Substitution values

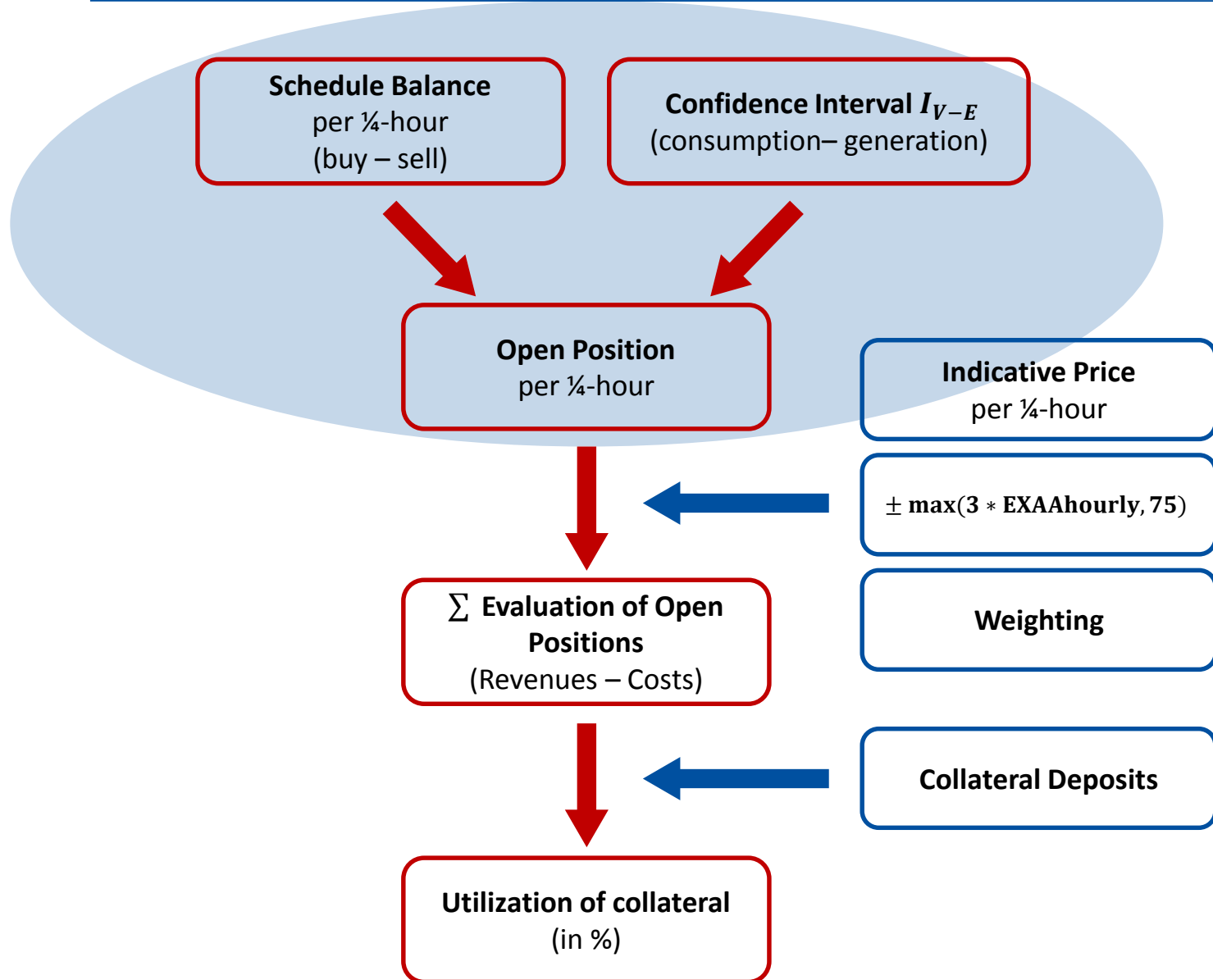Workshop Risk Management

03.12.2015

Concept

Calculation steps

Concept

Schedule Balance
per ¼-hour
(buy – sell)

Confidence Interval I_{V-E}
(consumption– generation)

Open Position
per ¼-hour

Indicative Price
per ¼-hour

$\pm \max(3 * \text{EXAAhourly}, 75)$

$\sum$ Evaluation of Open Positions
(Revenues – Costs)

Weighting

Collateral Deposits

Utilization of collateral
(in %)

- Confidence interval base on historic metered values
  - Produce intervals for the difference (consumption – generation) from historic data
  - External influences (workday, weekend) are taken into account
  - Assess imbalances in schedules (scheduled consumption – scheduled delivery) above/below those thresholds as open position
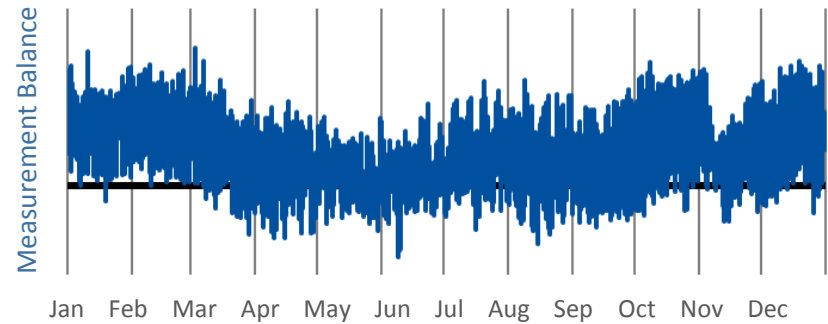
Calculation steps

