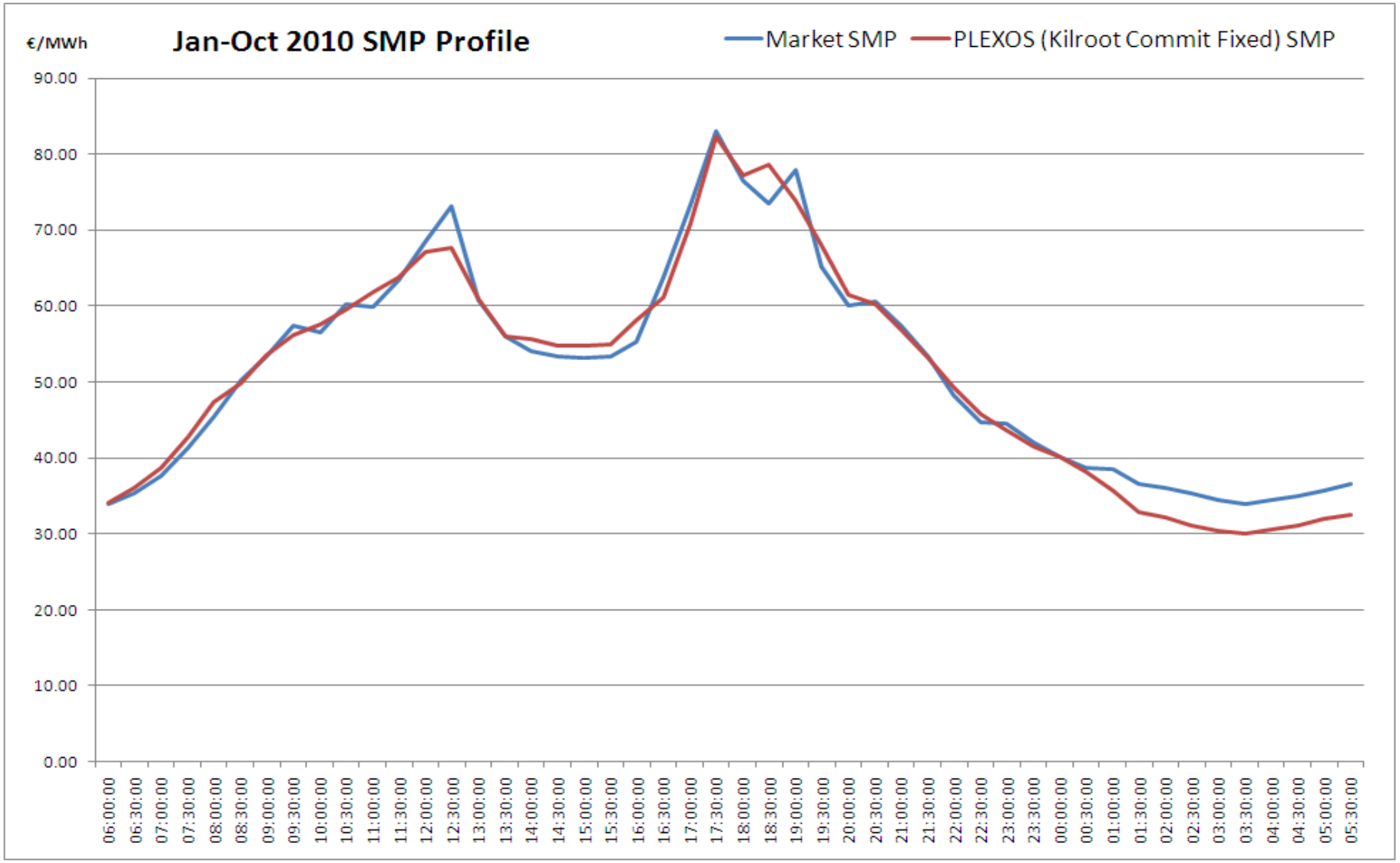
Kilroot Commitment Fixed



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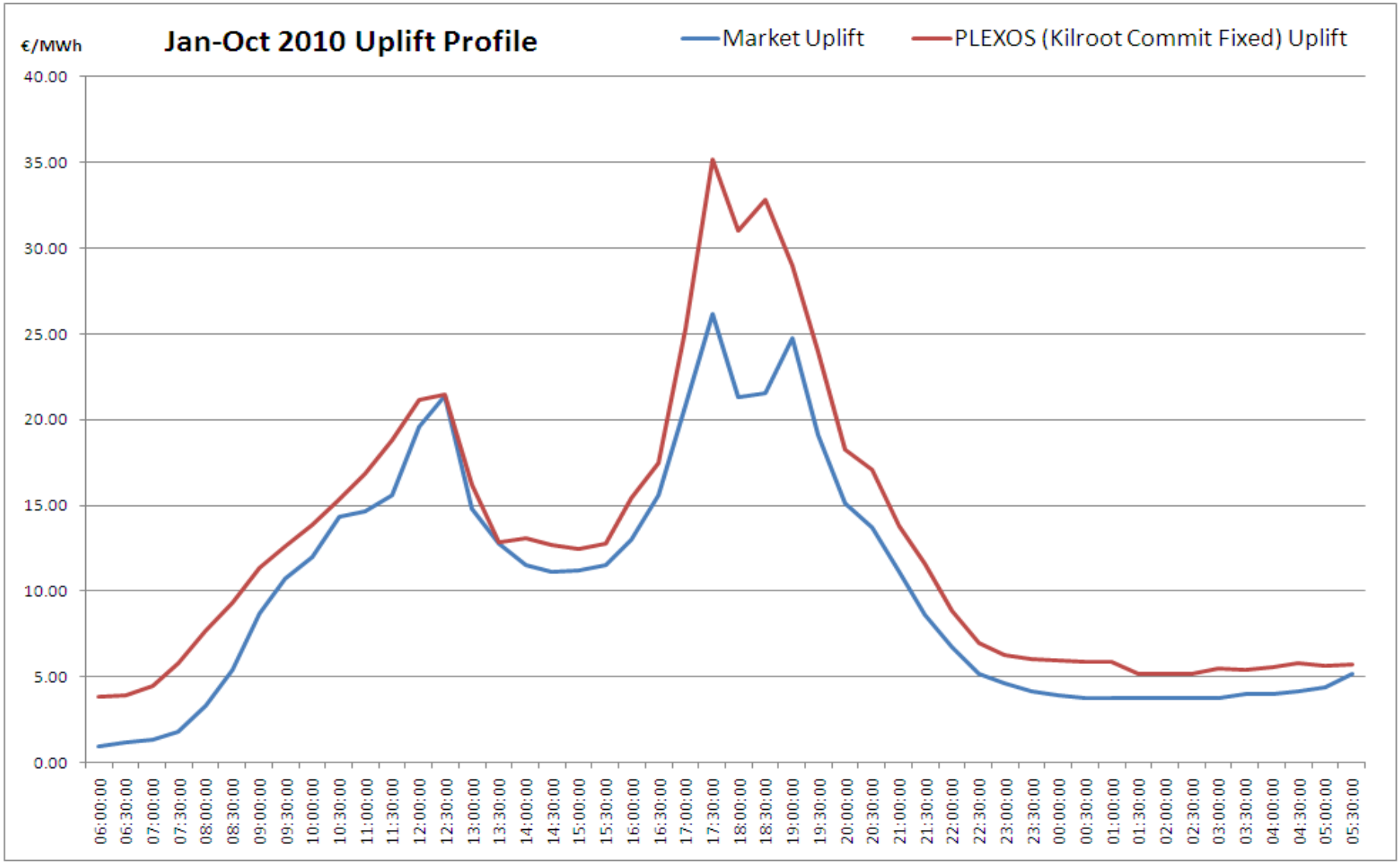

