



Energy systems modelling

Tutorial 7

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Implementing investments

Investment decisions in the electricity market

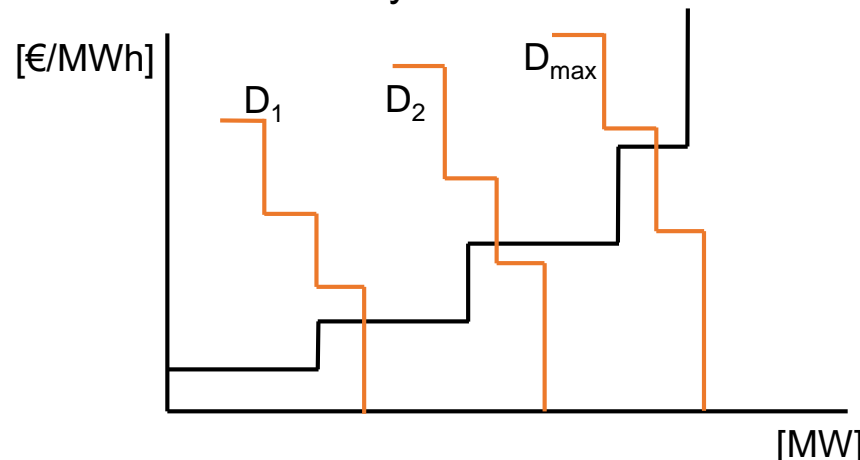
- ◆ Power generation capacities
- ◆ Energy storages
- ◆ Transmission capacity

Implementing investments

Investments in the electricity market – finding an equilibrium

1) Excess of generation capacities

- ♦ The total installed capacity is never fully used, hence, enough capacity to cover demand in each time is available → electricity prices are set by the variable costs of the most expensive unit which is “in the money”



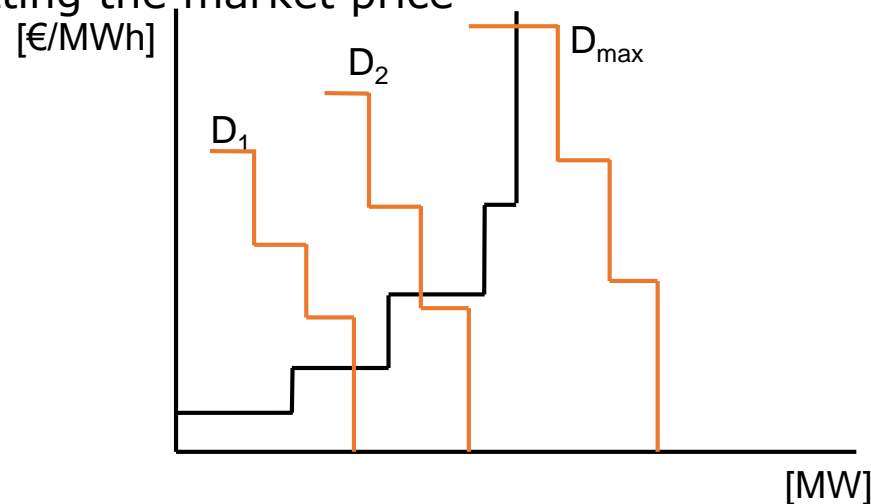
- ♦ Old capacity leaves the market but no incentives to replace it or to invest in further generation capacity (“missing money” problem?)

Implementing investments

Investments in the electricity market – finding an equilibrium

2) Lack of generation capacity

- ♦ The total installed capacity is not able to cover demand in all time periods → a scarcity situation and scarcity prices appears where the VOLL of the consumers is setting the market price