- Process for each balance group:
  - **I.** **Balance of metered data**
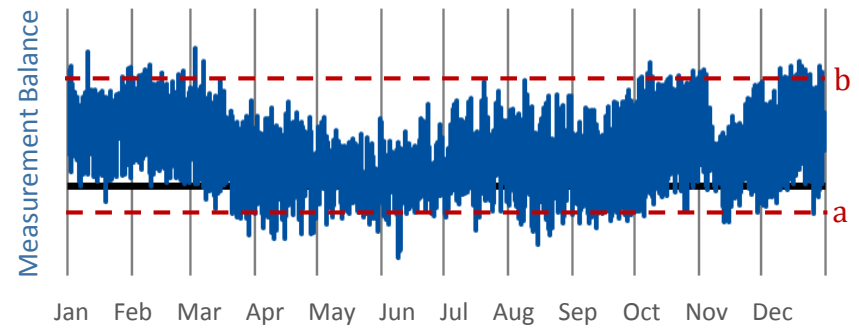
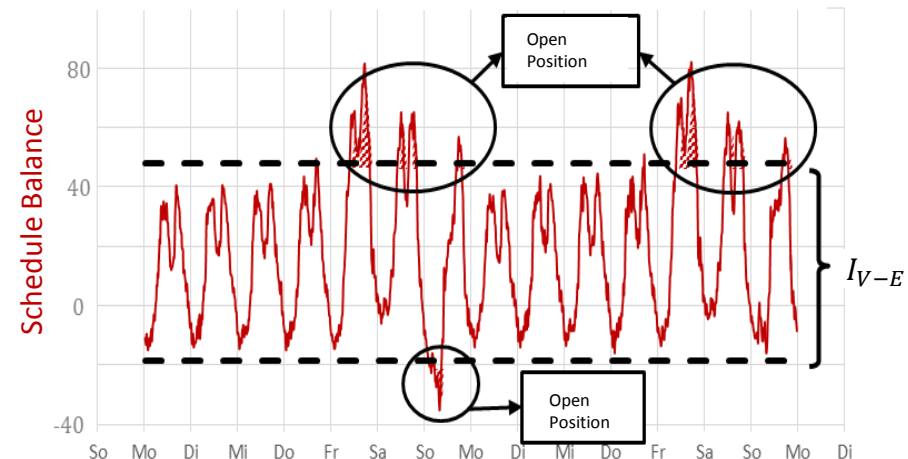   from last 12 settled months

  - **II.** **Confidence Inteval** $I_{V-\mathrm{E}} = [a, b]$

    for quantiles 5 % resp. 95 %

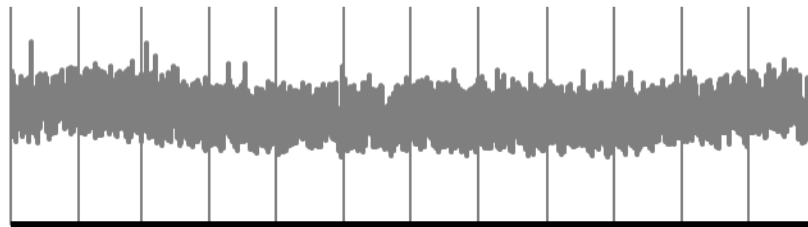 - **III. Open Position**

    as distance to confidence interval
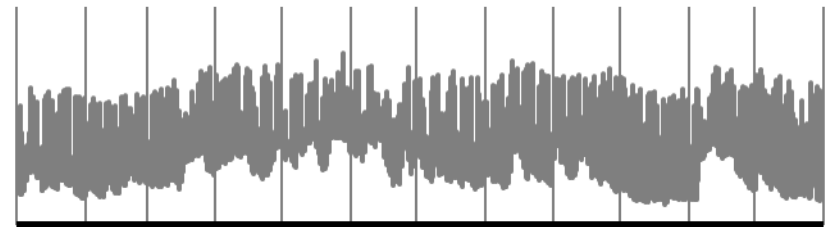
I. Metered Values Balance

I. Measurement Balance

- Metered values from the last 12 settled months are taken into account, if available

- Metered Balance per ¼-hour:
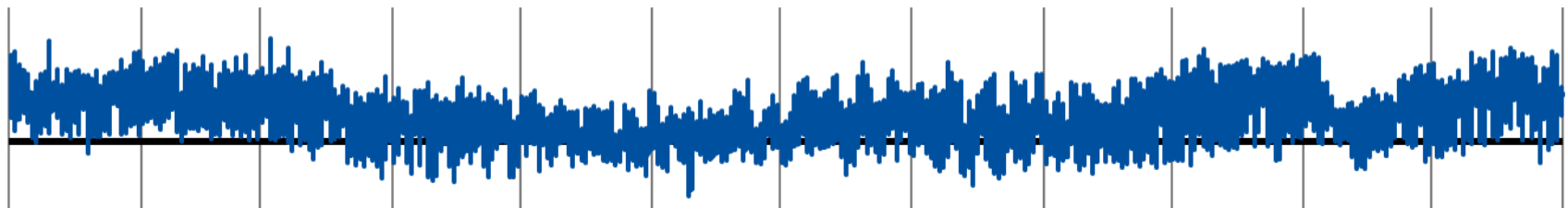 - Balance $=$ Consumption (V) $-$ Generation (E)

Consumption

Generation

Consumption - Generation

II. Confidence Interval

II. Confidence Interval

- Bounds are determined by quantiles
  - 90% of historic balances (consumption – generation) are contained in $I_{V-E} = [a, b]$
    (Suppose quantiles are set to 5% and 95%)

- Refinement of quantiles is useful
  - Ability to include differences between consumption/generation on workdays (WT) and weekends (WE)

- Calaculate quantiles based on
  - Workdays → $I_{V-E}^{WT} = [a_{WT}, b_{WT}]$
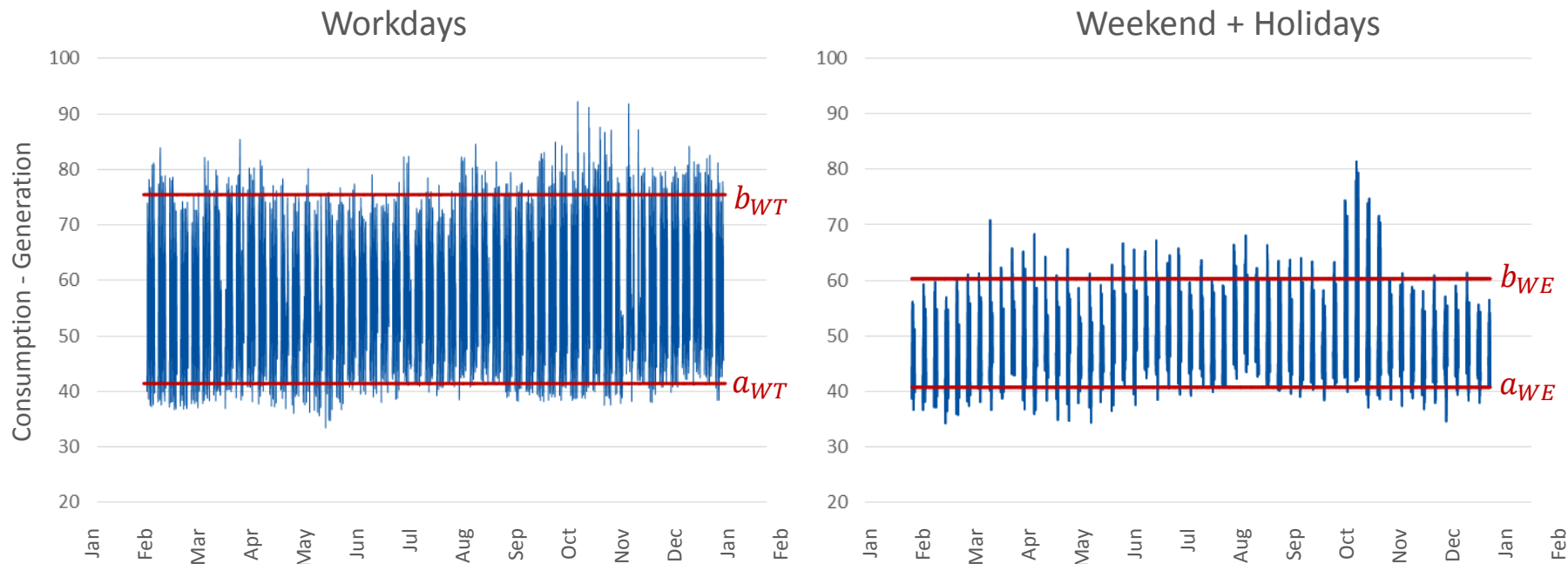 - Weekends → $I_{V-E}^{WE} = [a_{WE}, b_{WE}]$

