COLRUYT GROUP

PRODUCEREN

windturbines	**11** windturbines (febr 2016)	**25,1** MW	**14.500** ton CO² reductie
zonne-energie	**43** locaties	**6,8** MWp	**1788** ton CO² reductie
warmtekrachtkoppeling	**1** warmtekrach-koppelings-installatie	**926** kW thermisch / **889** kW elektrisch	**545** ton CO² reductie

EOLY

ESS feasibility / concept studies:

(1) Effect of ESS sizing:

- Power (kWe)

- Volume (kWh)

(2) Optimal setting in combined application:

- Reducing RE-excess

- Load shifting (BELPEX)

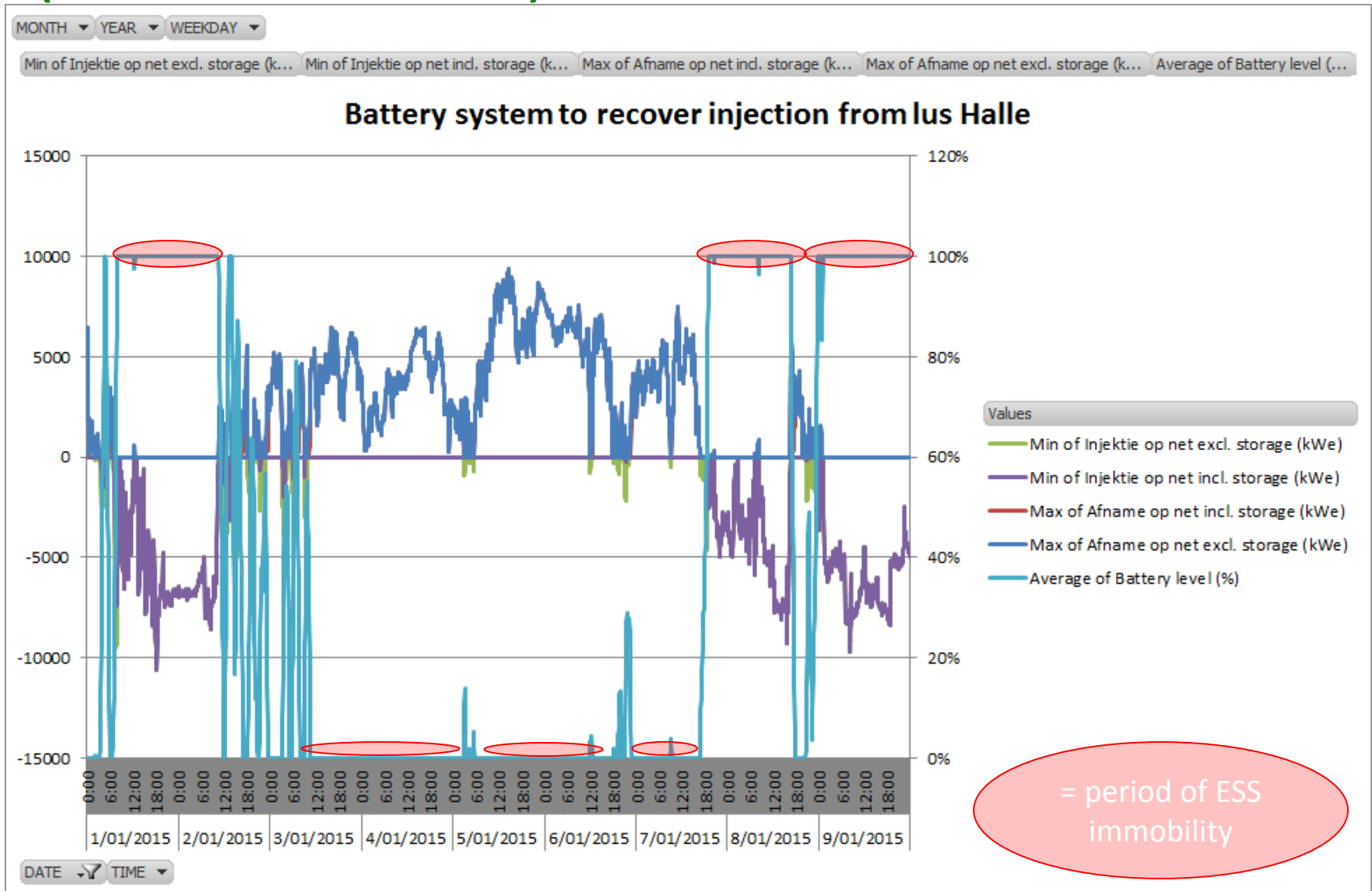# Illustration of the "difficult challenge ESS" (2MWe – 1 hour)

