Conceptualising Energy Security

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Introduction

This presentation will: provide a menu of different options

The presentation can not: make a choice on behalf of policy makers

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Commonalities and Differences between typical definitions

Energy Security Definitions:

"…continuous availability of energy in varied forms, in sufficient quantities, and at reasonable prices"
United Nations DevelopmentProgram (UNDP), 2000.
World Energy Assessment - Energy and theChallenge of Sustainability

"Energy insecurity can be defined as the loss of welfare that may occur as a result of a change in the price or availability of energy"
Bohi and Toman (1996)

"…energy supply security must be geared to ensuring… the uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers (private and industrial), while respecting environmental concerns and looking towards sustainable development"
European Commission, 2000.

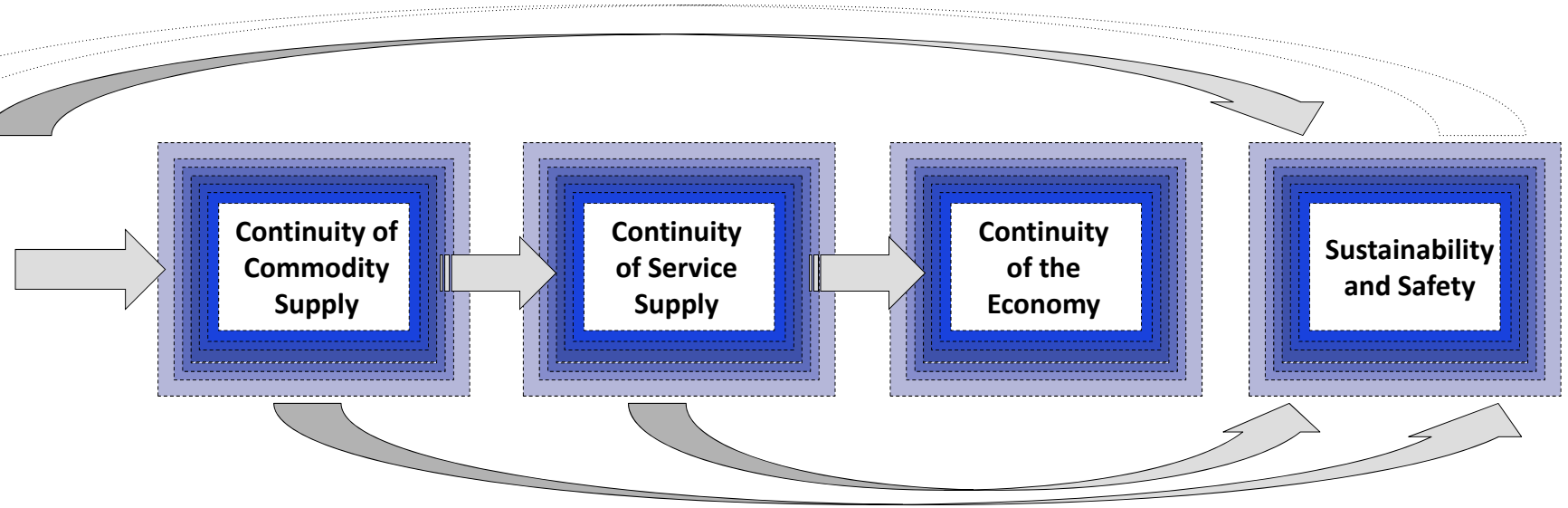
Difference between Concepts

Dimensions of Energy Security: Broad Concept

I) Sources of Risk:

* Natural Risk
* Technical Risk
* Human Risk

II) Scope of the Impact Measure:



Severity Filter:

- **III) Speed of Impacts:** Constant – Slow Changes – Fast Changes
- **IV) Size of Impacts:** Impending Change - Small Change - Phase Change
- **V) Sustention of Impacts:** Transitory – Sustained – Permanent
- **VI) Spread of Impacts:** Local – National – Global
- **VII) Singularity of Impacts:** Unique - Seldom – Frequent
- **VIII) Sureness of Impacts:** Deterministic – Stochastic –Heuristic - Unknown