- Database = last 12 invoiced months
- I_{V-E}^{WT}
  - a_{WT} = 5%-quantile of ¼-hourly metered balance on workdays
  - b_{WT} = 95%- quantile of ¼-hourly metered balance on workdays
- I_{V-E}^{WE}
  - a_{WE} = 5%- quantile of ¼-hourly metered balance on weekends
 - b_{WE} = 95%- quantile of ¼-hourly metered balance on weekends

- Intervals are valid for non-settled period
    - As soon as new meter data are available (after 1st clearing) the confidence intervals will be recalculated

- Possible further refinements and improvements of the confidence interval in the future to account for additional external influences (hour of the day, temperature, …)

- Possible refinements
    - Hours:
        - $I_{V-E}^{h1}, I_{V-E}^{h2}, \dots, I_{V-E}^{h24}$

III. Open Positions

Only schedule imbalances outside the confidence interval are counted

the open position is the distance to the nearest confidence interval bound

Replacement value method
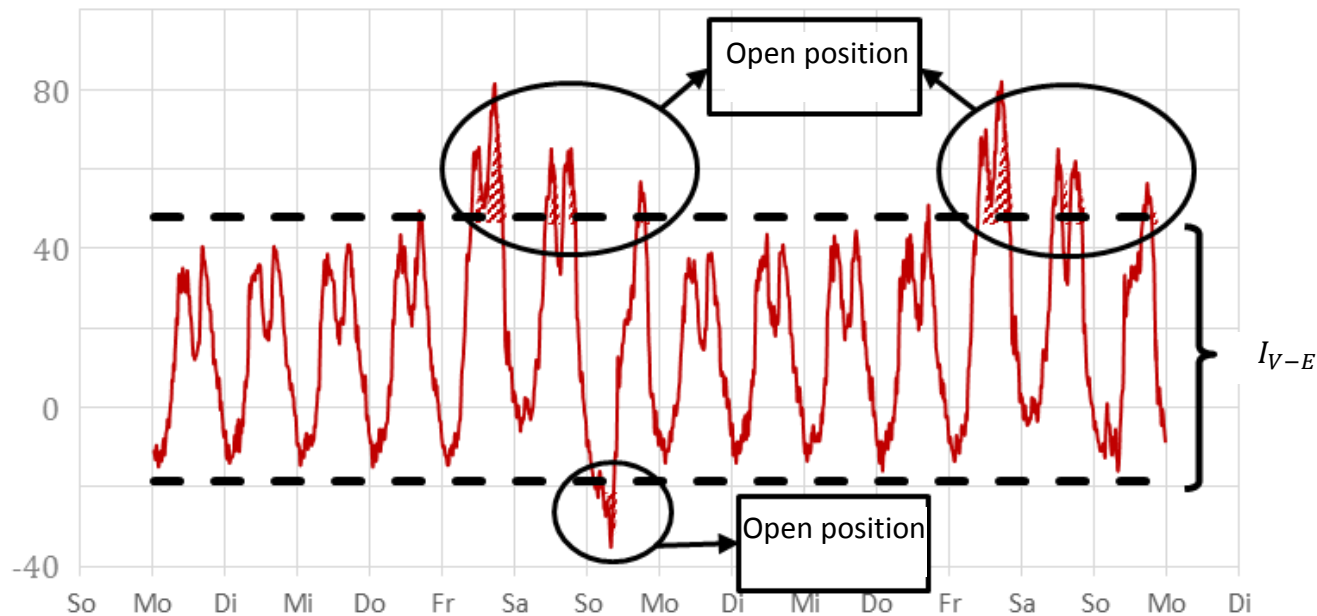
Process for each balance group:

I. Balance of metered data

a) Calculate balances (consumption – generation) for each ¼-hour
b) Database: Last 12 settled months

II. Confidence Inteval $I_{V-\mathrm{E}} = [a, b]$

a) $a = x\%$-quantile of metered balance
b) $b = (1 - x)\%$-quantile of m. b.
c) Status Quo: $x = 5$