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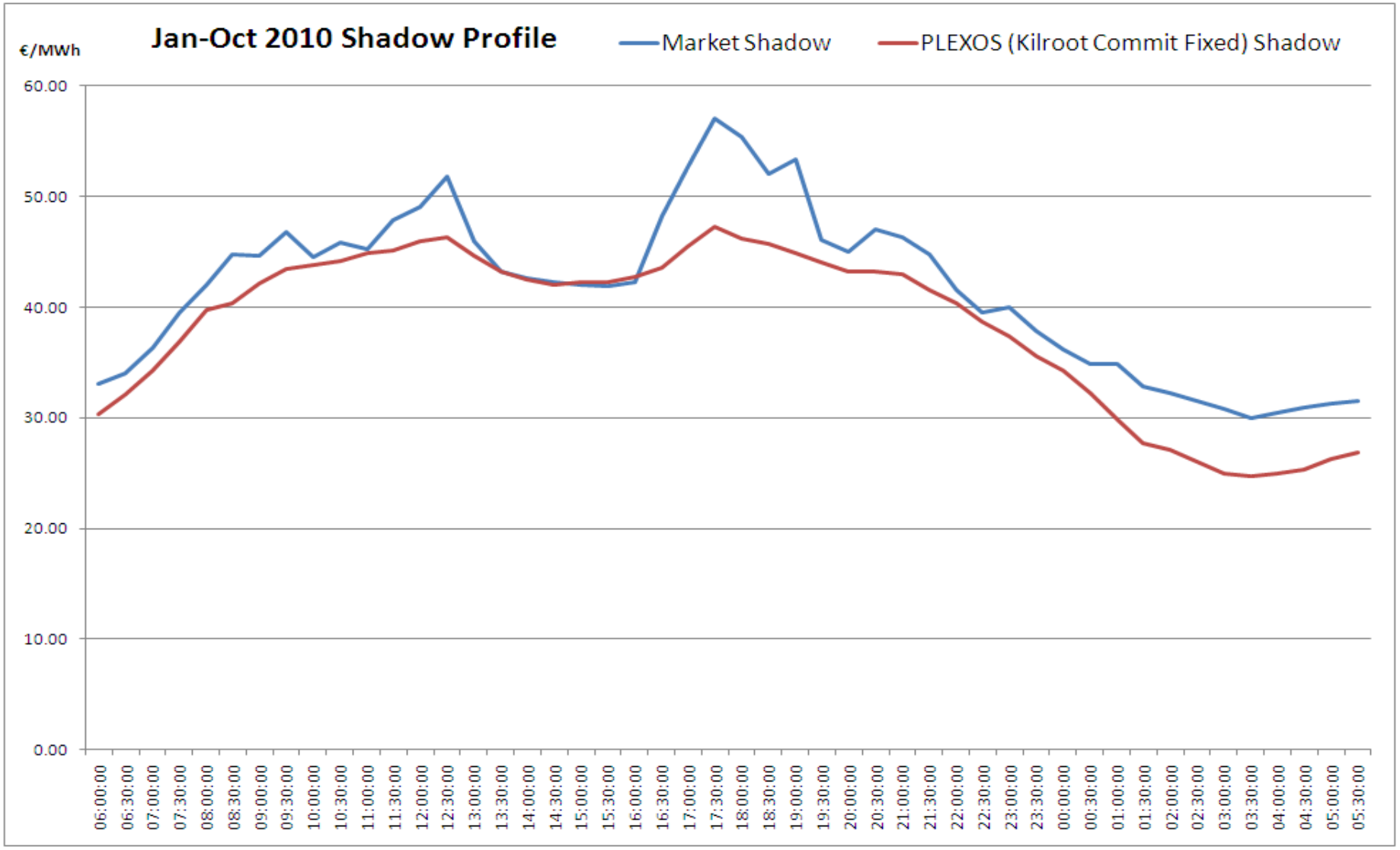

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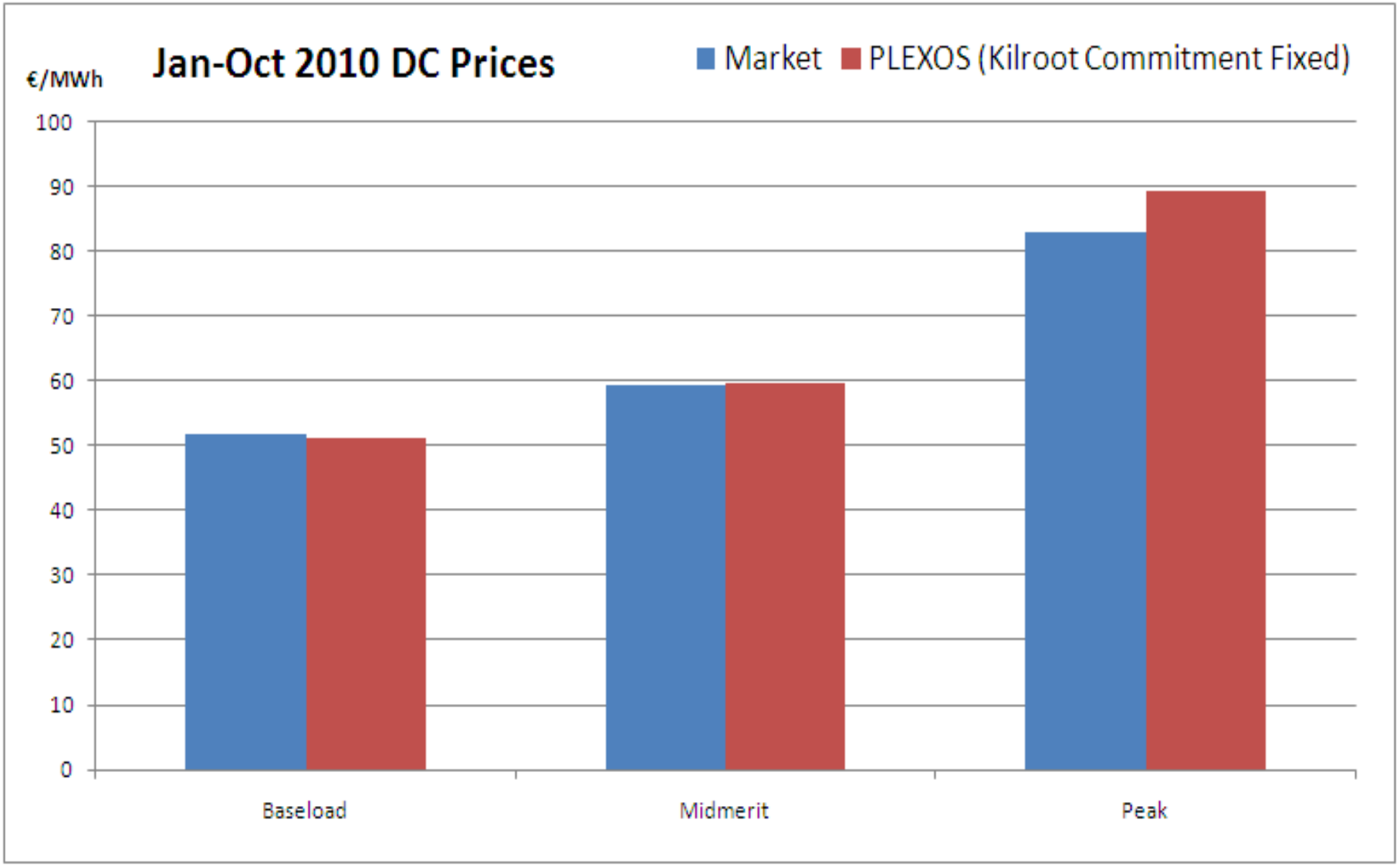

