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# A toy case for risk-neutral and risk-averse investment planning problem

(follows Munoz et al. 2017 paper)

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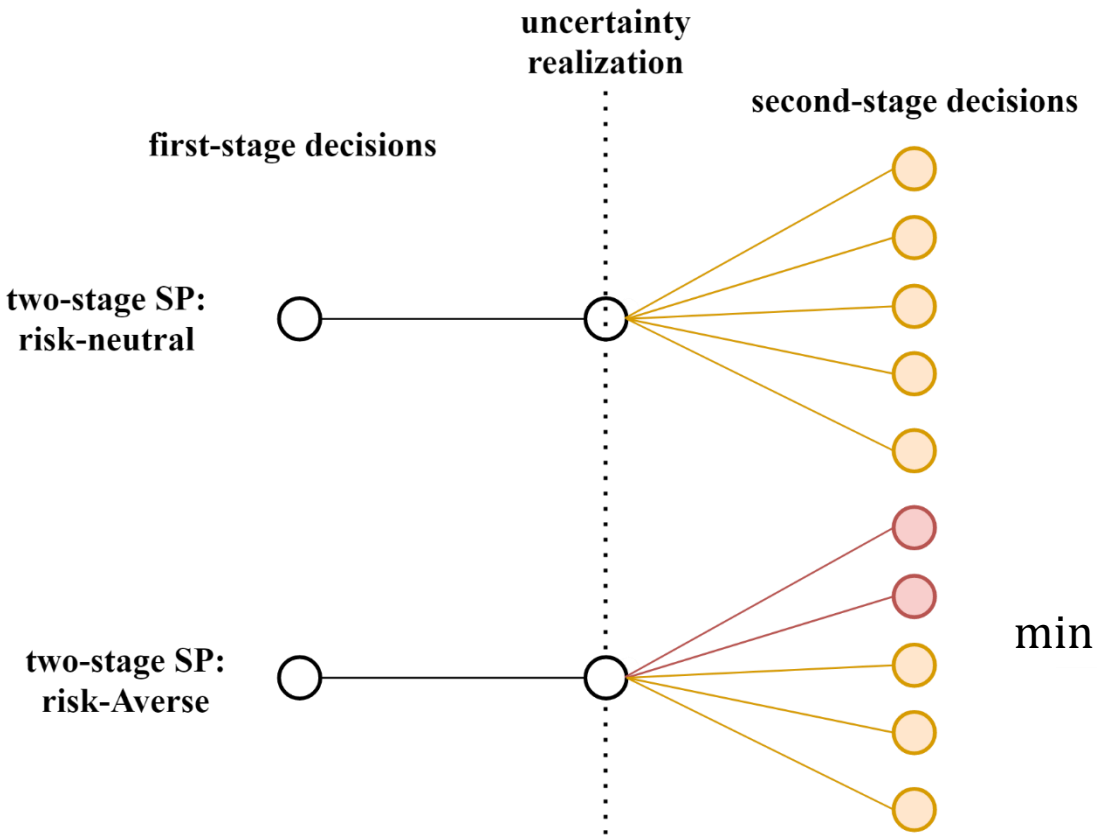
# SP risk-neutral vs risk-averse




$$\min \mathrm{IC} + \sum_{s=1}^{s} p_s \cdot \mathrm{OC}_s$$

$$\min \mathrm{IC} + (1-\omega) \sum_{s=1}^{s} p_s \cdot \mathrm{OC}_s + \omega \cdot \mathrm{cvar}$$