- ♦ Incentives to invest is given by the scarcity price

Implementing investments

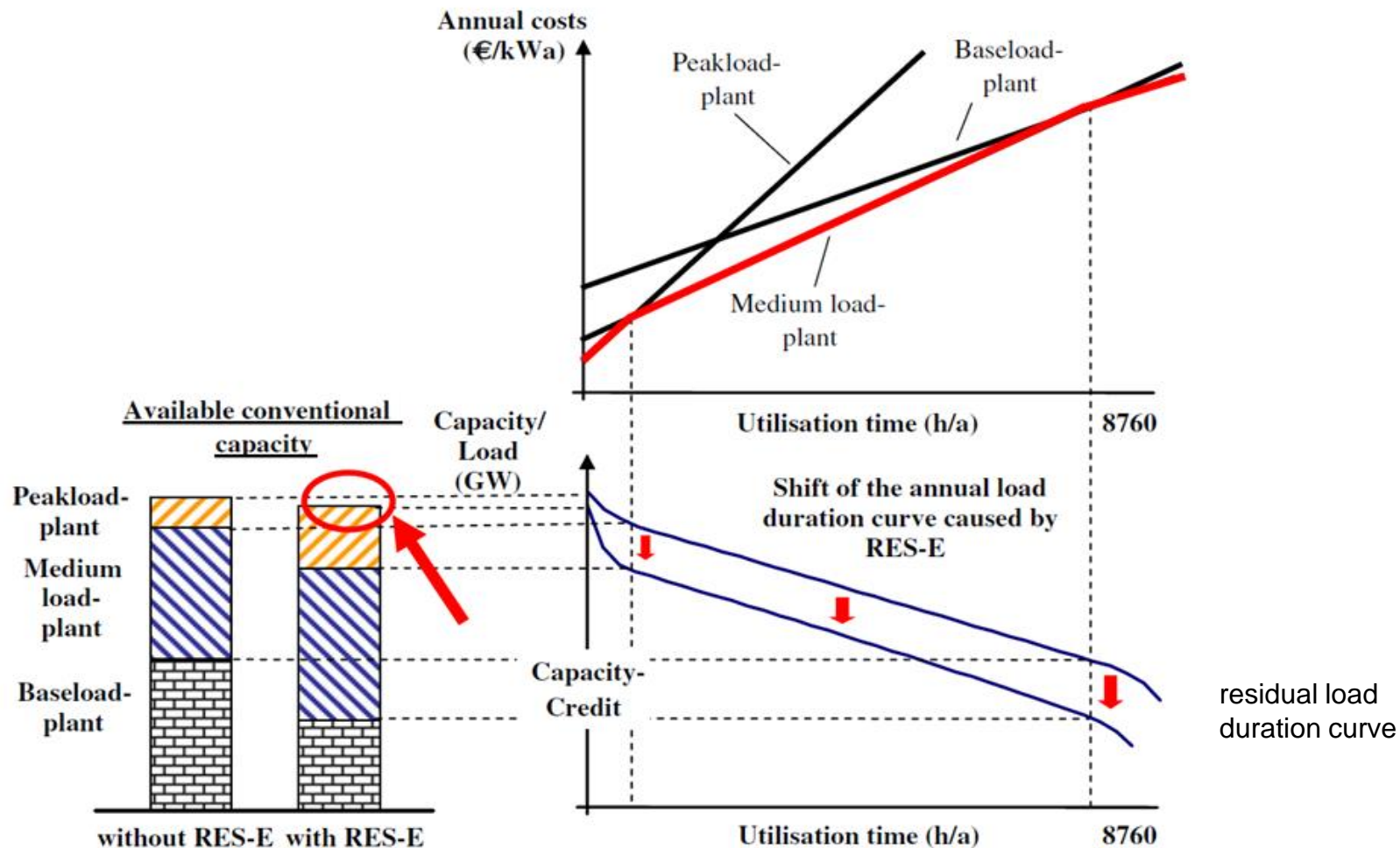
Adjustment to the objective function of the electricity market model

$$\min tc = \sum_{i,t} VC_i * g_{i,t} + \sum_i \boxed{cap_inv_i} * \boxed{INV_C_i}$$

The installed capacity of technologies (i) are now decision variables

(Annual) investment costs for technology i
 [\$/MW per year] -> [\$/MWh]

Increasing RES infeed changes the utilization of technologies



See you next class!