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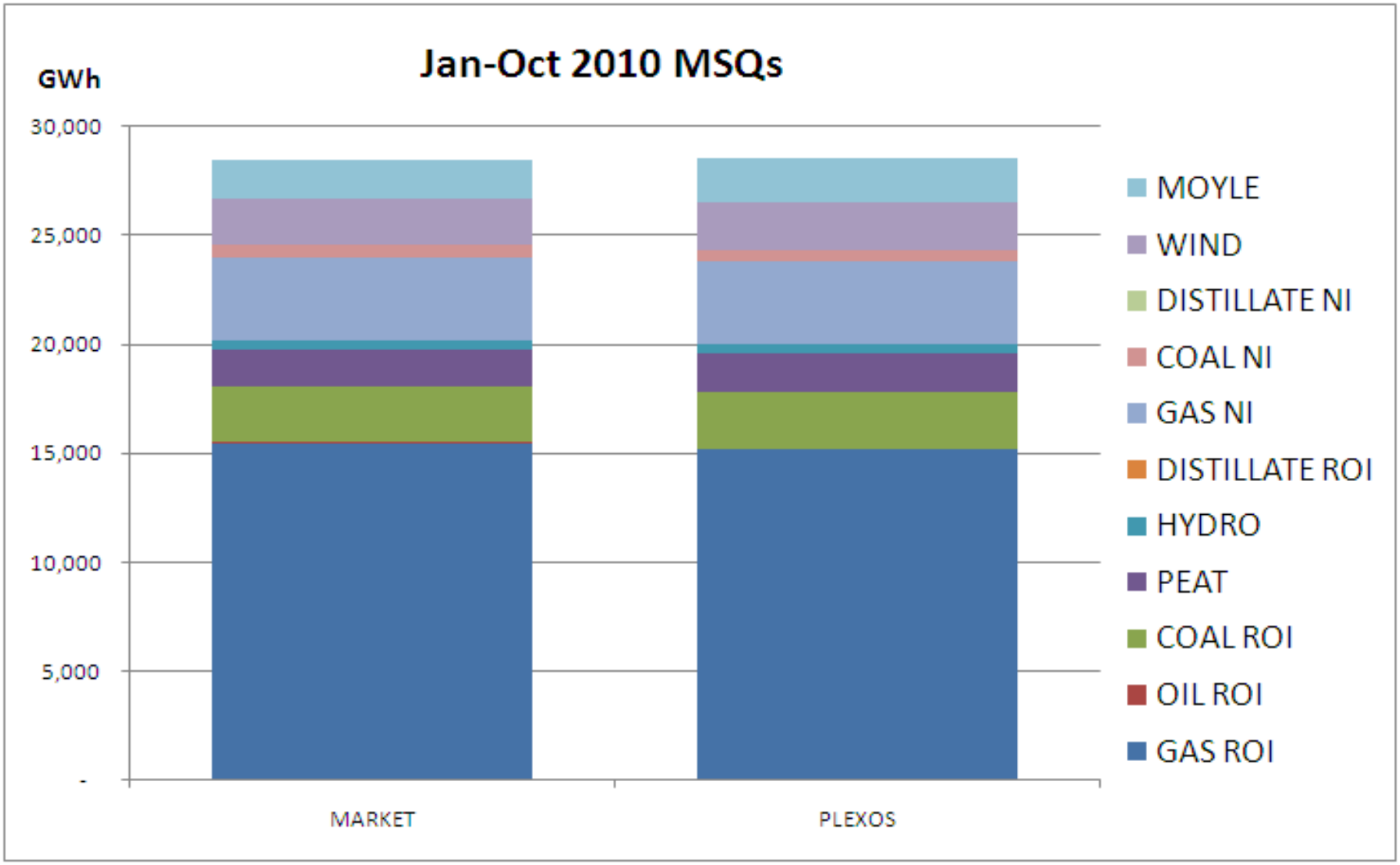

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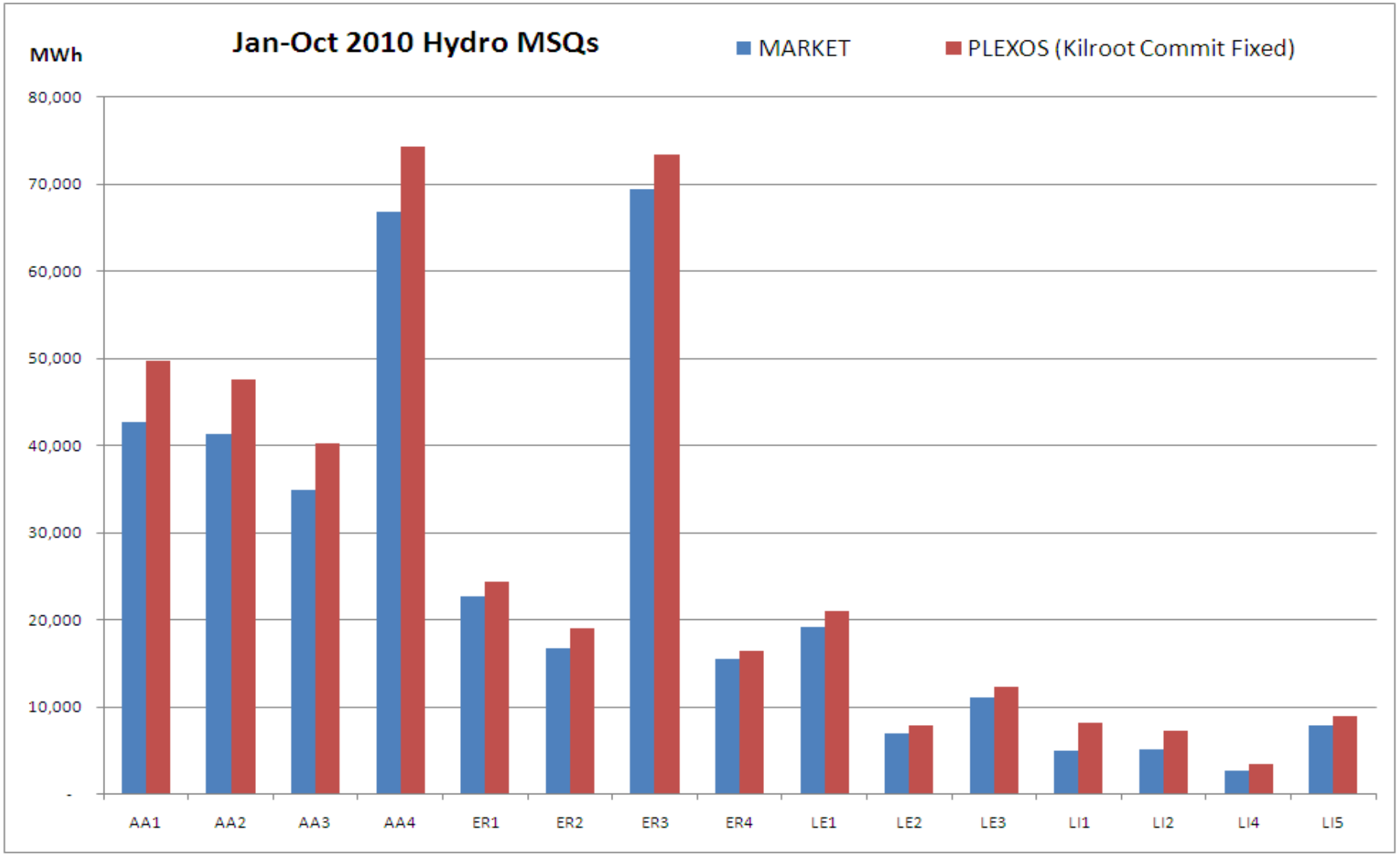