Illustration of the "difficult challenge ESS" (2MWe – 1 hour) icw 50% load shift on BELPEX
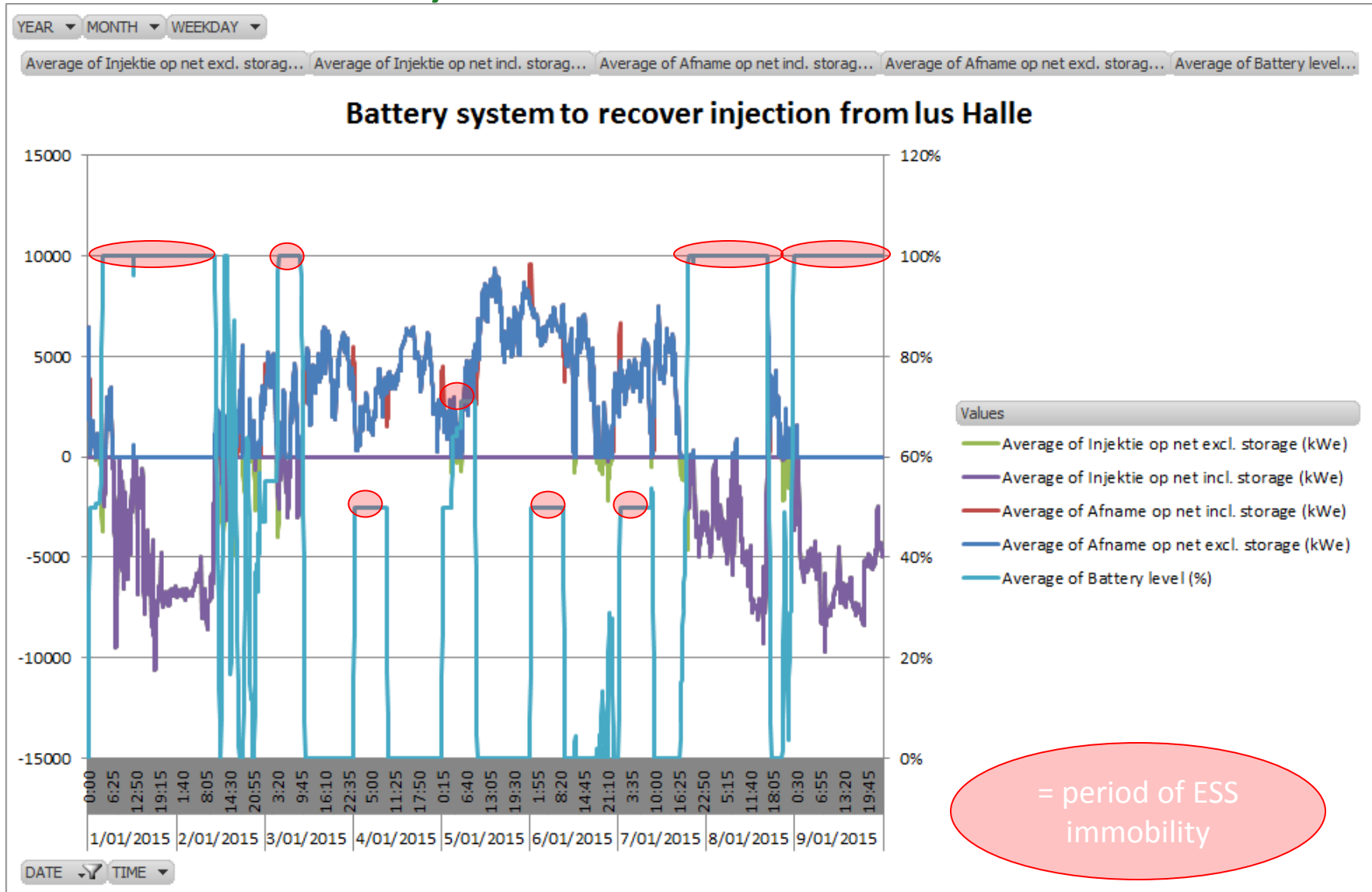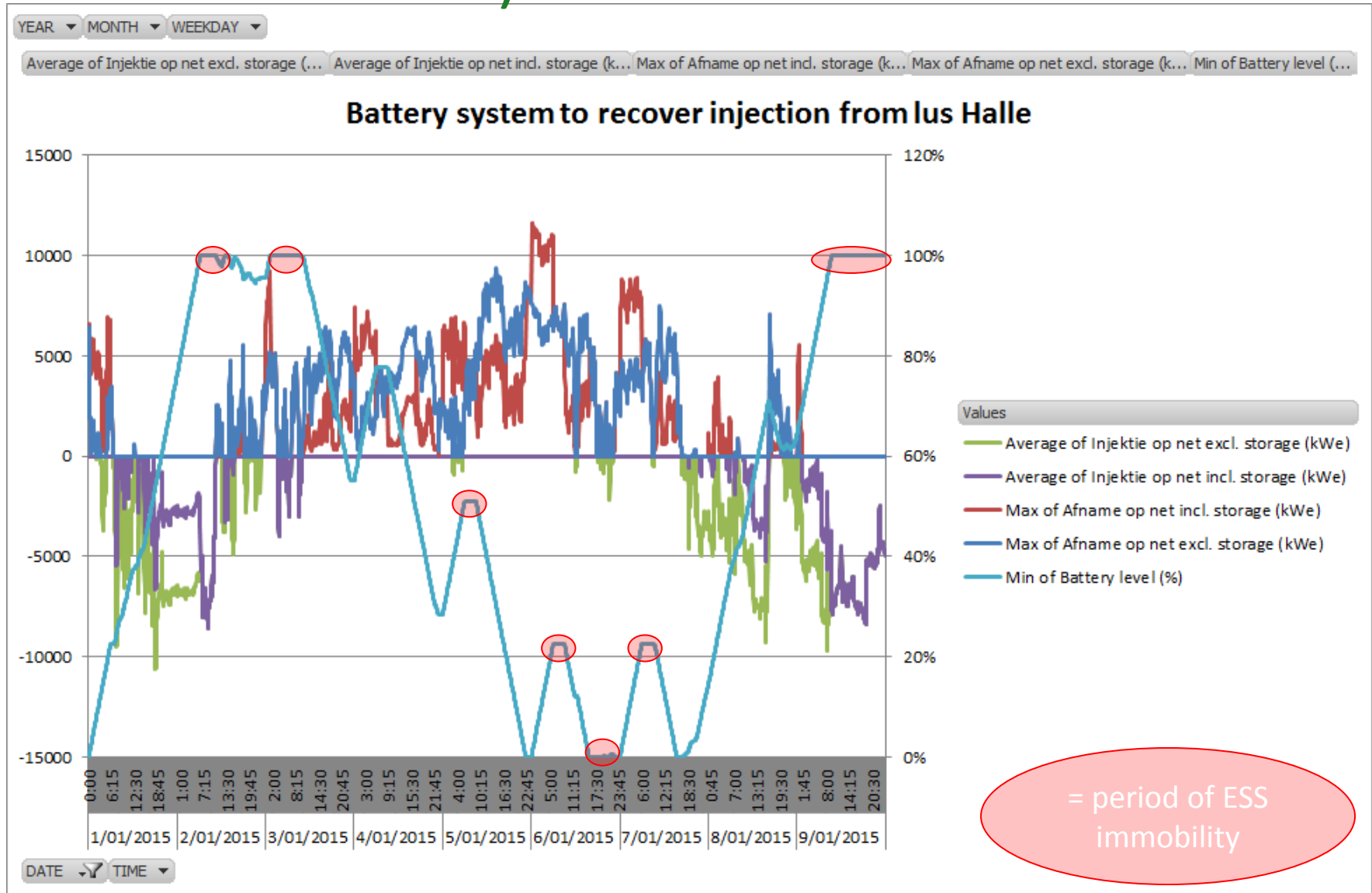