III. Open Position

a) Calculate schedule balance (scheduled consumption – scheduled supply) for each ¼-hour
b) Valuate difference between schedule balance and upper/lower bound of I_{V-E} as open position
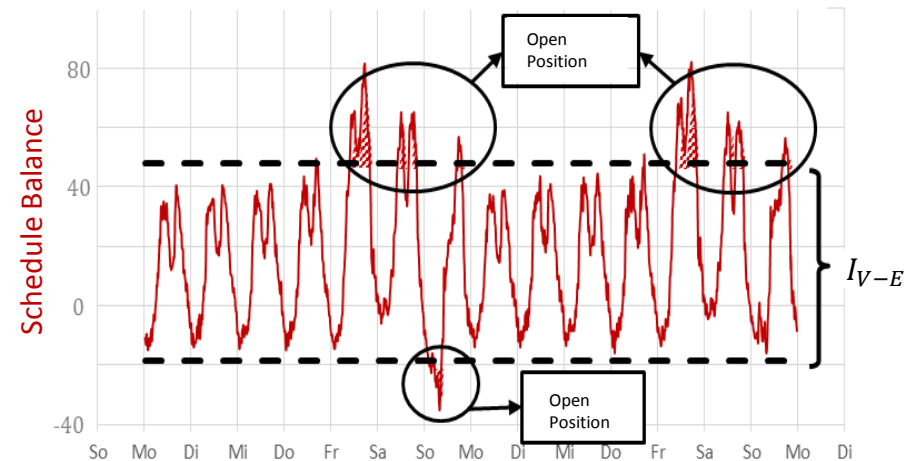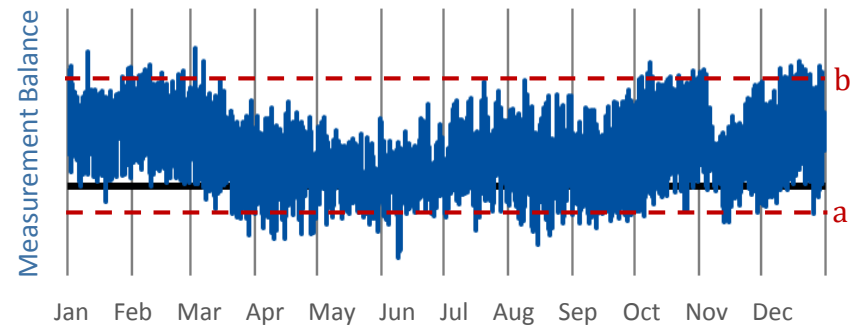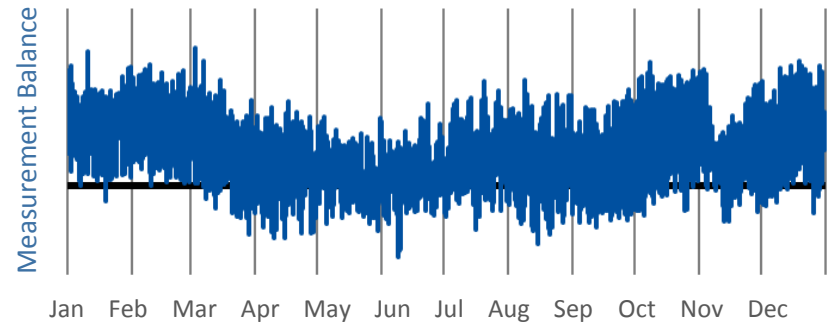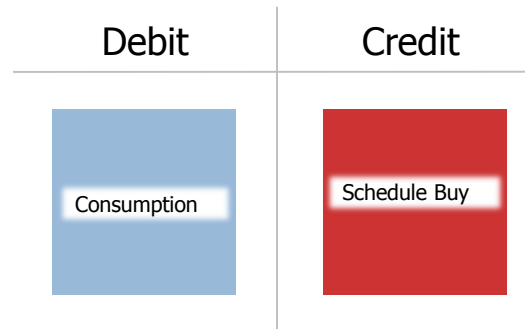
Examples

Simplification

- Refinement of quantiles (workday, weekend) will not be included in the following illustrations
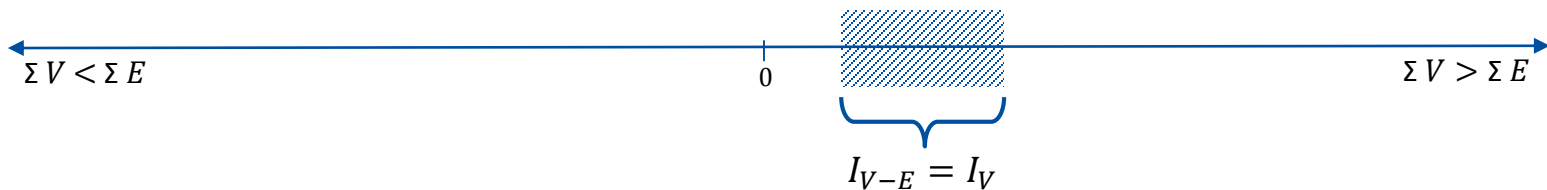 - No difference between workdays and weekends

Consumption Balance Groups

Examples

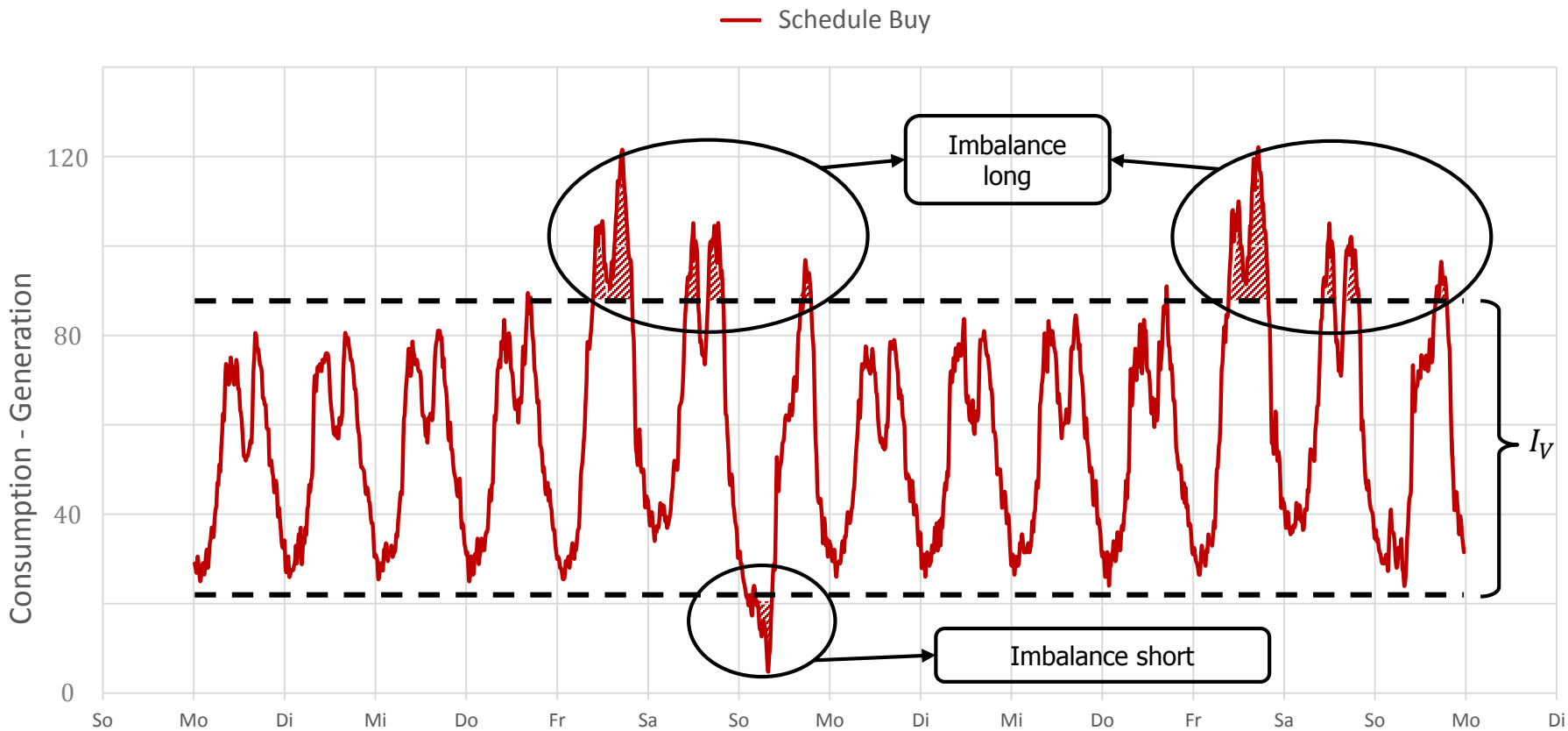**Type:** Consumption Balance Group $I_{V-E} = I_V$