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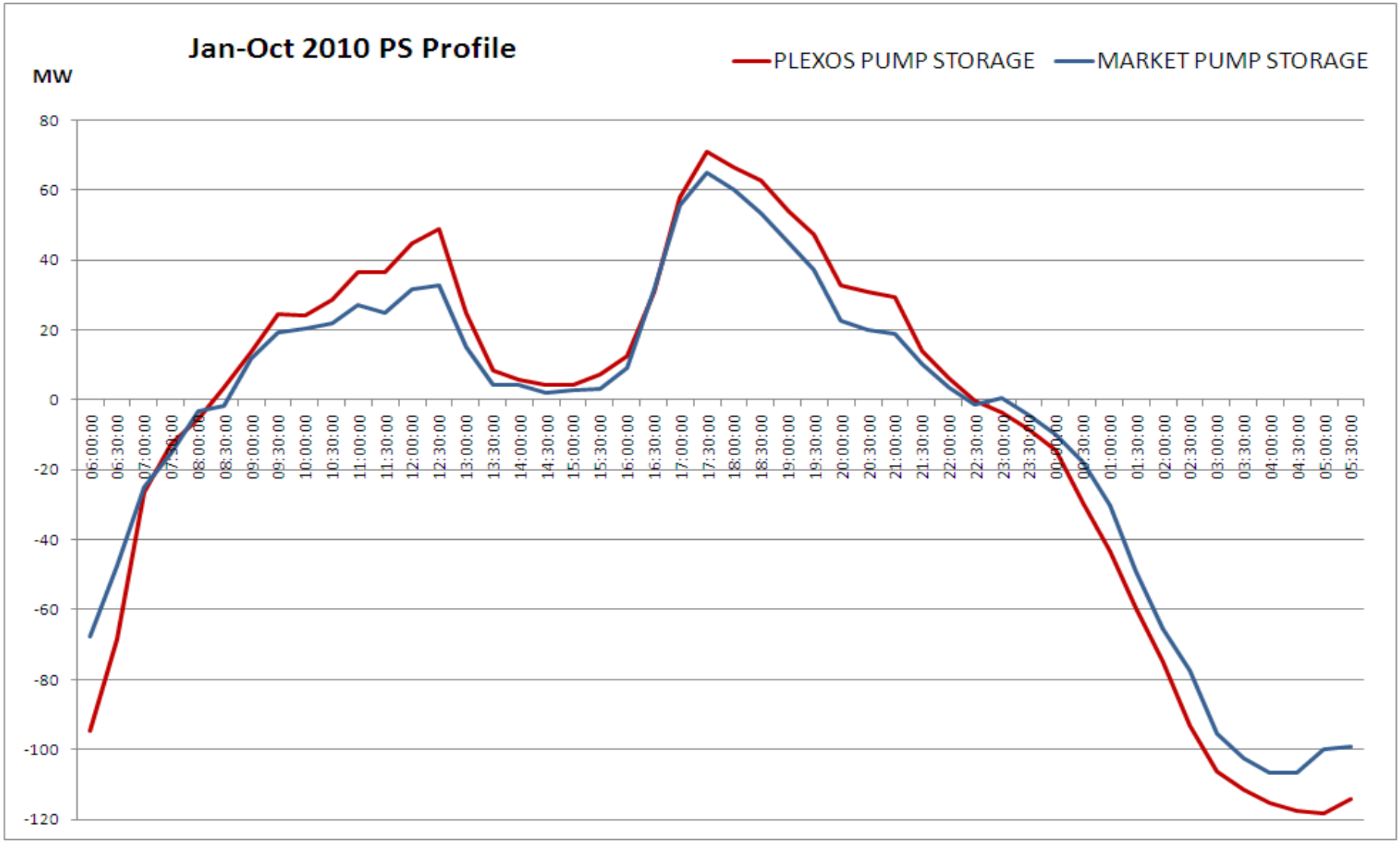

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Nov-Dec 2010

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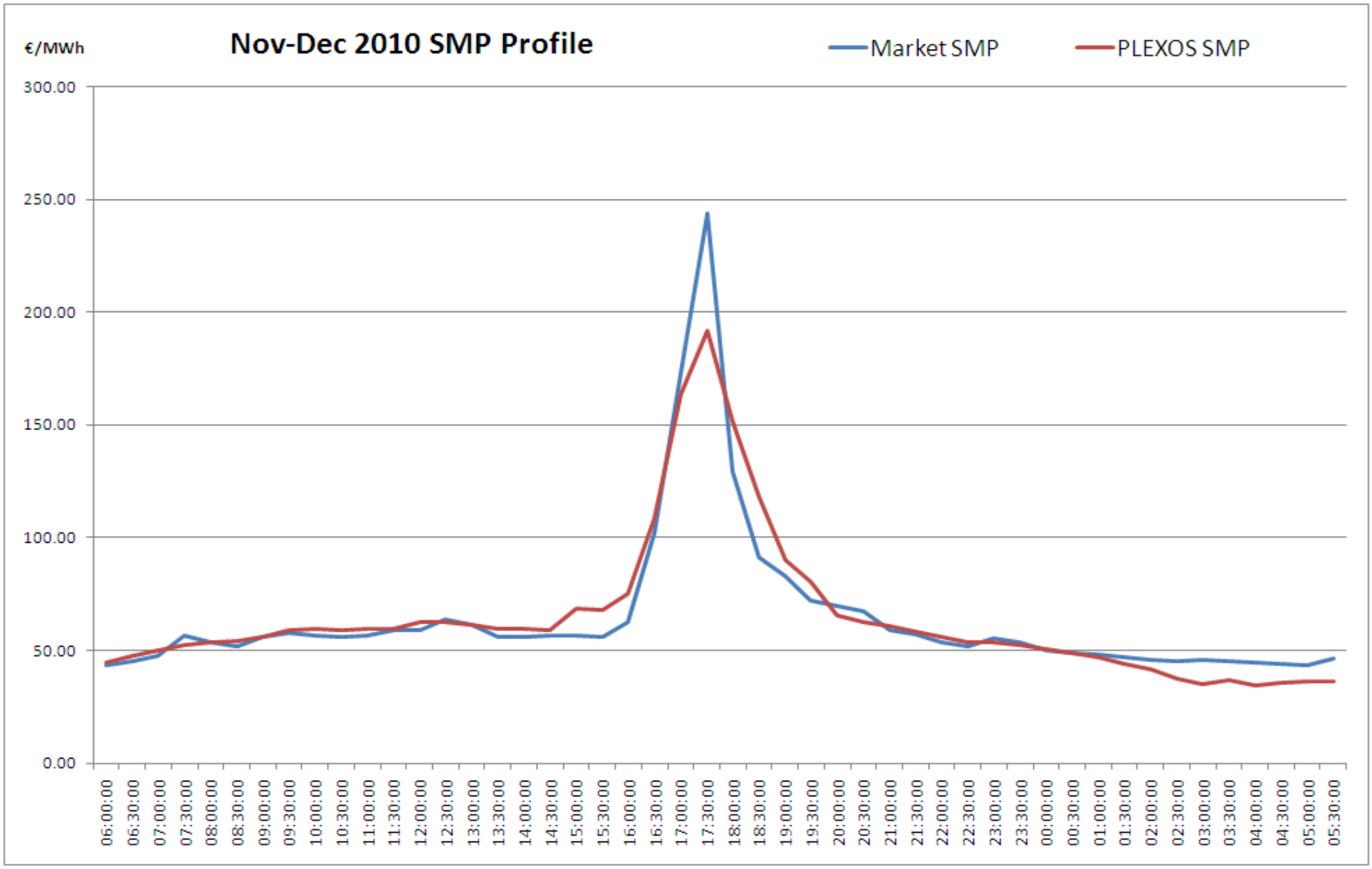
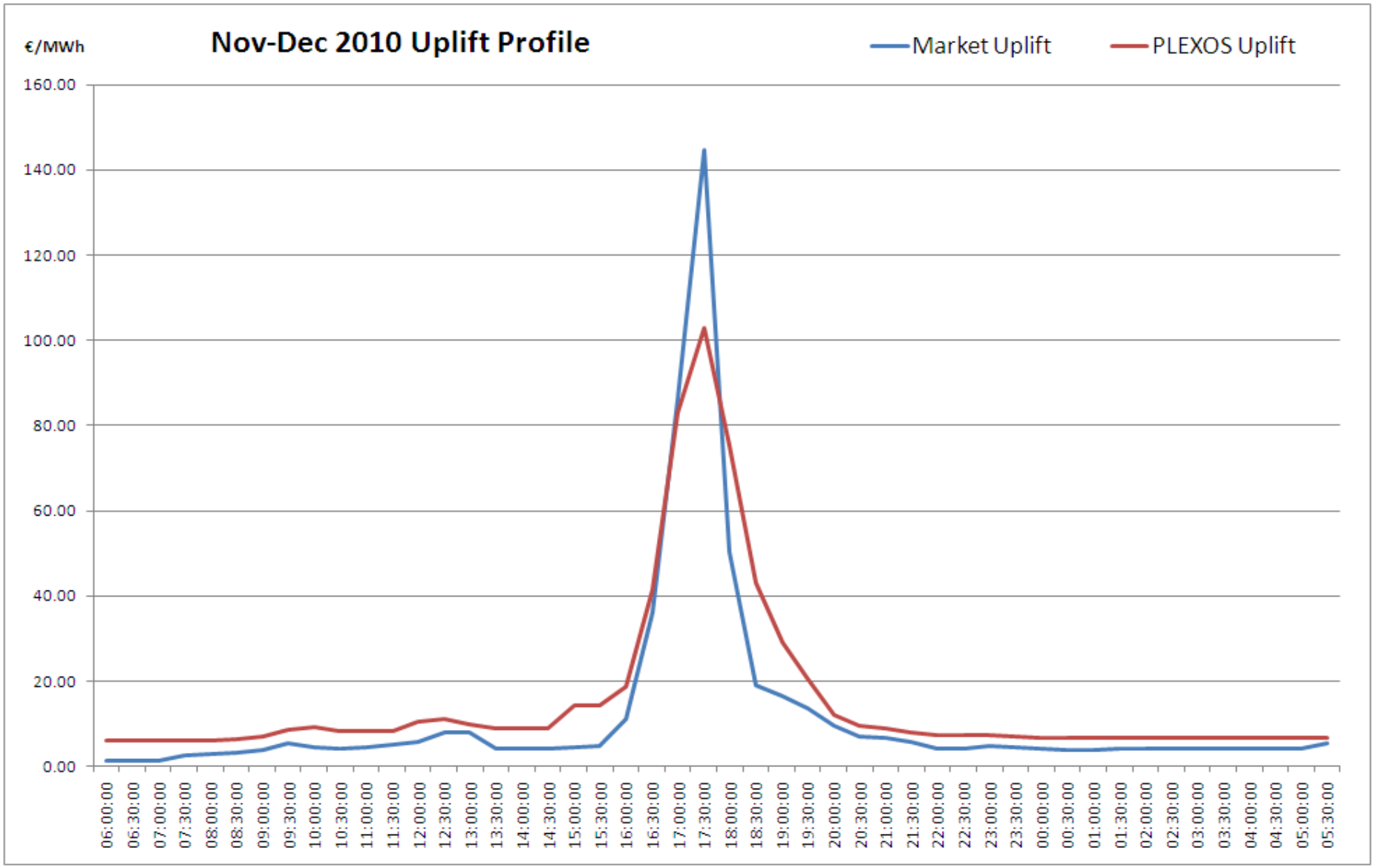