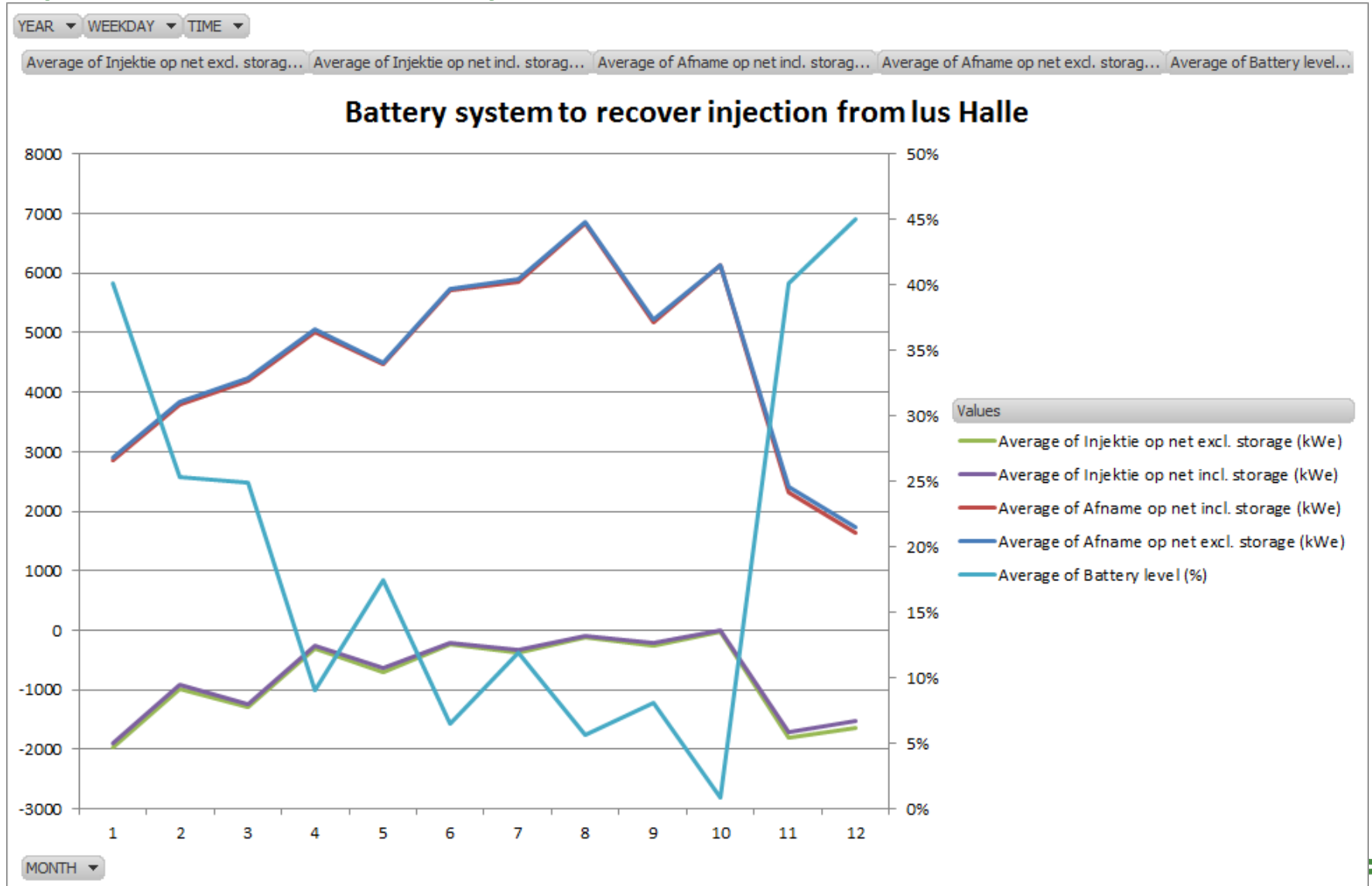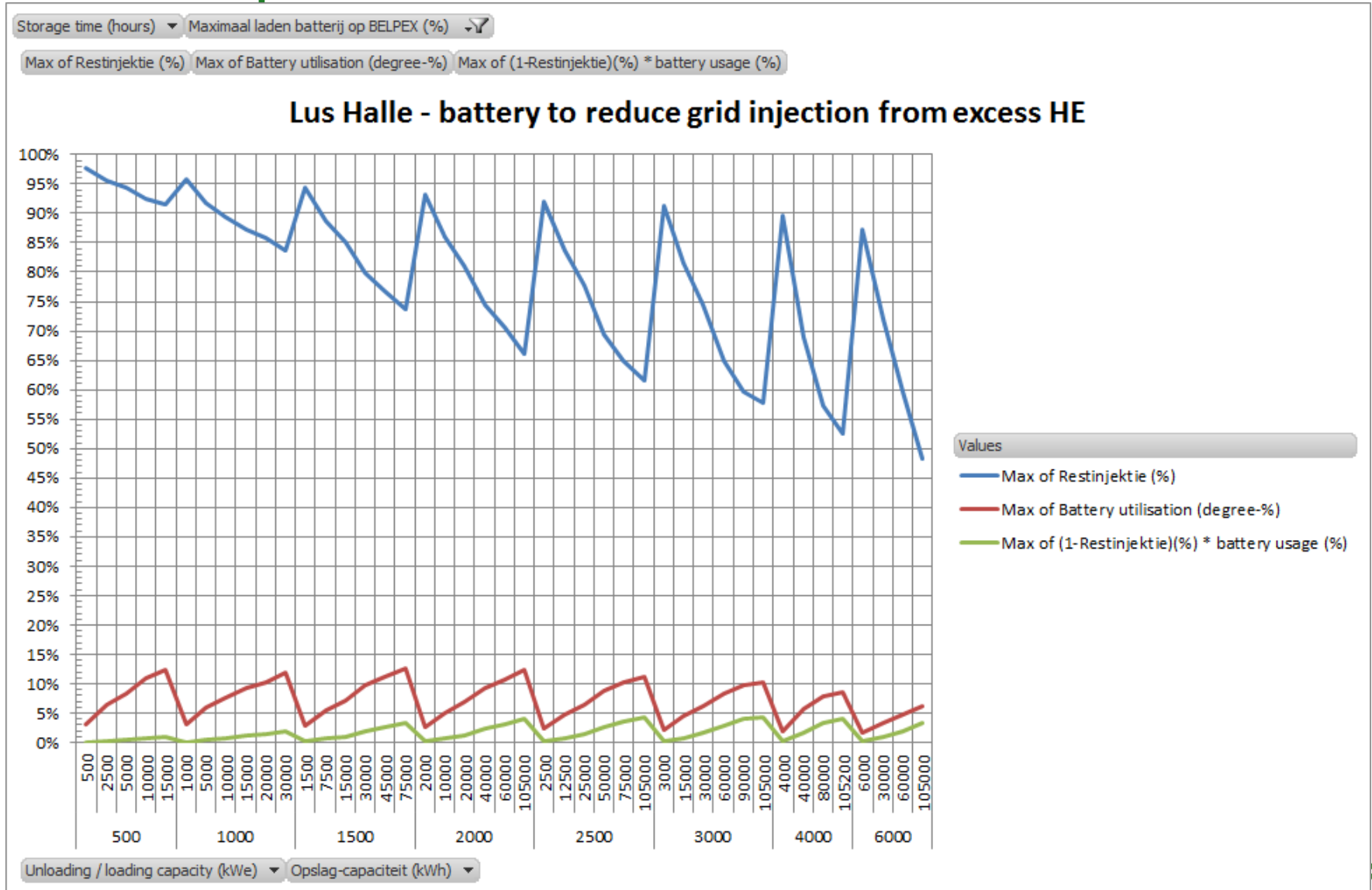Battery system to recover injection from lus Halle