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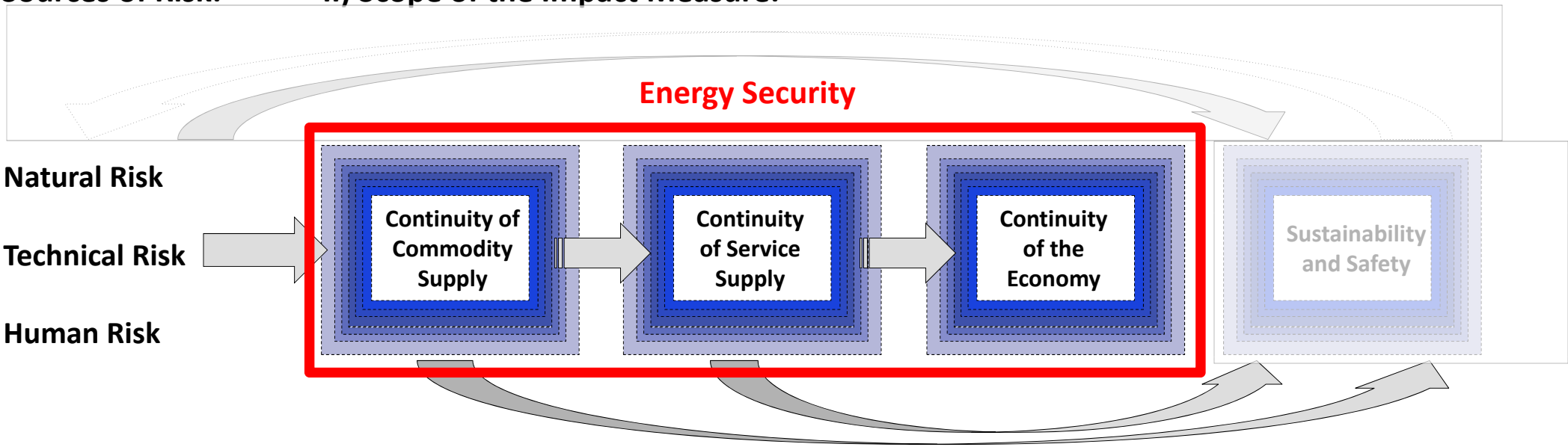