Nov-Dec 2010


Nov-Dec 2010 Uplift Profile
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PLEXOS Uplift
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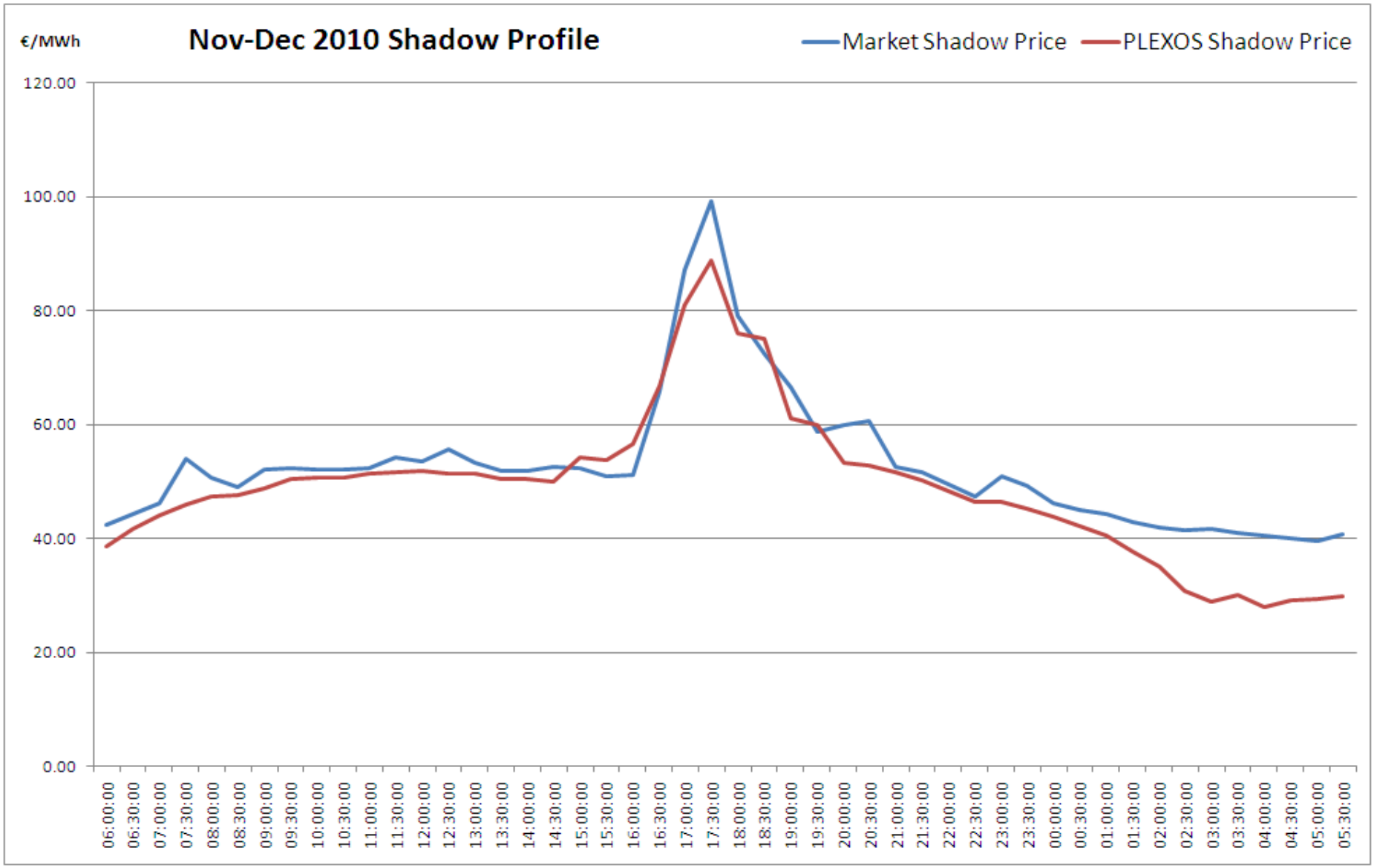

