# Ancillary services of the future

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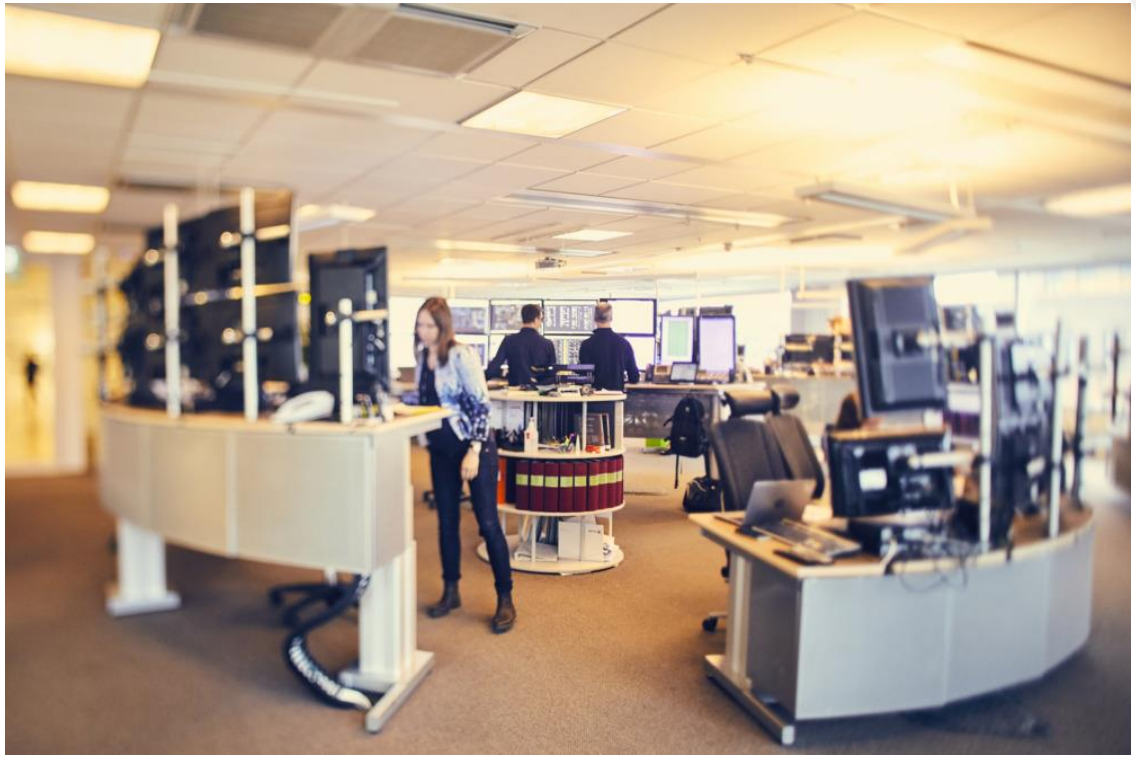
# Introduction