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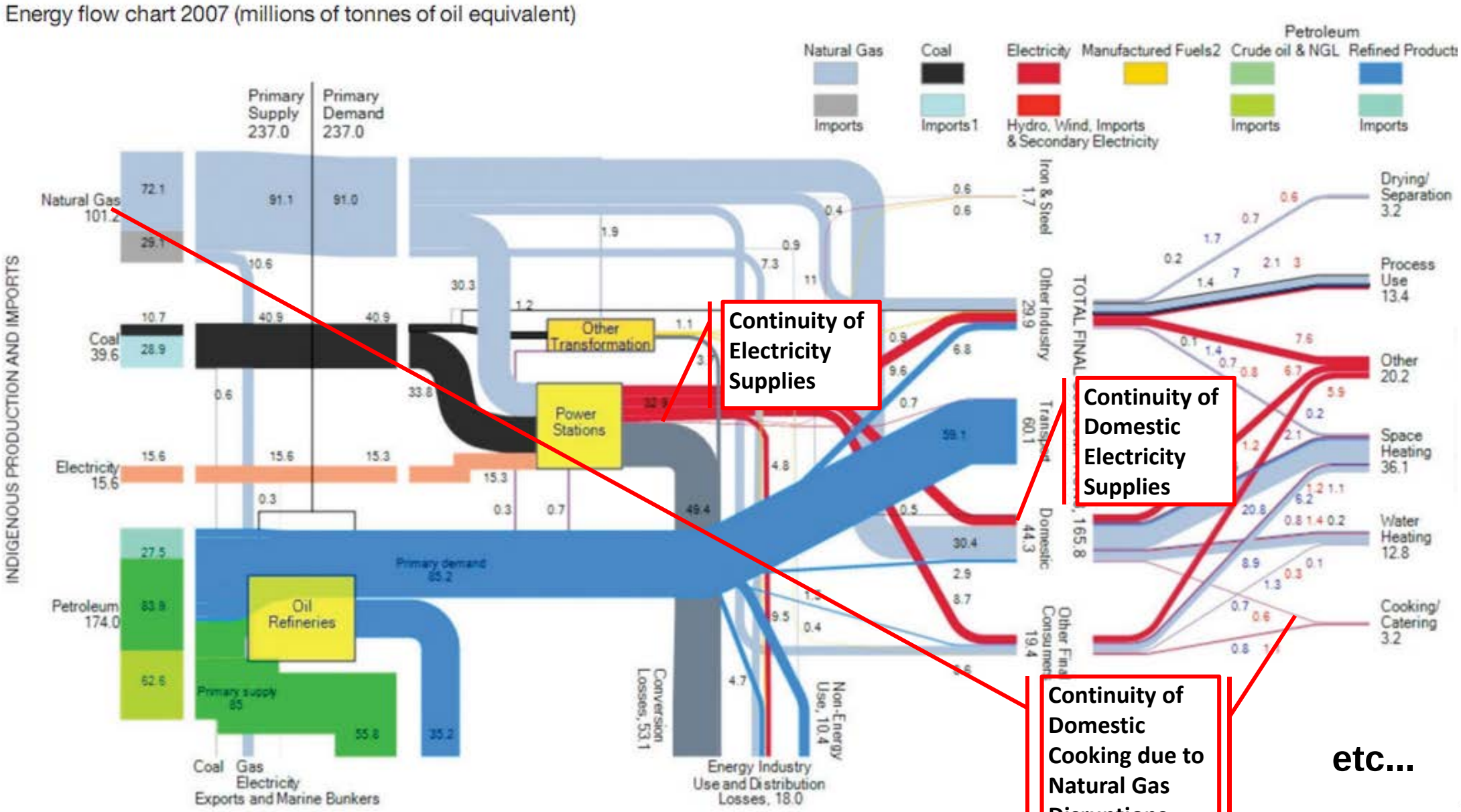
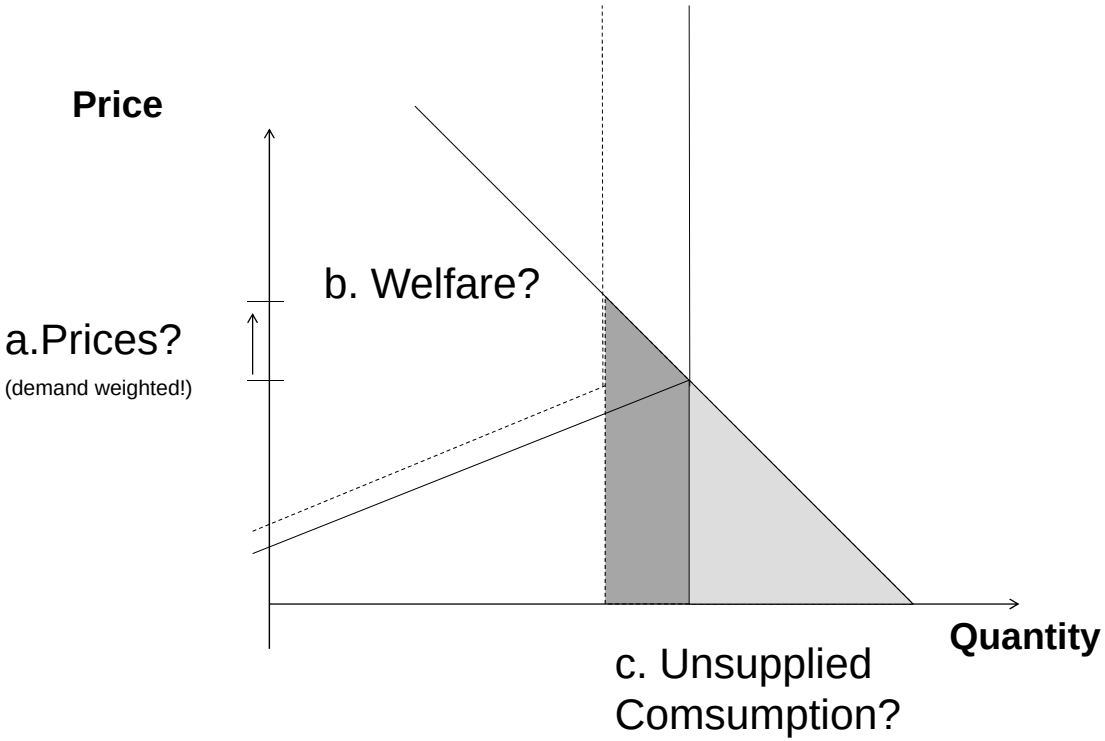
Potential Continuity Metrics 1: Sinks and Sources



Sankey diagram of UK energy flows. From: Building a roadmap for heat. 2050 scenarios and heat delivery in the UK. Report prepared by the University of Surrey for the Combined Heat and Power Association (CHPA). February 2010

Potential Continuity Metrics 2: Integrals or Intersects

Continuity of What?



So we are trying to protect against..