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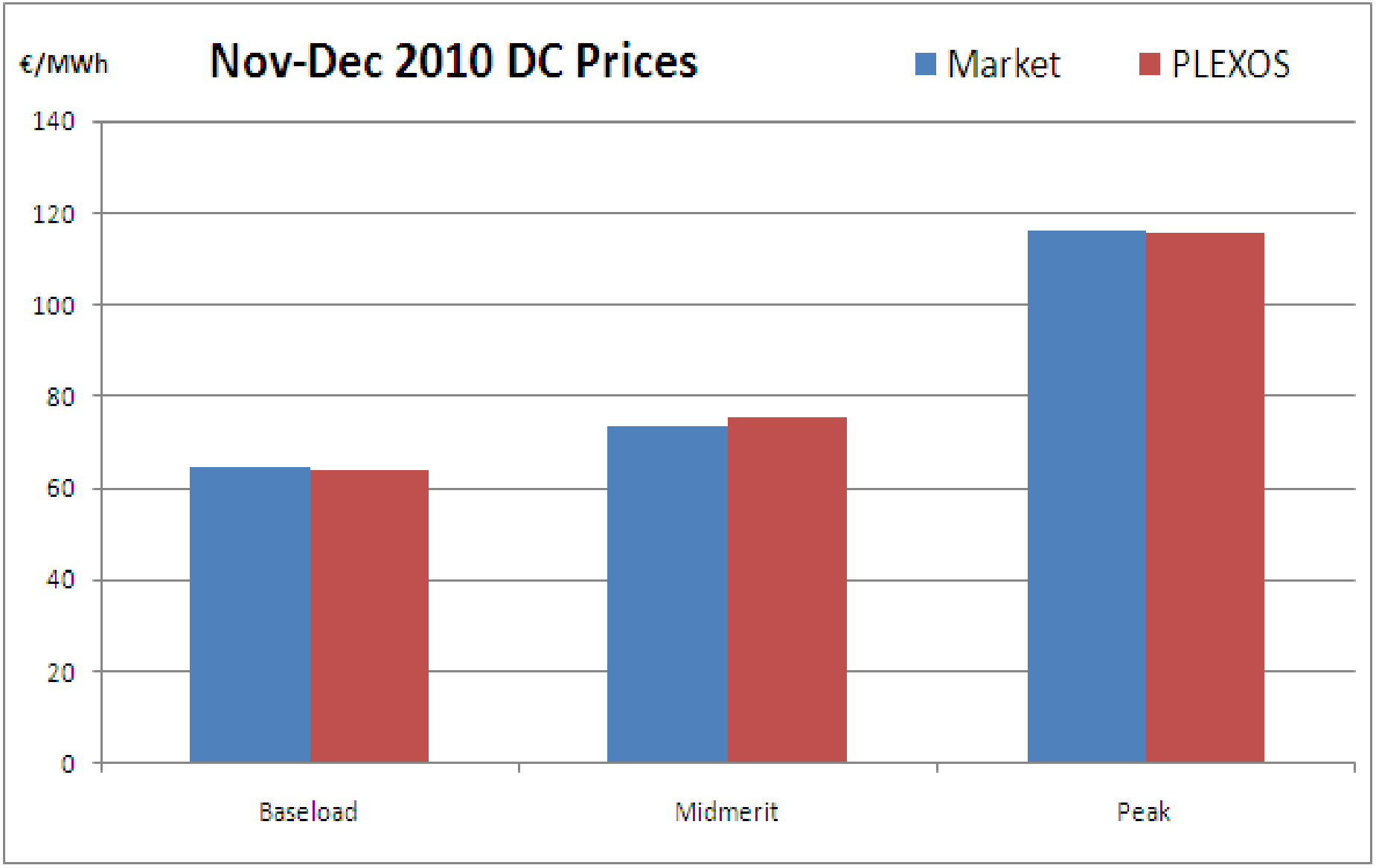

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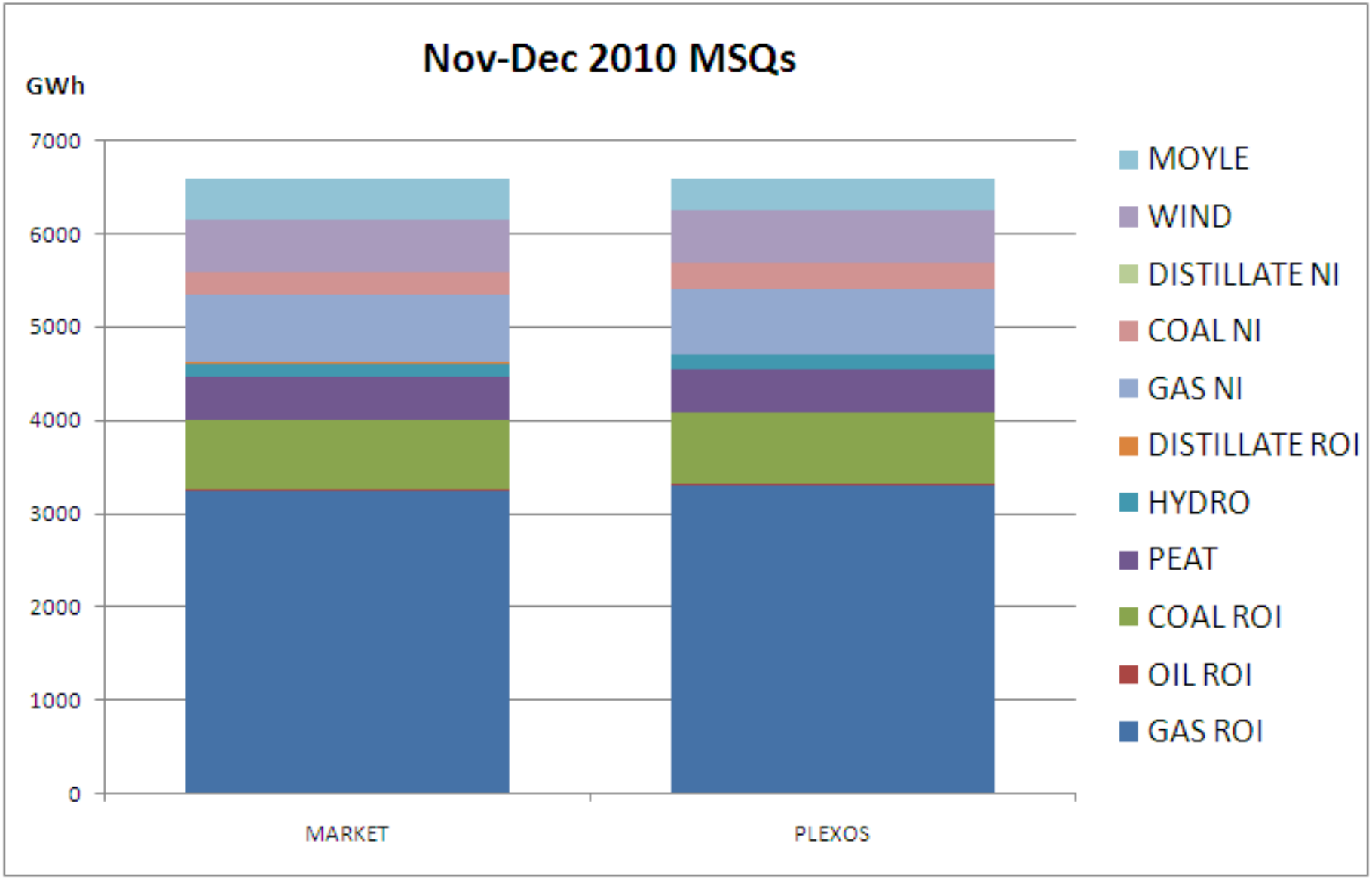
Nov-Dec 2010 MSQs
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WIND
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COAL NI
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DISTILLATE ROI
HYDRO
PEAT
COAL ROI
OIL ROI
GAS ROI

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Nov-Dec 2010

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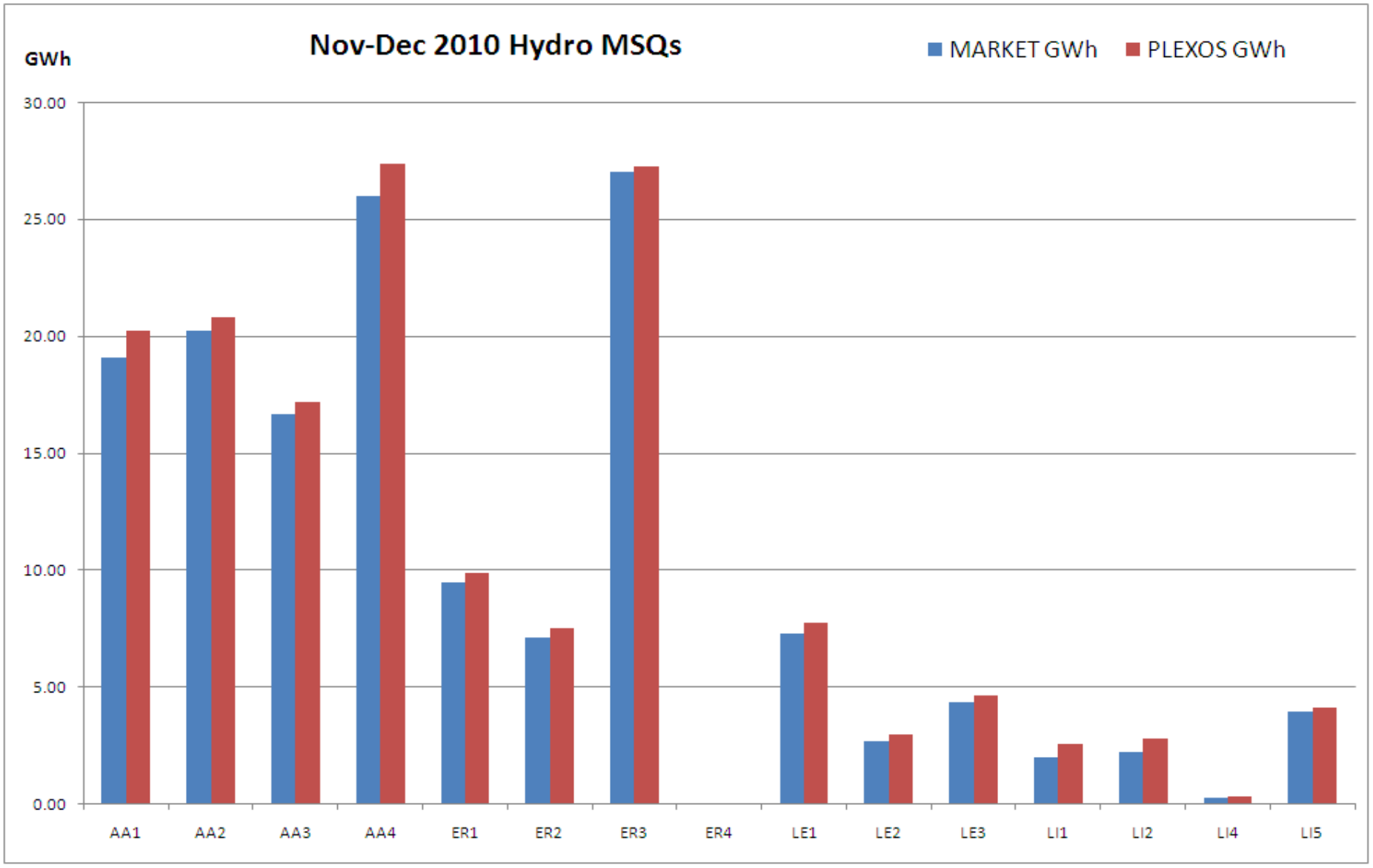