- Balance:

Debit	Credit
Consumption	Schedule Buy

- Interval I_V:

$$\Sigma V < \Sigma E \qquad\qquad 0 \qquad\qquad \Sigma V > \Sigma E$$

$$I_{V-E} = I_V$$

Type: Consumption Balance Group $I_{V-E} = I_V$

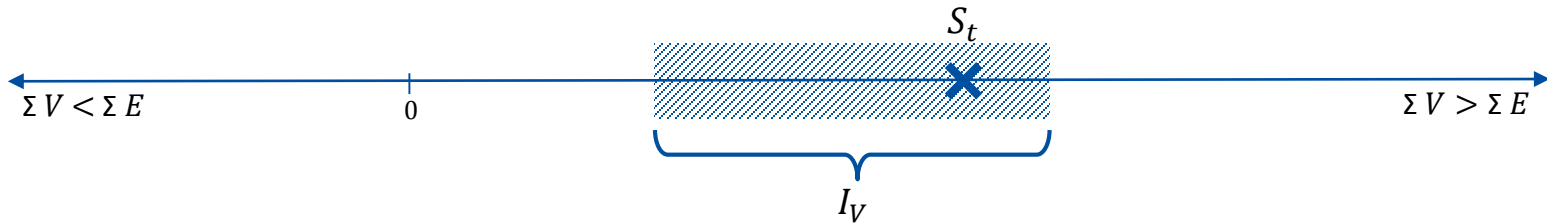- Schedule buy of a balance group two weeks in January 2015

- Data for quantile calculation → Consumption within 01.12.2013 – 01.12.2014

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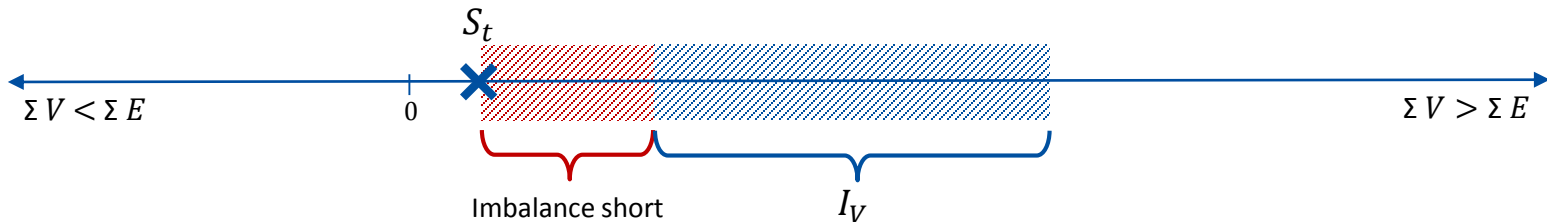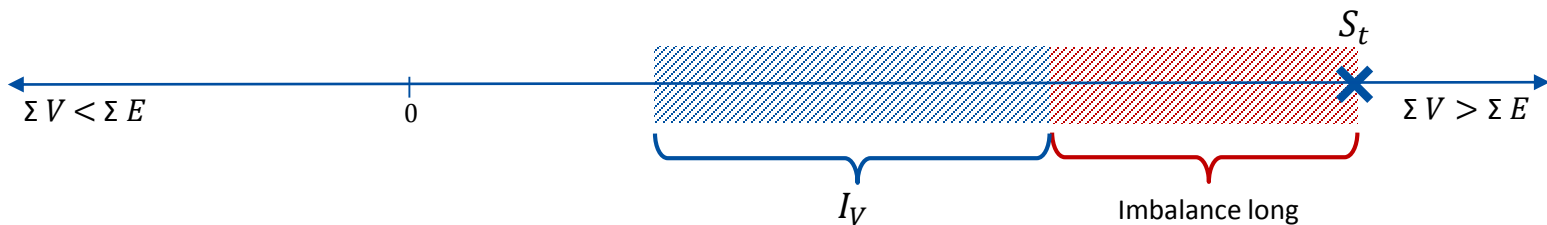**Type:** Consumption Balance Group $I_{V-E} = I_V$

– $S_t = \text{sched. balance at } \frac{1}{4}\text{hour } t = \text{sched. cons.}_t - \underbrace{\text{sched. supply}_t}_{= 0} \geq 0$

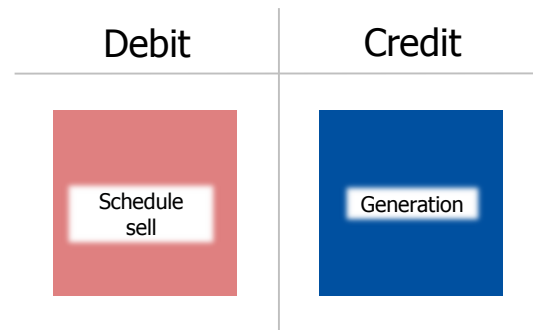– No open position:

– Imbalance short:
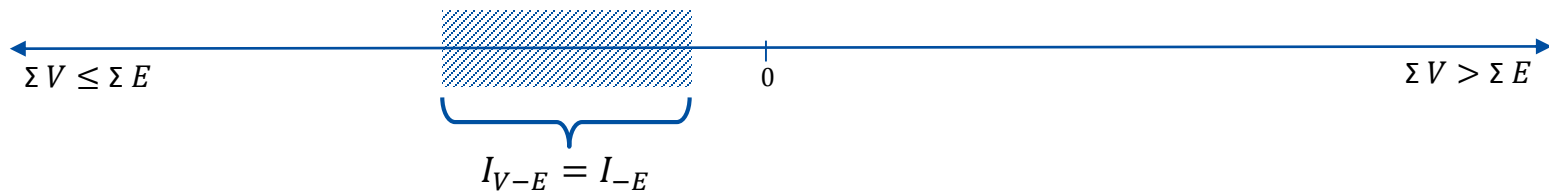

– Imbalance long:

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Generator balance groups

Examples

Type: Generator balance group $I_{V-E} = I_{-E}$

- Balance:

Debit	Credit
Schedule sell	Generation

- Interval I_{-E}:

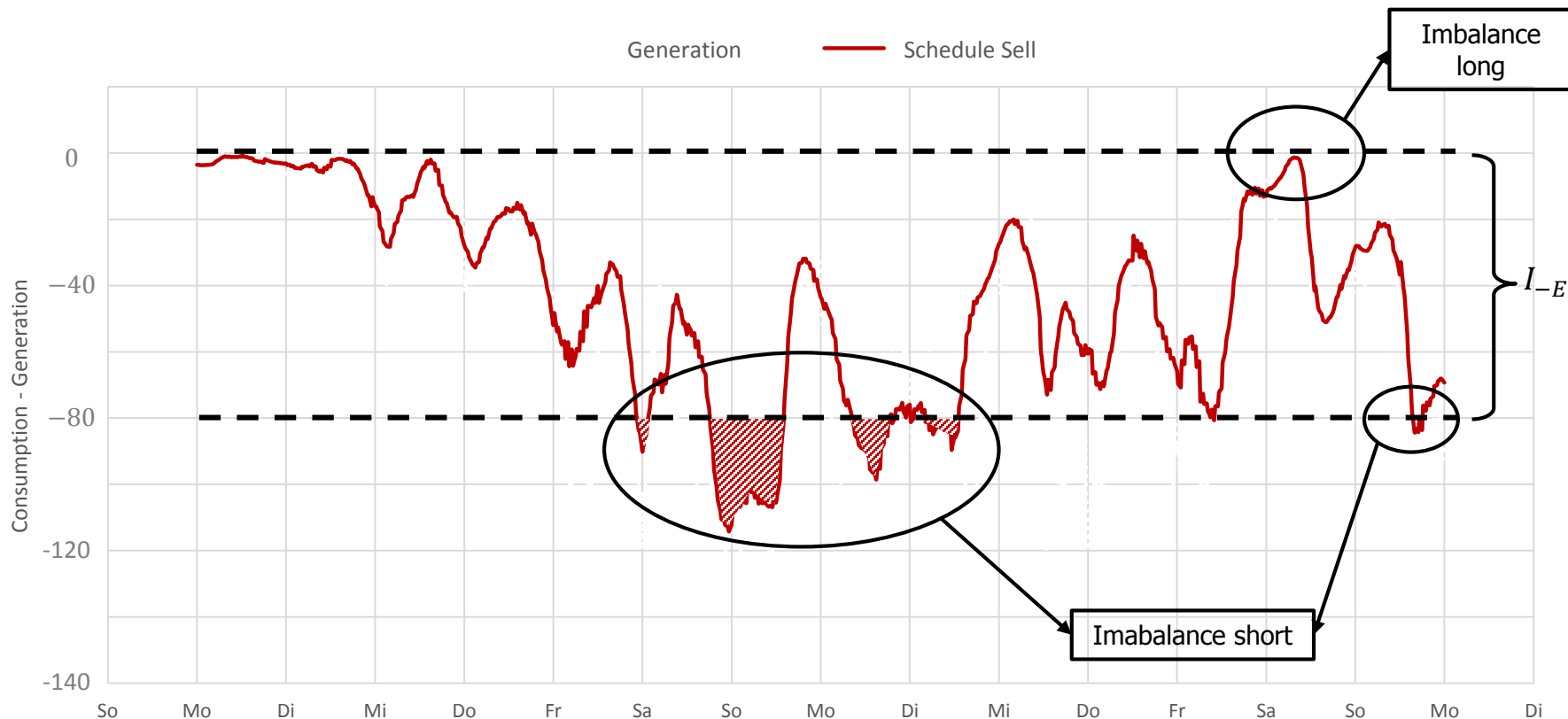$$\Sigma V \leq \Sigma E \qquad\qquad 0 \qquad\qquad \Sigma V > \Sigma E$$

$$I_{V-E} = I_{-E}$$

Type: Generator balance group $I_{V-E} = I_{-E}$

- Schedule sell of a balance group two weeks in January 2015

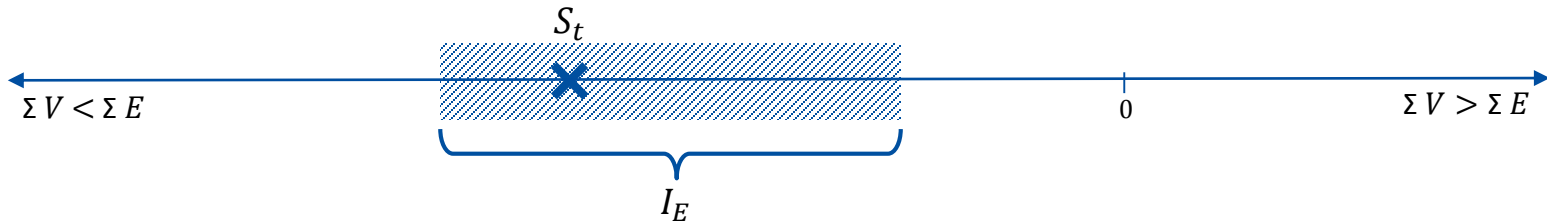- Data for quantile calculation → Generation within 01.12.2013 – 01.12.2014