# Model adjustments

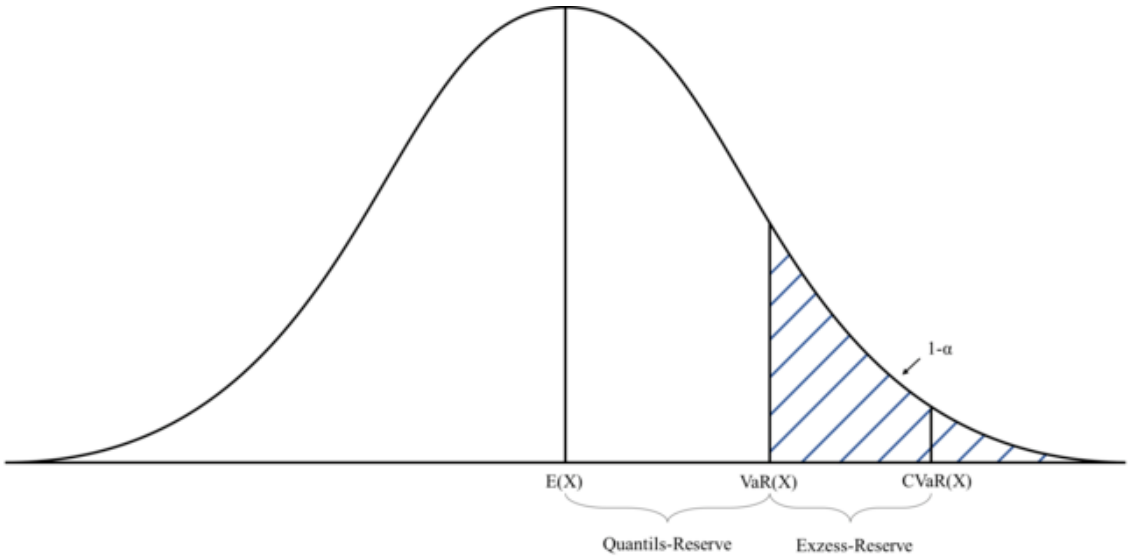
$$\min \mathrm{IC} + (1-\omega)\sum_{s=1}^{s} \mathrm{p_s} \cdot \mathrm{OC_s} + \omega \cdot \mathrm{cvar}$$

Par:
$\alpha$ − confidence level on CVaR
$\omega$ – weight on CVaR

$$\zeta + 1/(1-\alpha) \cdot \sum_{s=1}^{s} \mathrm{p_s} \cdot \mathrm{OC_s} \leq CVaR$$

$$a_s \geq \mathrm{OC_s} - \zeta$$

Var:
$\zeta$ – value at risk
$a_s$ – aux var
$CVaR$ – CVaR



# Toy model

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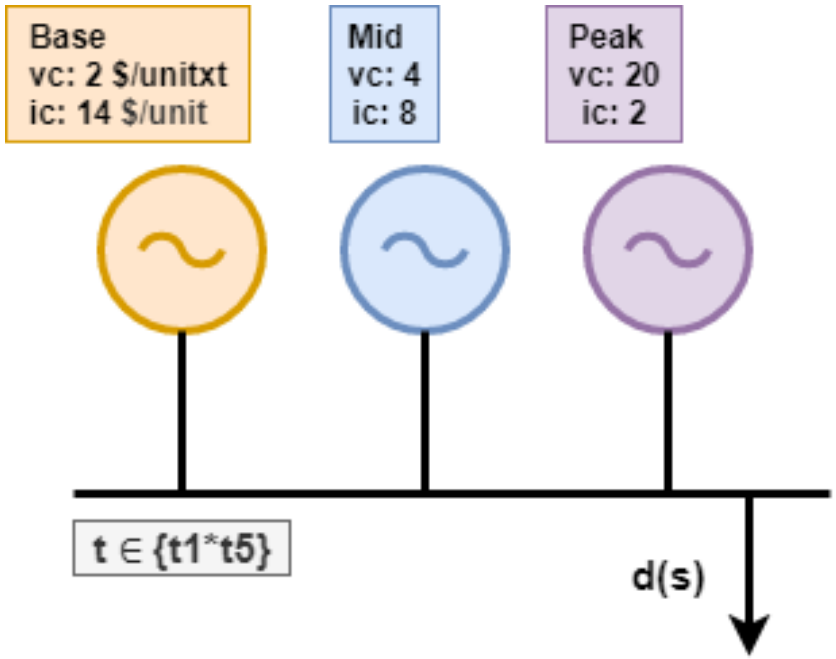


