



University of  
**Strathclyde**  
Engineering

# Grid Security

**Keith Bell**

*Department of Electronic and Electrical Engineering*

University of Strathclyde

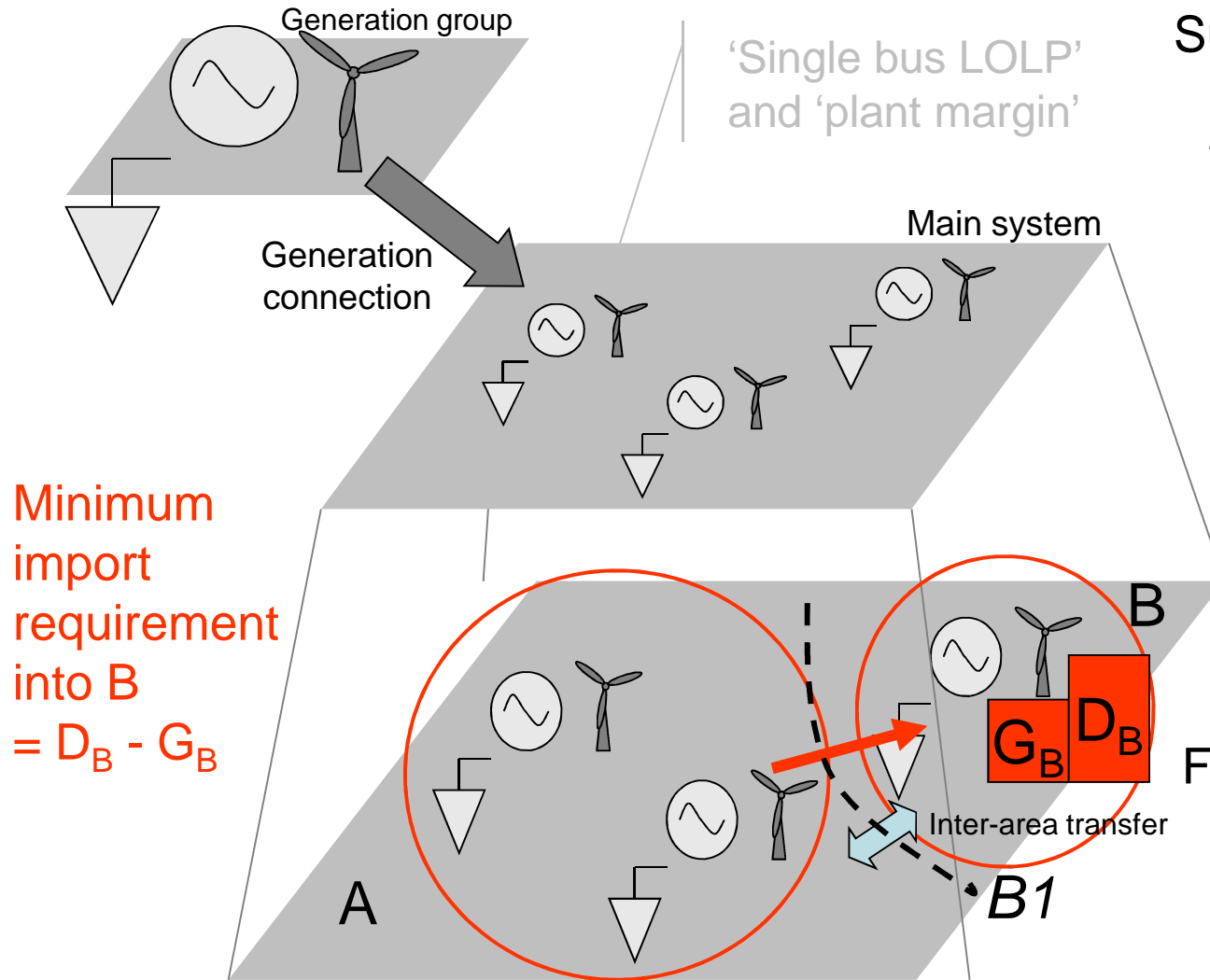


# The need for the grid

- What are the drivers?
  - To enable demand for electricity to be met reliably
  - To facilitate connection of generation and competition in provision of electrical energy