	Price	Welfare	Unsupplied Consumption
a.	Increasing	Constant or Increasing	Constant or Decreasing
b.	Constant or Decreasing	Decreasing	Constant or Decreasing
c.	Constant or Decreasing	Constant or Increasing	Increasing

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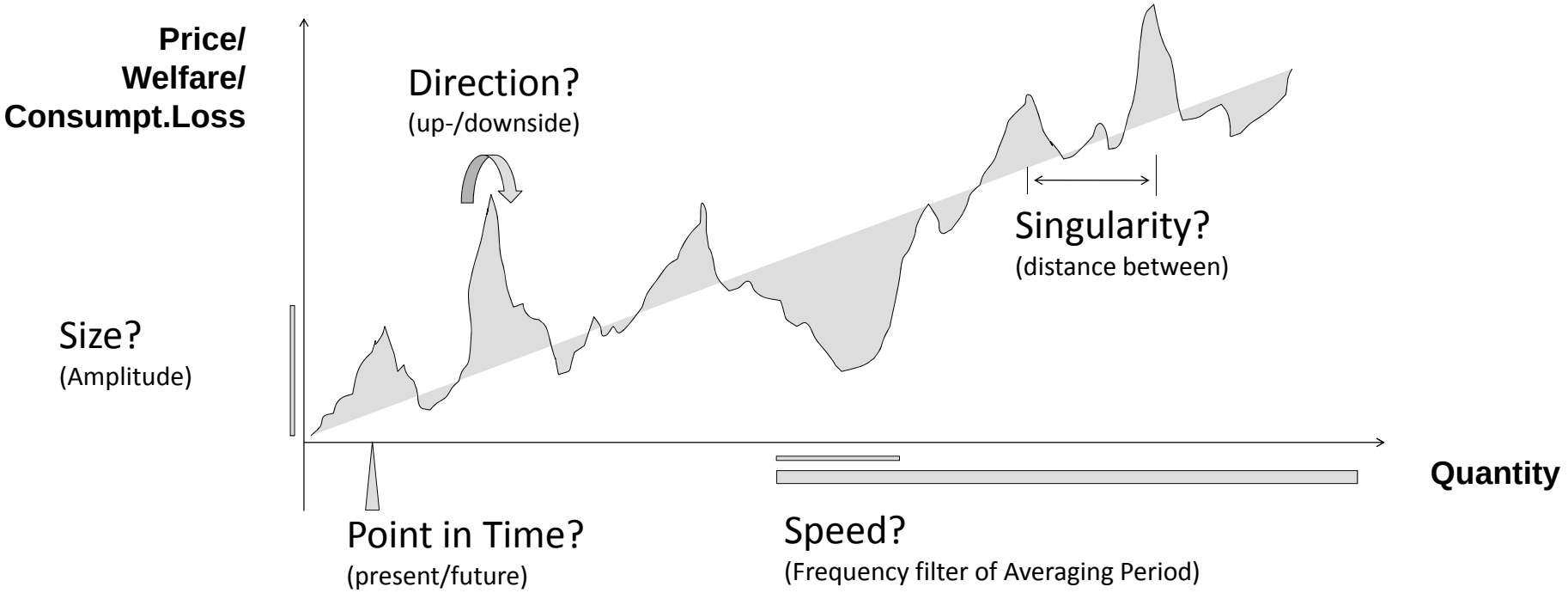
Potential Continuity Metrics 3: Shocks, Stresses and other Severity Filters

Which signal filters?