- Power system operation = Keep
  - voltage
  - frequency
  - power flows

within acceptable limits



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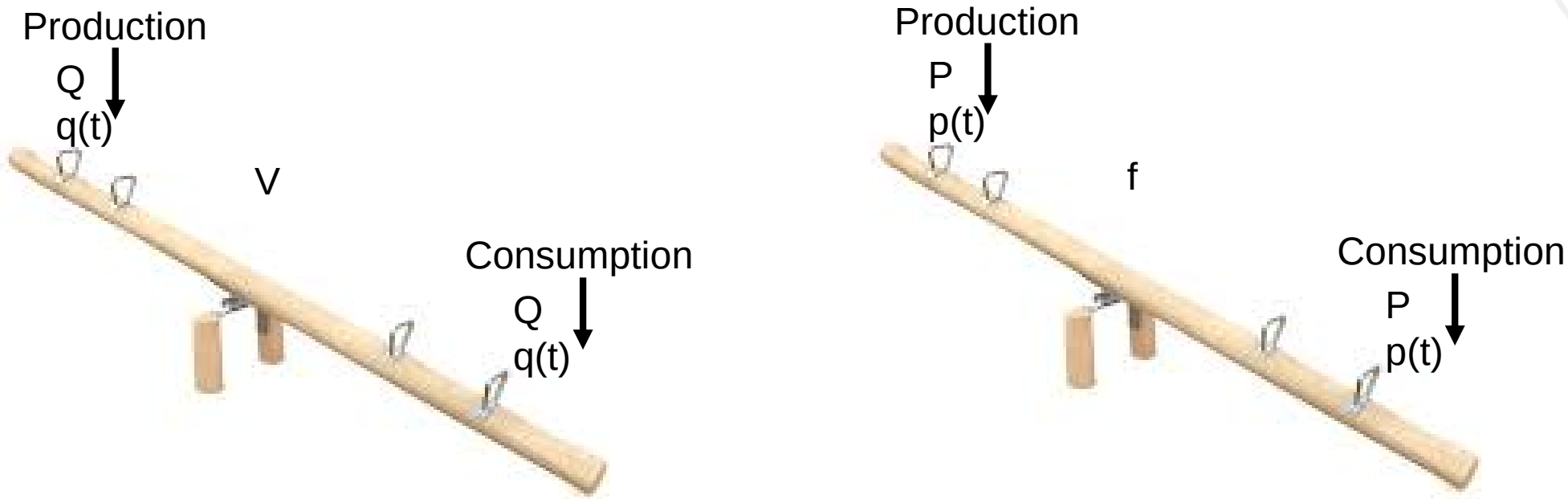
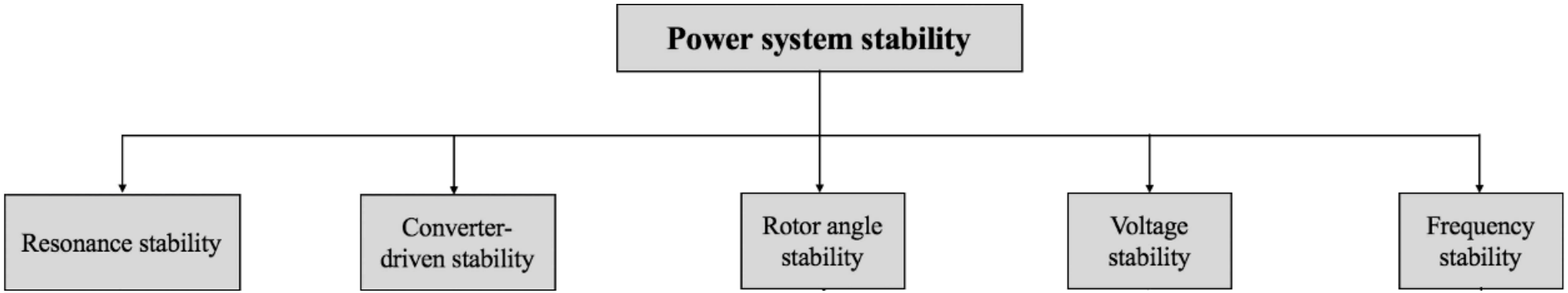
# Automatic control actions

- Keep balance

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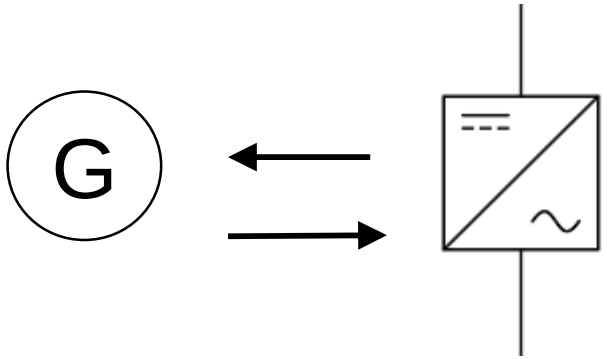
# Ancillary services

- ”Ancillary services refer to a range of support functions necessary for the reliable operation of electric power systems. These services help maintain the balance between electricity supply and demand, stabilize grid frequency and voltage, and ensure the overall reliability and security of the power grid.”

- Inherent
  - Eg.inertia, electromagnetic responses
- Controlled
  - Products on markets
  - Network codes

  - Eg. k-faktor for fast fault current injection
  - Eg. Reactive power for voltage control

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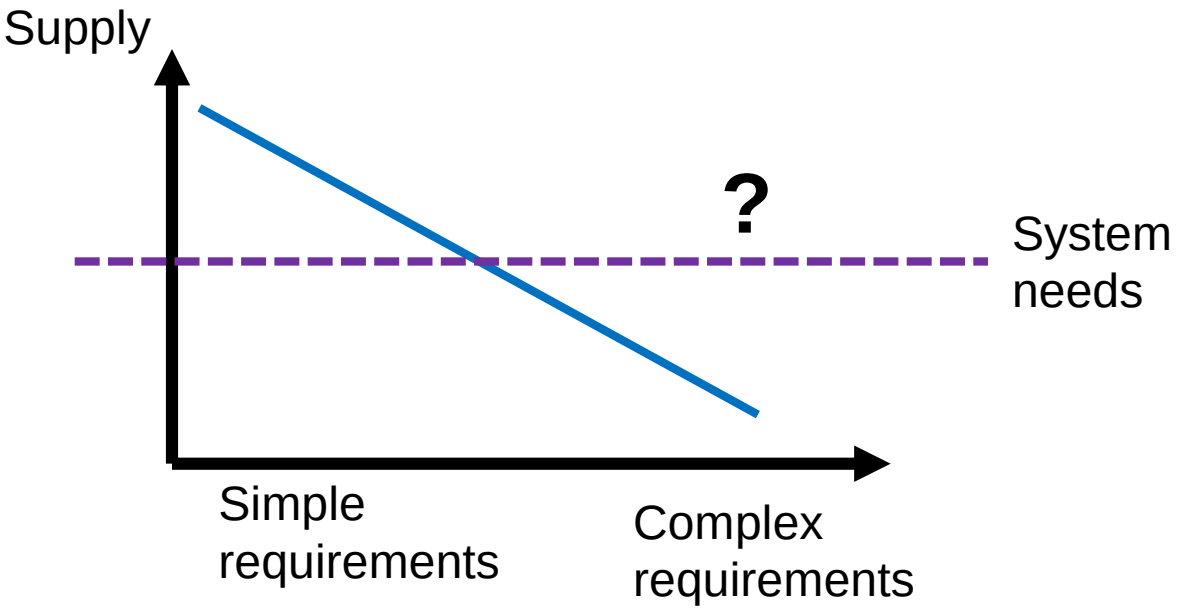
# Technical requirements