# Need for the grid: meeting of demand

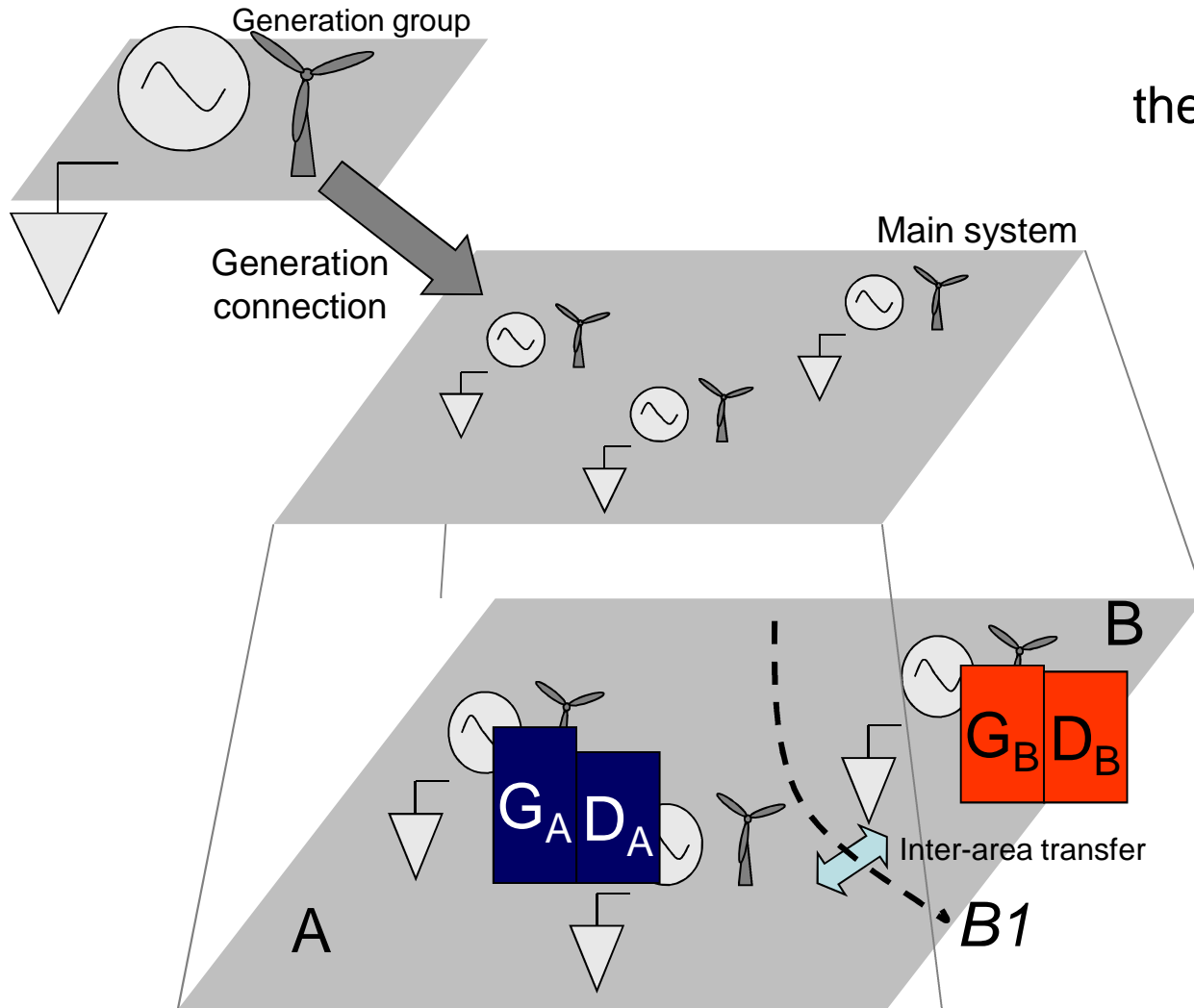


Suppose there is sufficient generation available on the system as a whole to meet demand

At a particular time, demand in area B is  $D_B$  and the total available generation in the area is  $G_B$

For demand  $D_B$  to be met, boundary B1 must be capable of transferring at least  $D_B - G_B$

# Need for the grid: facilitation of competition



Which generation will the market 'prefer' to use?

Depends on which generation is most 'competitive'

Transmission licensee's role in GB is to facilitate competition

- Give equal opportunity to the available generation
- Don't restrict any available generation more than any other



# The need for the grid

- What are the drivers?
  - To enable demand for electricity to be met reliably
  - To facilitate connection of generation and competition in provision of electrical energy
- How much is needed?
  - Determined by security standards
    - These are licence conditions for the grid companies
    - Background against which to apply them is uncertain...
  - Determined by degree of 'smartness' in operation
- What are the constraints on grid development?
  - Planning consents
  - Regulation
    - Grid ownership and operation are generally monopoly activities



# What is the value of grid security?

- Avoid the inconvenience of loss of supply
  - Avoid it happening too often and for too long
- Avoid lost economic output from loss of supply
- Avoid social problems from loss of supply
- How much is it worth?