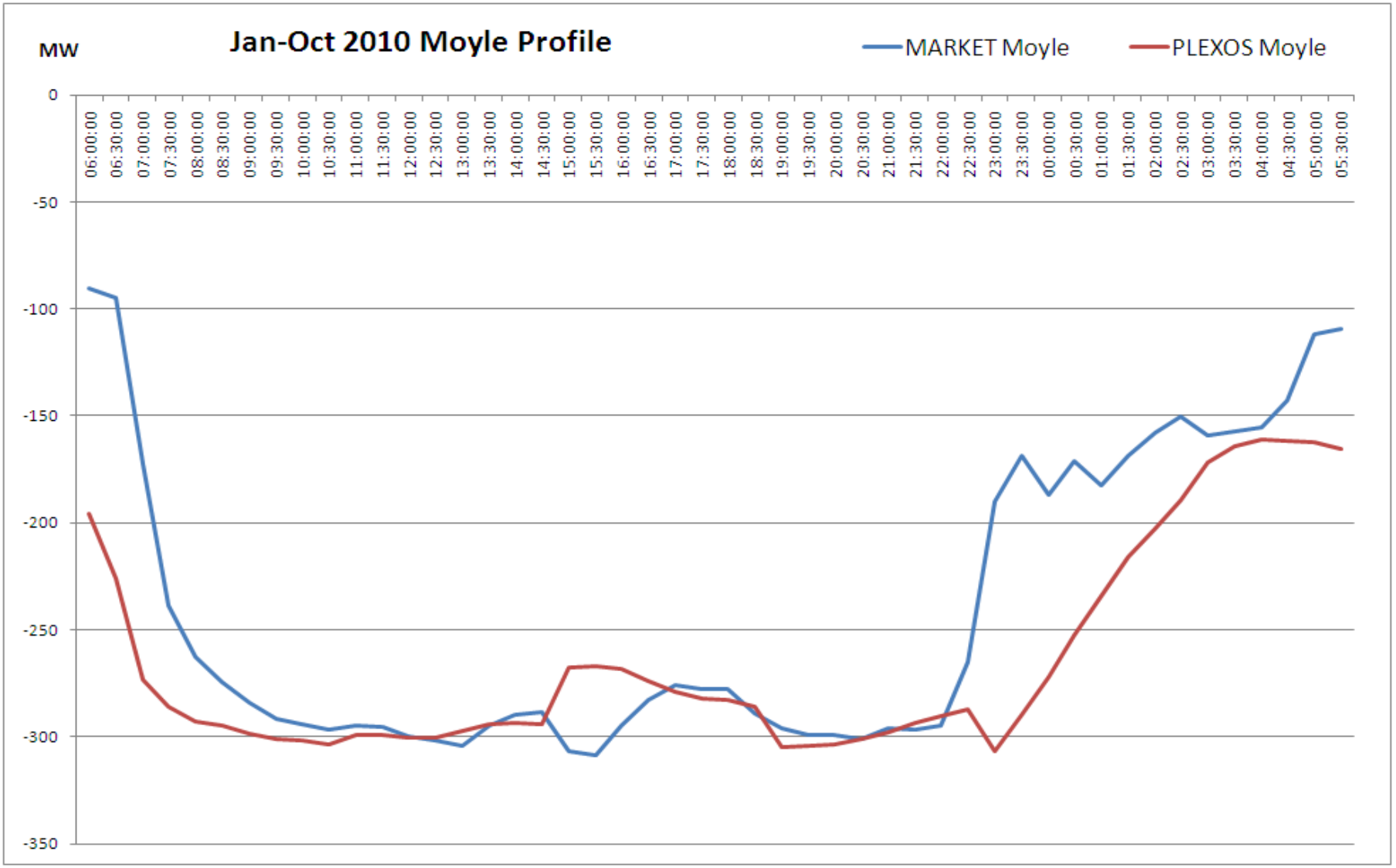
Moyle

- GB Prices
  - Same methodology as last year
  - Single GB generator
  - Regression of 2010 GB price series against daily gas and carbon prices
  - GB prices defined over 4-hour EFA blocks for both summer and winter
  - VOM Costs and Heat Rates represent regression constants and coefficients

Moyle (2)

- New Wheeling Charges Back
  - Based on analysis of Average Interconnector Bid vs GB Price
  - Defined for each 4 hour EFA block for summer and winter

Moyle (3)


Jan-Oct 2010 Moyle Profile
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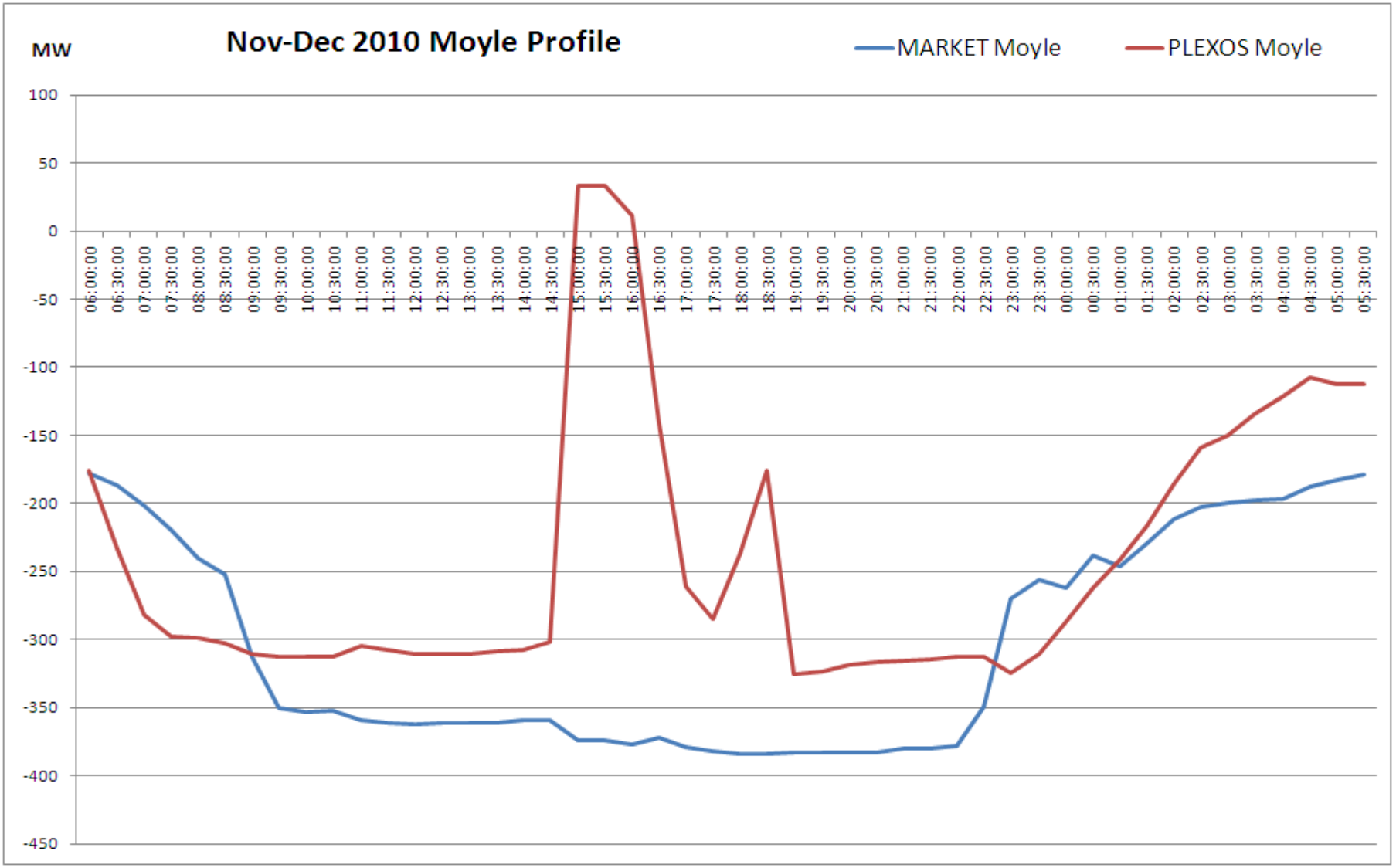
Moyle (4)