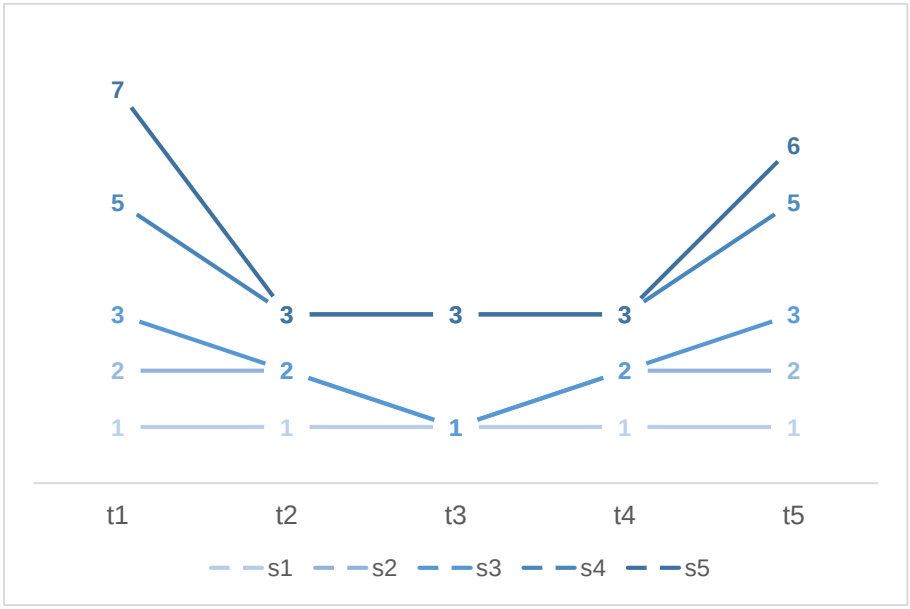


- Toy case - insular power system
- Energy demand is supplied by three potential generating units.
- Energy demand is uncertain, but it may take solely five scenarios.
- Five time periods

# 5 det scen + SP risk-neutral

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---- 121 PARAMETER report

| | s1 | s2 | s3 | s4 | s5 | SP |
|---|---|---|---|---|---|---|
| TC . | 24.0 | 46.0 | 62.0 | 104.0 | 132.0 | 100.8 |
| INV.base | 1.0 | 2.0 | 2.0 | 3.0 | 3.0 | 2.0 |
| INV.mid | EPS | EPS | 1.0 | 2.0 | 4.0 | 4.0 |
| INV.peak | EPS | EPS | EPS | EPS | EPS | 1.0 |

# SP risk-averse | alpha=0.8

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```
----    123 PARAMETER report_RA

                i1          i2          i3          i4          i5

TC   .      100.8       109.8       115.7       121.1       126.6
w    .                    0.2         0.4         0.6         0.8
var  .                   56.0        46.0        46.0        46.0
cvar .                   84.0        58.0        58.0        58.0


----    124 PARAMETER report_RA2

                  i1          i2          i3          i4          i5

INV.base       2.000       2.000       3.000       3.000       3.000
INV.mid        4.000       4.000       4.000       4.000       4.000
INV.peak       1.000       1.000         EPS         EPS         EPS
OC .s1        10.000      10.000      10.000      10.000      10.000
OC .s2        18.000      18.000      18.000      18.000      18.000
OC .s3        26.000      26.000      22.000      22.000      22.000
OC .s4        56.000      56.000      46.000      46.000      46.000
OC .s5        84.000      84.000      58.000      58.000      58.000
a  .s1        10.000         EPS         EPS         EPS         EPS
a  .s2        18.000         EPS         EPS         EPS         EPS
a  .s3        26.000         EPS         EPS         EPS         EPS
a  .s4        56.000         EPS         EPS         EPS         EPS
a  .s5        84.000      28.000      12.000      12.000      12.000
ic .base      28.000      28.000      42.000      42.000      42.000
ic .mid       32.000      32.000      32.000      32.000      32.000
ic .peak       2.000       2.000         EPS         EPS         EPS
```