£3/kWh?

£40/kWh?

Annual GDP  
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annual electrical energy consumption?

Are system blackouts more 'costly' than  
 $50\text{GW} \times 24 \text{ hours} \times \text{£}3/\text{kWh}$ ?

How smart is  
smart operation?



# System Security

What the GB transmission system may experience each year

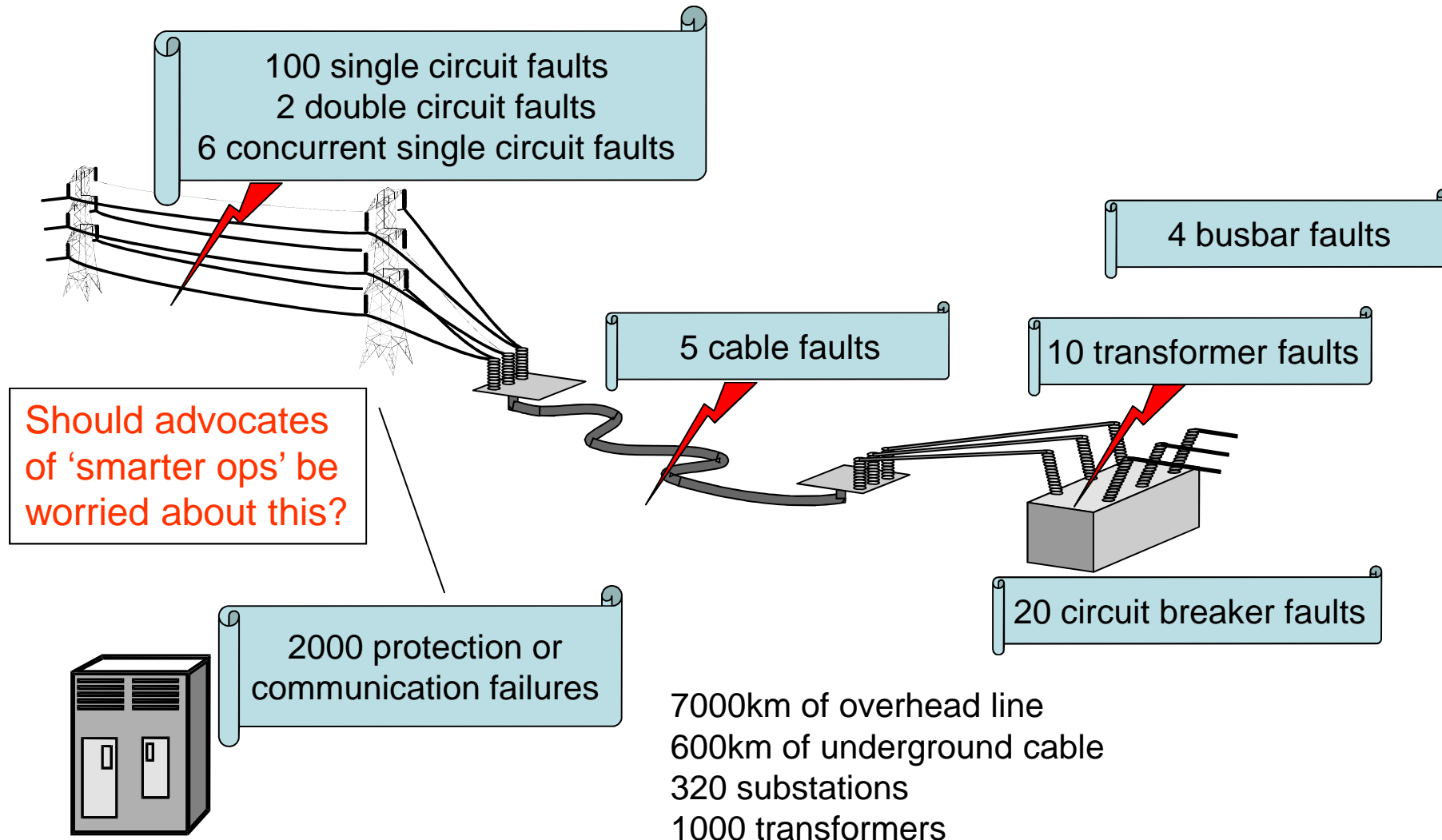


Figure: National Grid



# The future electric power system