- Sustention
- Spread
- Sureness
- Etc…

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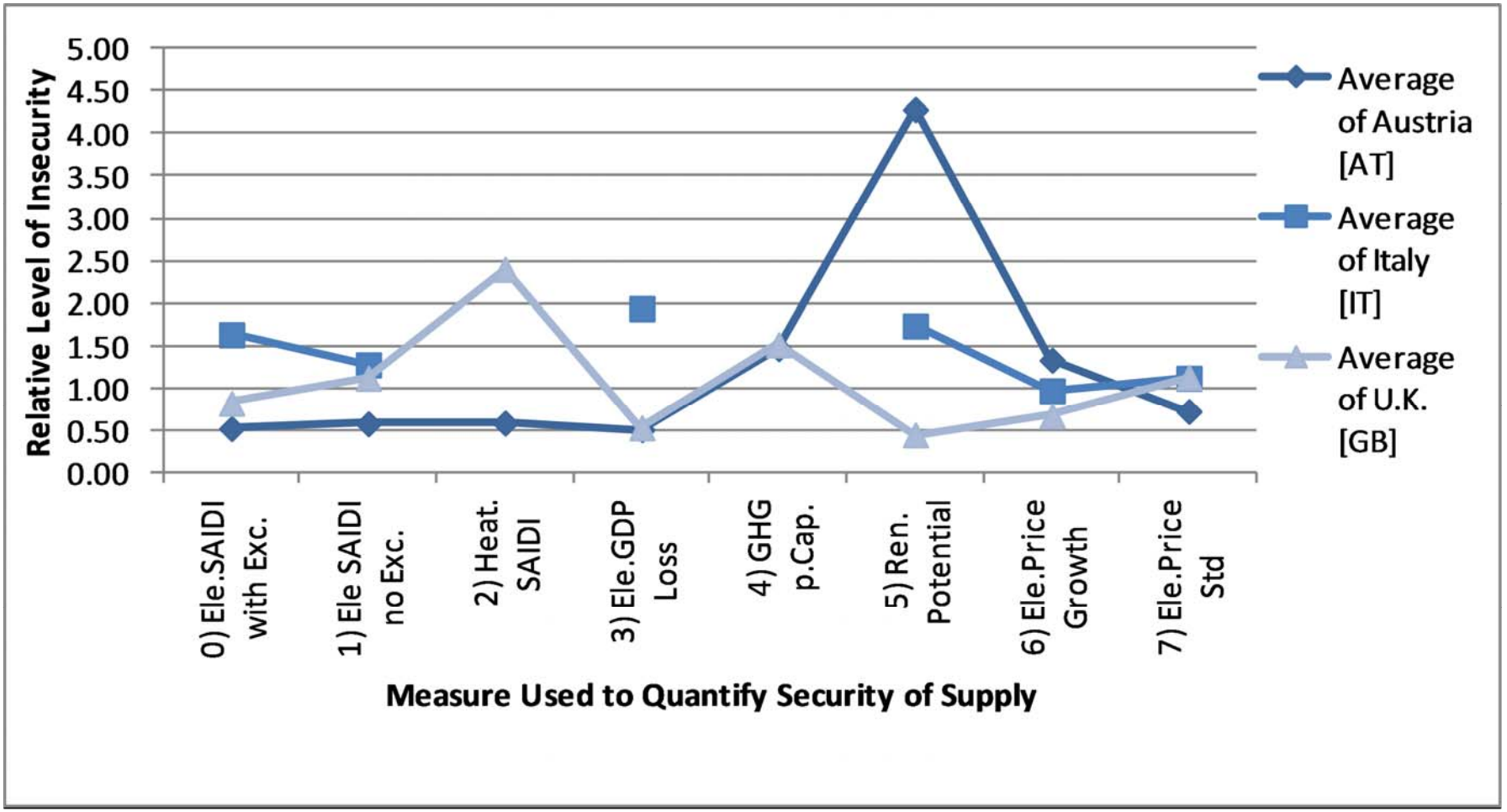