Illustration of the "difficult challenge ESS" (4MWe – 26 hour) icw 50% load shift on BELPEX
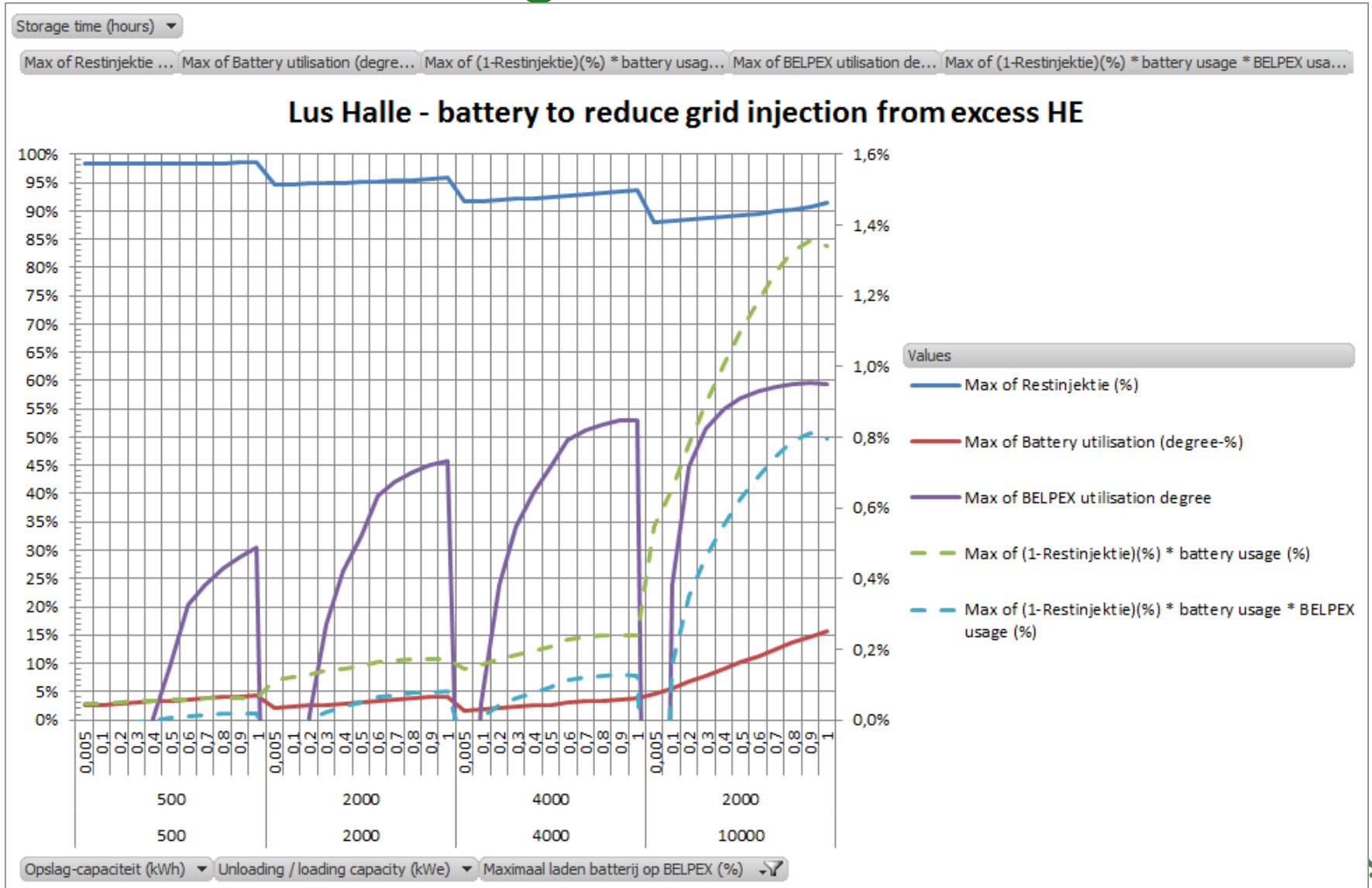
Conclusions – average load ESS ifo season (2MWe – 1 uur)