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Type: Generator balance group
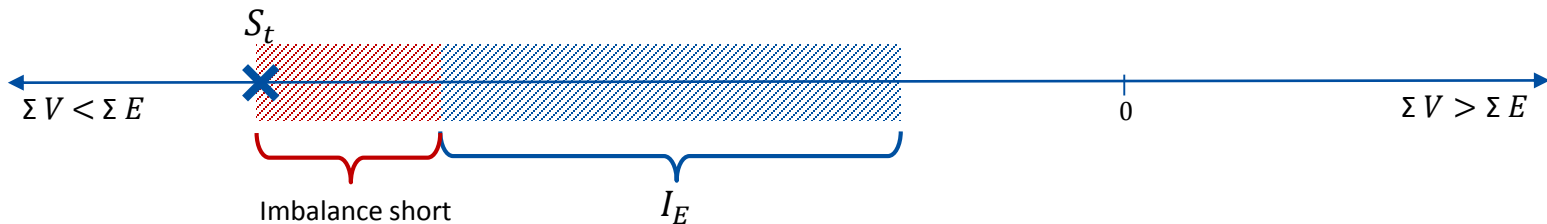
– S_t = Sched. balance at $\frac{1}{4}$ hour t = $\underbrace{\text{sched. cons.}}_{= 0}$ $_t$ − sched. supply$_t \leq 0$

– No open position:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

I_E

– Imbalance short:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

Imbalance short I_E

– Imbalance long:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

I_E Imbalance long

Mixed balance groups
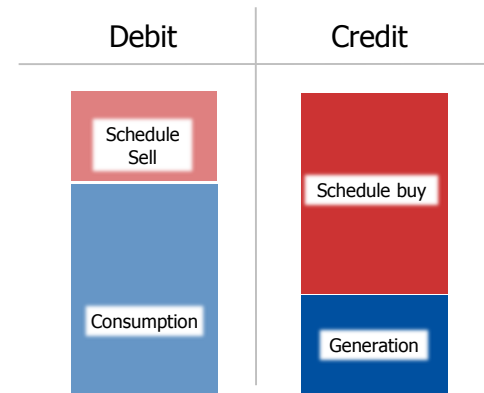
Examples

Examples

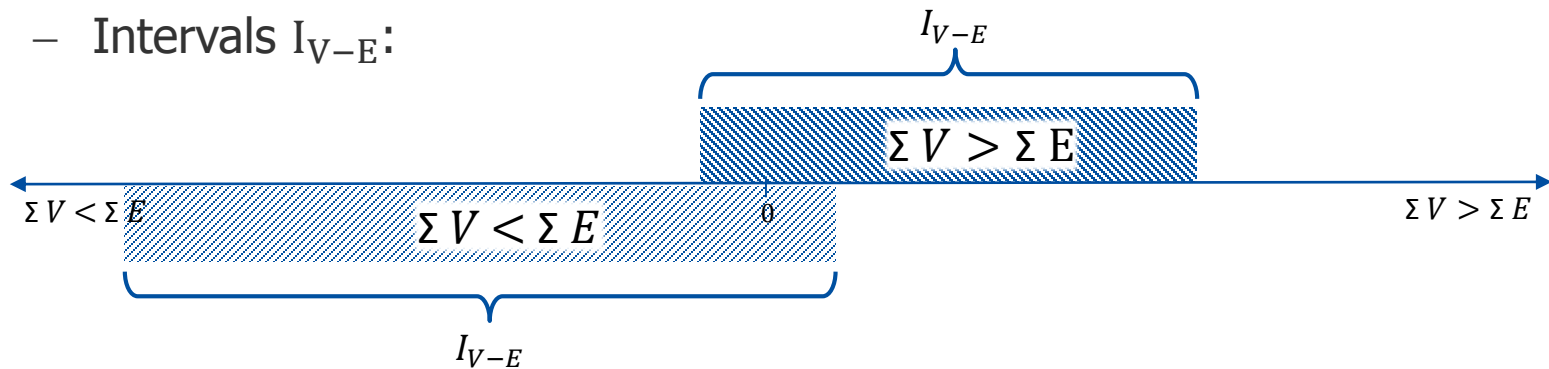**Type:** Mixed balance group

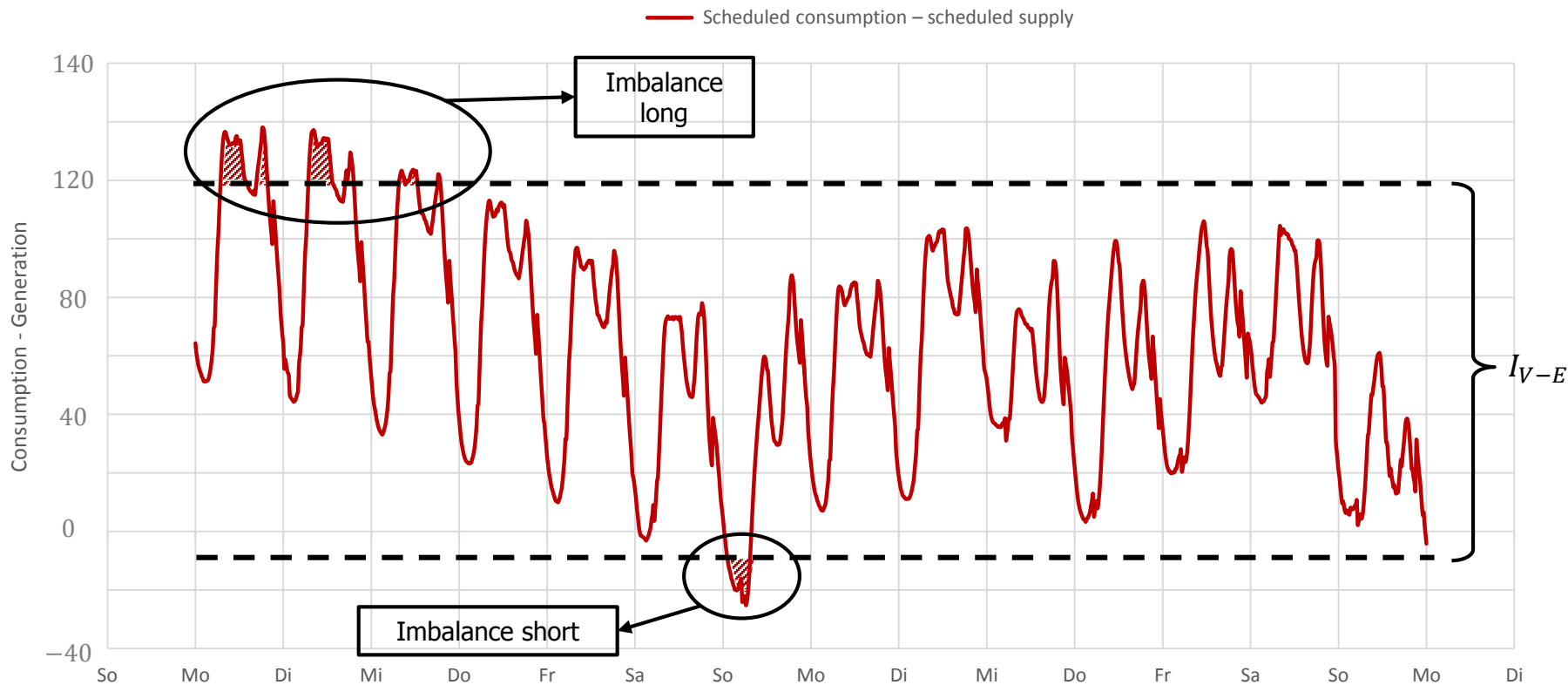- Balance: $\Sigma V < \Sigma E$ $\qquad\qquad$ $\Sigma V > \Sigma E$