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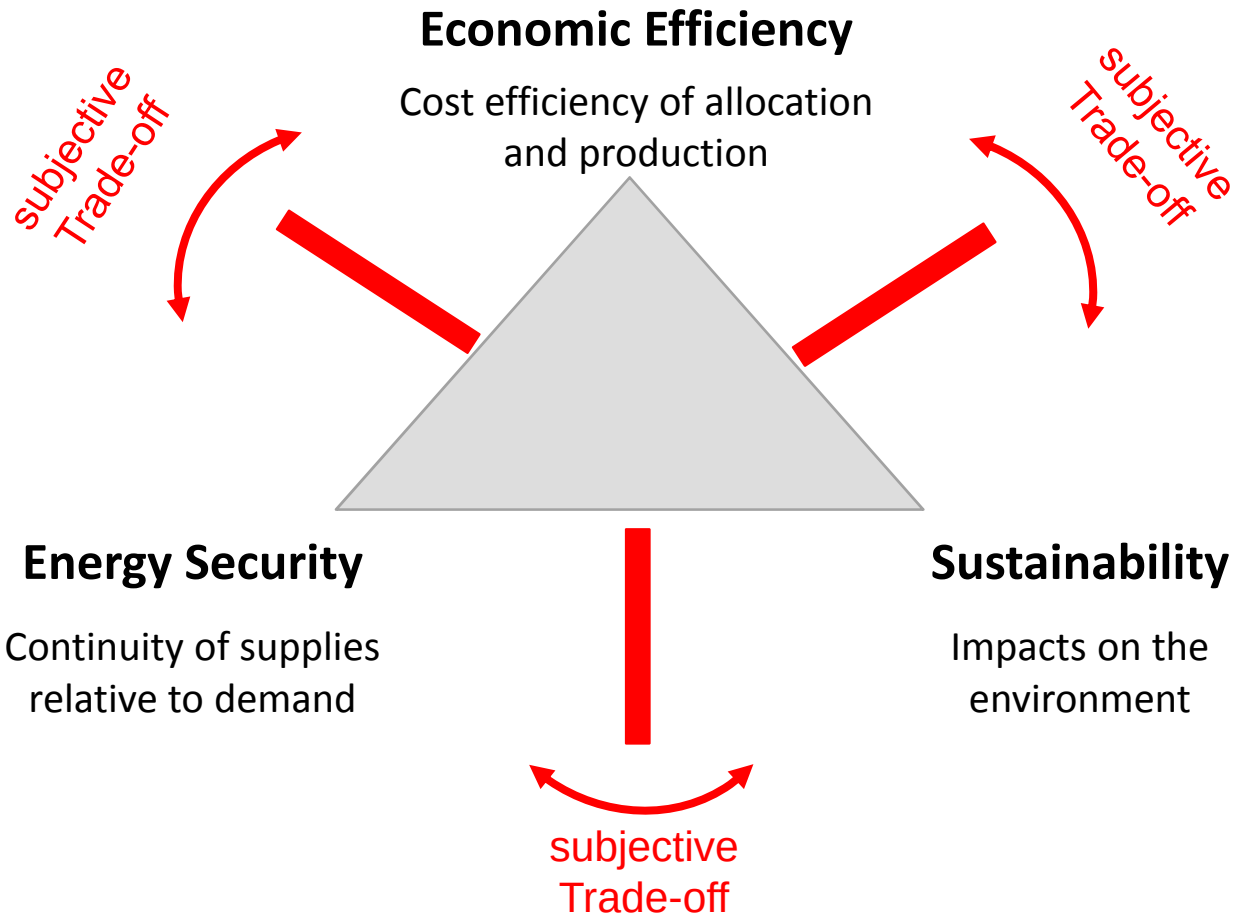
Advantages of Separating Concepts



The golden Rule

Individual indicators allow individual trade-off in case of diverging preferences but lead to unnecessary complexity in case of homogenous preferences

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Backup slides

ID	Measure for Energy Security	Sources of Risk	Scope of Impacts	Speed of Impacts	Size of Impacts	Sustention of Impacts	Spread of Impacts	Singularity of Impacts	Sureness of Impacts
0)	**Electricity SAIDI Including All Events**	-Natural -Technical -Human	-Electricity Commodity Continuity	-Fast	-Phase Changes	-Transient -Sustained	-Local -National -Global	-Unique -Infrequent -Frequent	-Deterministic -Stochastic -Heuristic -Unknown
1)	**Electricity SAIDI Excl. Except. Events**	-Technical -Unexcept. Natural	'-Electricity Commodity Continuity	-Fast	-Phase Changes	-Transient -Sustained	-Local -National -Global	-Frequent	-Deterministic -Stochastic
2)	**Heat SAIDI**	-Natural -Technical -Human	-Heating Service Continuity	-Fast	-Phase Changes	-Transient -Sustained	-Local -National -Global	-Unique -Infrequent -Frequent	-Deterministic -Stochastic -Heuristic -Unknown
3)	**GDP Loss Caused by Ele.SAIDI**	-Natural -Technical -Human	-Electricity Economic Continuity	-Fast	-Phase Changes	-Transient -Sustained	-Local -National -Global	-Unique -Infrequent -Frequent	-Deterministic -Stochastic -Heuristic -Unknown
4)	**CO2 per Capita**	-Natural -Technical -Human	-Electricity Environmental Sustainability	-Fast	-Gradual Change -Phase Change	-Sustained -Permanent	-Global	-Unique	-Deterministic -Stochastic -Heuristic -Unknown
5)	**Renewable Energy Potential**	-Natural -Technical -Human	'-Electricity Commodity Continuity	-Constant	-Phase Changes	-Permanent	-Local -National -Global	-Unique	-Deterministic -Stochastic -Heuristic -Unknown
6)	**Electricity SAIFI Trend**	-Natural -Technical -Human	'-Electricity Commodity Continuity	-Slow	-Phase Changes	-Sustained -Permanent	-Local -National -Global	-Unique -Infrequent	-Deterministic -Stochastic -Heuristic -Unknown
7)	**Electricity Price Trend**	-Natural -Technical -Human	'-Electricity Commodity Continuity	-Slow	-Gradual Change	-Sustained -Permanent	-Local -National -Global	-Unique -Infrequent	-Deterministic -Stochastic -Heuristic -Unknown
8)	**Electricity Price Volatility**	-Natural -Technical -Human	'-Electricity Commodity Continuity	-Fast	-Gradual Change	-transient -Sustained	-Local -National -Global	-Unique -Infrequent -Frequent	-Deterministic -Stochastic -Heuristic -Unknown