Nov-Dec 2010 Moyle Profile
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SMP Results Summary

- Jan-Oct 2010 Kilroot Free
  - 4.1% over Market Outcomes
- **Jan-Oct 2010 Kilroot Commitment Fixed**
  - 1.2% under Market Outcomes
- **Nov-Dec 2010 Kilroot Using New Bidding Structure**
  - Same structure as that used in the forecast model
  - <0.2% under Market Outcomes

Recommended Settings

- Xpress-Mp Solver
- Rounded Relaxation
- RR Threshold Level = 25
- ”3 State” Start Costs

Forecast Model - Data Requirements

Data Requirement	Source
Generator COD and TOD data	Generators
Fuel transportation charges (Variable)	Generators
Generator New entry & Retirements	System Operators
Half hourly SEM demand assumptions out to the end of 2012	System Operators
Embedded generation	System Operators
Wind profiles	System Operators
Transmission Loss Adjustment Factors	System Operators
Daily hydro availability limits	System Operators
Outage schedules	System Operators

Forecast Model - Generator Data

Commercial Offer Data	Technical Offer Data
❖ Heat Rates & No Load	❖ Outages (Forecast & Forced)
❖ Variable Operational & Maintenance Costs	❖ Ramp Rates
❖ Start Costs & Energy	❖ Min Up & Down Times
❖ Delivered Fuel Prices	❖ Start Boundary Times
❖ TLAFs (incorporated to all the above)	❖ Max Capacity
	❖ Min Stable level

- Generator submissions was compared to last year's validated dataset.
- Compared to market submissions.

Forecast Model - Changes to Last Year

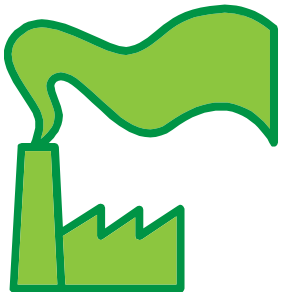
Fuel Sheet

- Variable fuel transportation adders - updated based on generator submissions and publicly available data.
- Dublin Bay fuel - Discount 30% (estimate) on ROI gas prices.
- Kilroot Start Fuel - coal (60%) and oil (40%) mix.
- Aughinish fuel - zero price (as with the peat stations).

Generator Data

Compared to last year's data and to market submissions

- 3 starts for all Generators that have them.
- Addition of Contour unit 3.
- NW4 is out for the period.
- Various COD and TOD characteristics of existing generators.



- VOM Data is considered confidential by most generators.

Forecast Model - Changes to Last Year

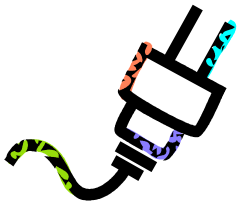
SEM System Data

- **SEM Demand growth**:

  Revision of 2011: -1.2%

  2012 change on new 2011: +2%

  Profile based on 2007.

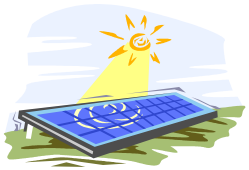


- **Wind**:

  Capacity: SO data on target connection dates by quarter.

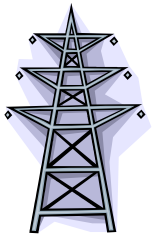
  Profile based on 2008.

- **Embedded Generation**: Updated profiles for 2011 and 2012.



- **Hydro**: Daily limits based on monthly averages from the last 5 years.

- **TLAFs**: 2011



Forecast Model - Changes to Last Year

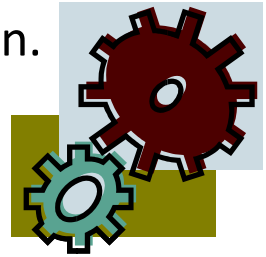
Interconnection

- Moyle wheeling charges updated.
- East-West Interconnector has been added from 24th September 2012.

Great Britain

- Single generator – same approach to last year.
- Capacity & Demand updated for East-West entry.
- Heat Rate coefficients & VOM values based on Regression Analysis used in Backcast.

Model Settings



- Solver used Xpress MP – Rounded Relaxation.
- RR25

Next Steps

- RAs to publish validated model by Fri 24 June including:
  - Input database of gen technical characteristics
  - SEM system data, e.g. demand, wind profiles
  - Fuel spreadsheet to convert index prices into delivered SEM costs
- Excludes confidential data: gen VOM and outages, and fuel prices
- Model will be followed up with a report

Next Steps

- RA Paper on DC pricing and quantities to be published over approx next week
- Primary Subscription Window for DCs from Mon 27th June to Mon 11th July inclusive
- Supplemental Subscription Window from Mon 18th to Fri 22nd July

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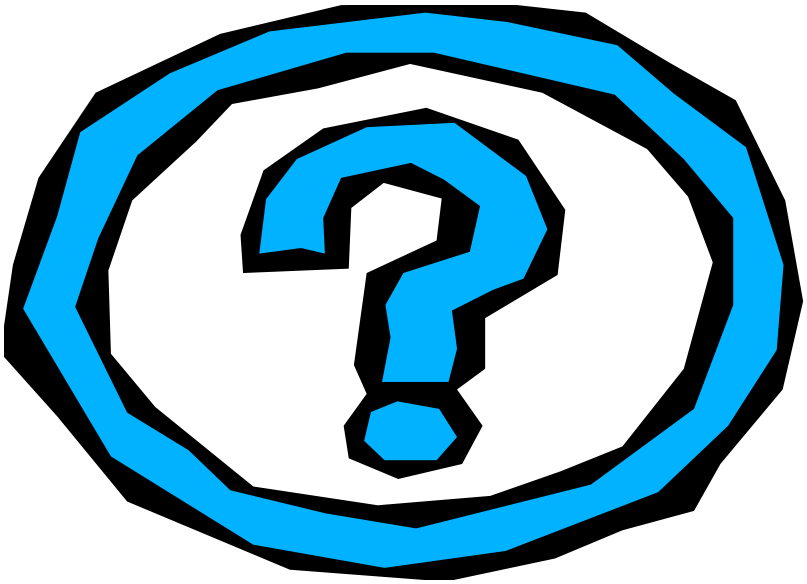

Questions and Answers