- Well-defined products
- Requirements in grid codes
- Drawback – does not utilise the full capability of units
- Requirements vary with operating conditions

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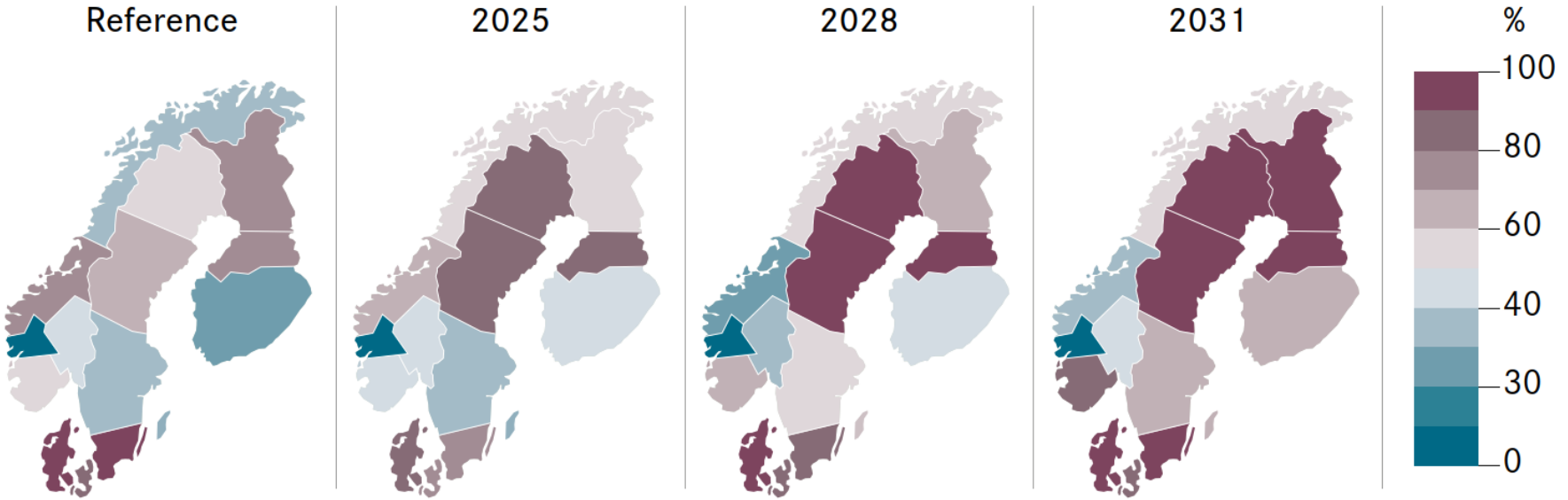
# System needs

- Defining technical requirements – operating conditions
  - Inertia
  - System strength
  - Share of IBRs
  - …
- Level of robustness