Example 2: Non-economic Feedbacks from Sustainability

Closure of Nuclear Plants in Germany

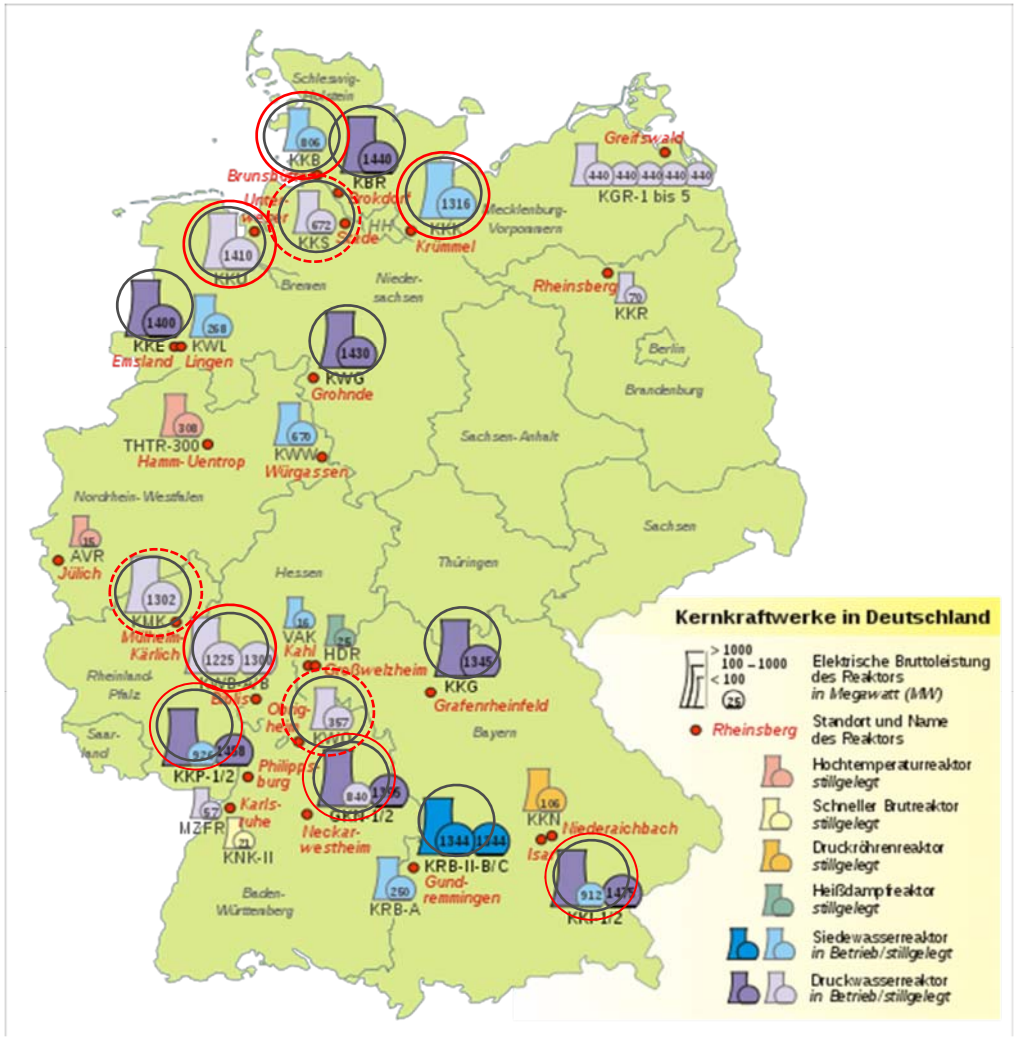

Image Source: Wikipedia

2000. Decision to exit nuclear energy

2002. Reformed nuclear laws

-No new plants

-Maximum lifetime 32 years

-Remaining energy 2.62 Mio GWh

-Last closure expected 2022

2010. Reformed nuclear laws