- Intervals I_{V-E}:

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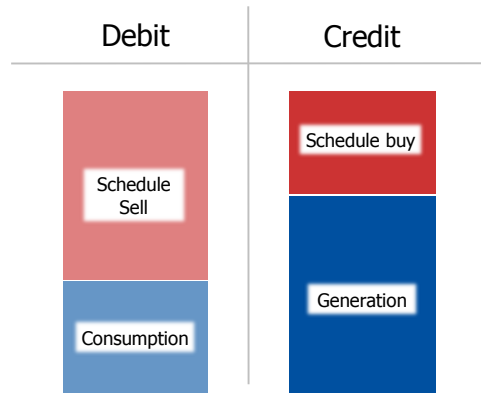
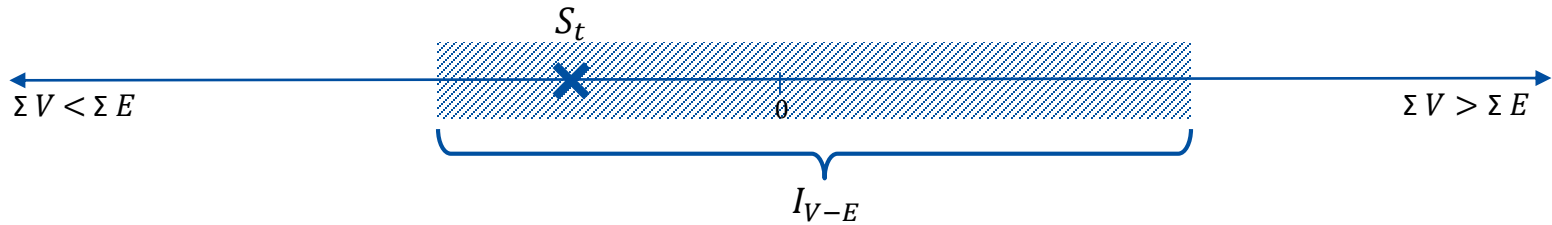**Type:** Mixed balance group → Type $\Sigma V > \Sigma E$

Considered period:
2 weeks

– Scheduled balance of a balance group two weeks in January 2015

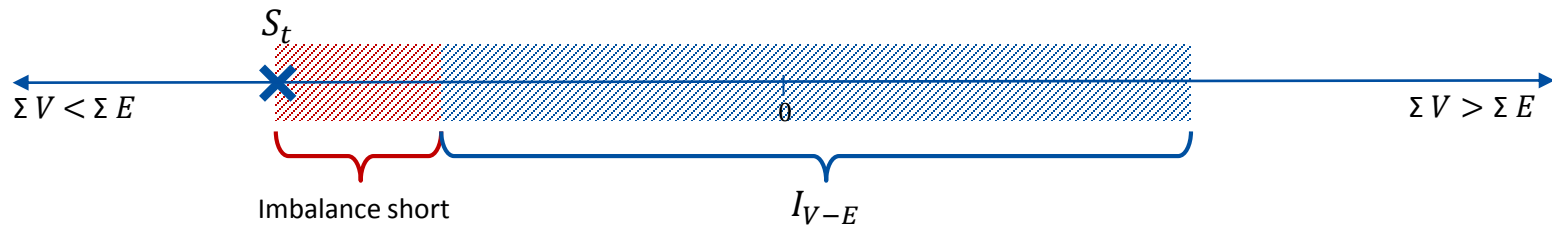– Data for quantile calculation → Measurement balance within 01.12.2013 – 01.12.2014
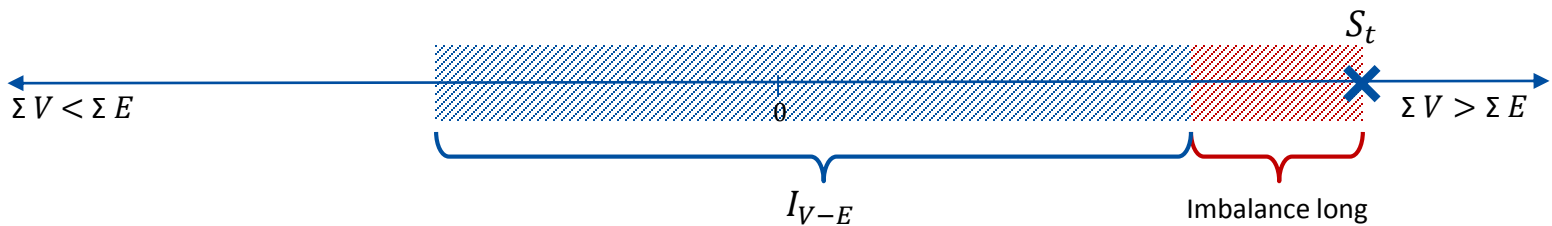
Type: Mixed balance group

- $S_t = \text{sched. balance at } \frac{1}{4} \text{hour } t = \text{sched. cons.}_t - \text{sched. supply}_t$

- No open position:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

I_{V-E}

- Imbalance short:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

Imbalance short I_{V-E}

- Imbalance long:

S_t

$\Sigma V < \Sigma E$ 0 $\Sigma V > \Sigma E$

I_{V-E} Imbalance long

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