Source: Nordic grid development perspective 2023

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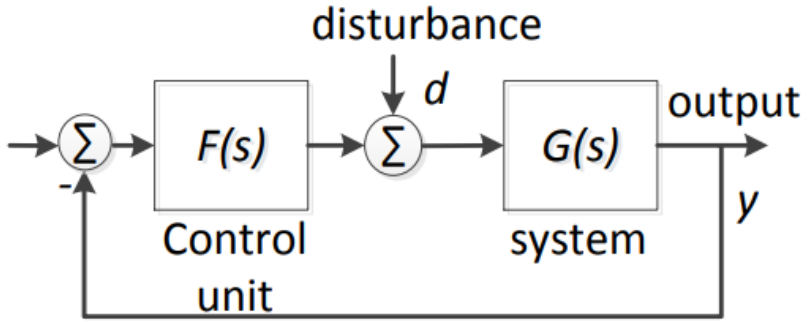
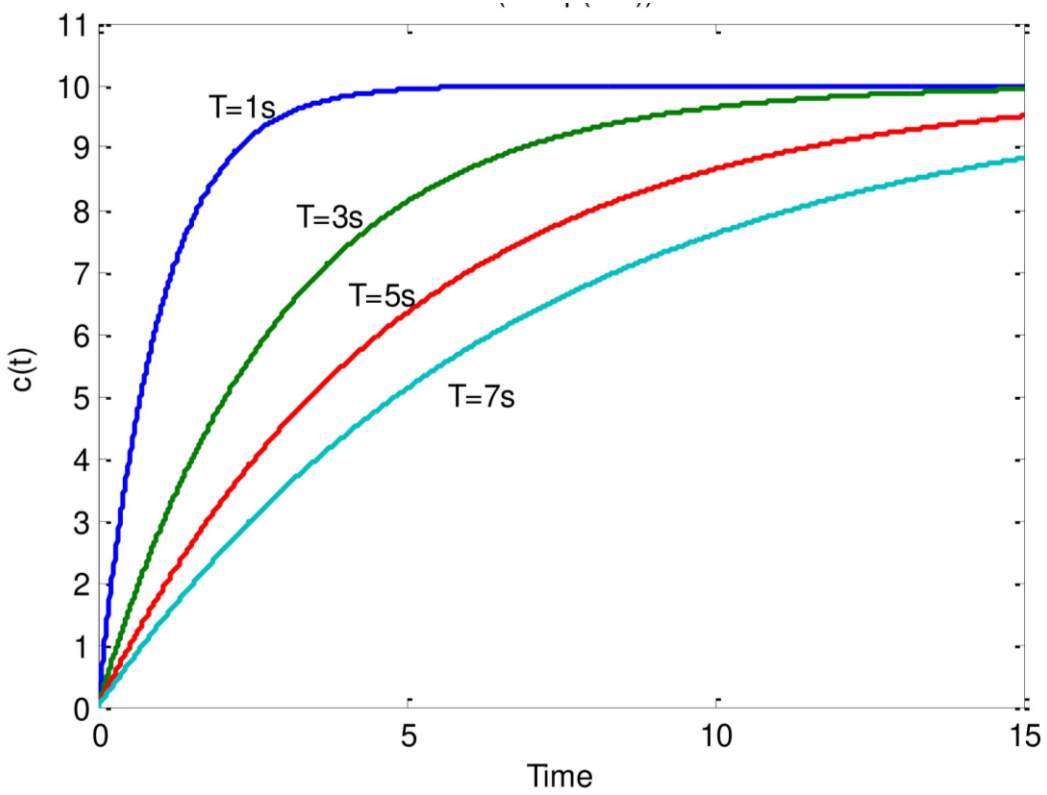
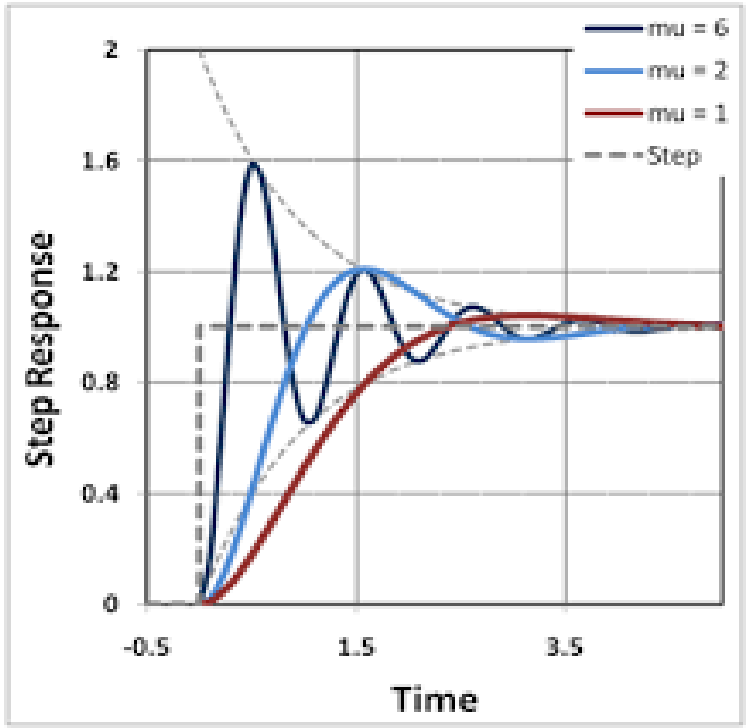
# Quality metrics

- Pay per performance
- Develop assessment criteria
- Optimisation to ensure the right amount

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# Thank you for listening!

# Questions?

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