Conclusions – reduction of RE-excess ifo ESS-power and volume

Conclusions – effect of combination with load shifting BELPEX

Storage time (hours)

Max of Restinjektie ... | Max of Battery utilisation (degre... | Max of (1-Restinjektie)(%) * battery usag... | Max of BELPEX utilisation de... | Max of (1-Restinjektie)(%) * battery usage * BELPEX usa...

Lus Halle - battery to reduce grid injection from excess HE

Values

— Max of Restinjektie (%)

— Max of Battery utilisation (degree-%)

— Max of BELPEX utilisation degree

– – Max of (1-Restinjektie)(%) * battery usage (%)

– – Max of (1-Restinjektie)(%) * battery usage * BELPEX usage (%)

Opslag-capaciteit (kWh) | Unloading / loading capacity (kWe) | Maximaal laden batterij op BELPEX (%)

CONCLUSIONS

The «difficult challenge» of ESS:

- Phenomenon of « RE-excess waves»: the battery gets saturated/blocked during waves with / without RE-excess

- The battery usage degree is relatively low;

- Combination with load shifting is positive but impacts internalisation of RE-excess

ESS volume: becomes very big for enabling a substantial internalisation of RE-excess:

- ESS > 10 MWh for 10% reduction

- ESS > 100 MWh voor 50% reduction

ESS power: has to be limited to the minimum necessary

eoly

PERSPECTIVES FOR 2ND LIFE BATTERIES

In order to enable an economical ESS, 2nd life batteries should achieve:

- extremely low CAPEX price for the ESS volume (Euro / kWh)

- applications with no extreme requirements of performances ….

- ….. but still proving reliable and low O&M cost

eoly