-Lifetime extension between 8 and 14 years

-Additional energy 1.8 Mio GWh for 17 plants

-Last closure expected 2036

2011. 13th Reformed nuclear laws

-closure of first **8.5GW (~10.5%peak) within 1 month**

-closure of all remaining plants by 2022

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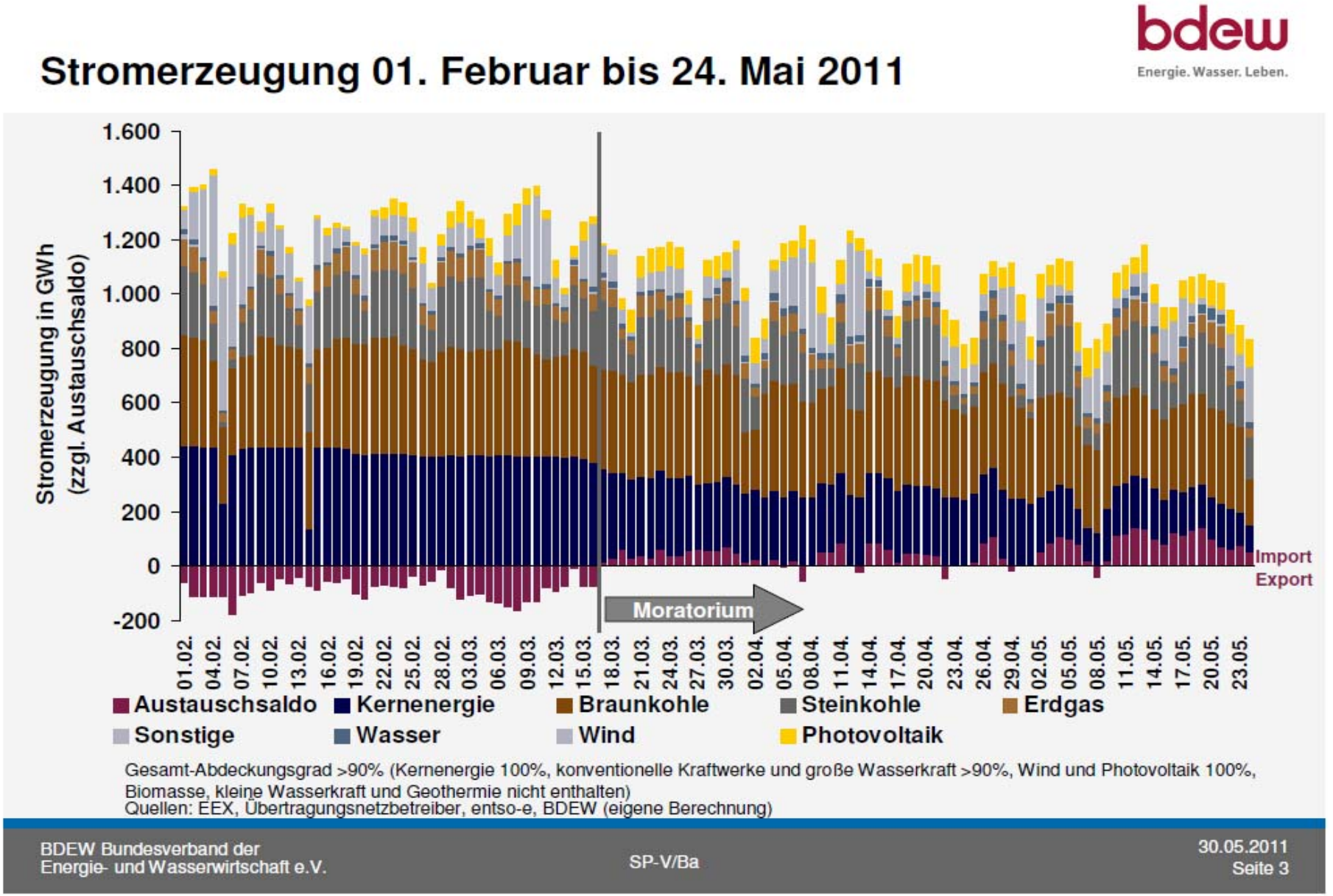

Source: BDEW