

# The long-term benefits of the energy transition/transformation

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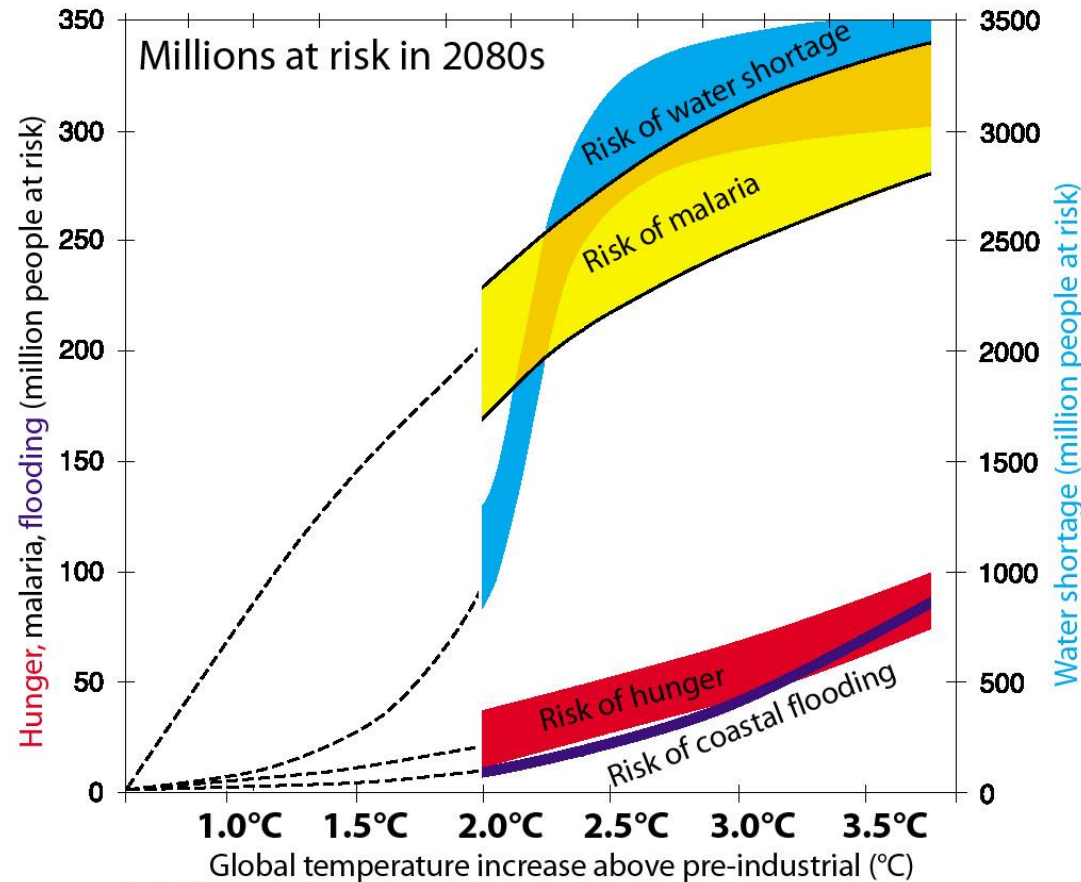
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# Benefits and costs – what is relevant for whom

- The energy transition/transformation will lead to benefits and costs
- The distribution of benefits and costs could differ
  - with a view to the macroeconomic perspective
  - with a view to the industry and businesses (markets, competitiveness, carbon leakage ...)
  - with a view to private households
- The real challenge: the distribution of benefits and costs will also differ significantly for the transformation phase
  - between those who have the ability to adjust relatively quickly and those who don't have the ability or only have it on the longer term

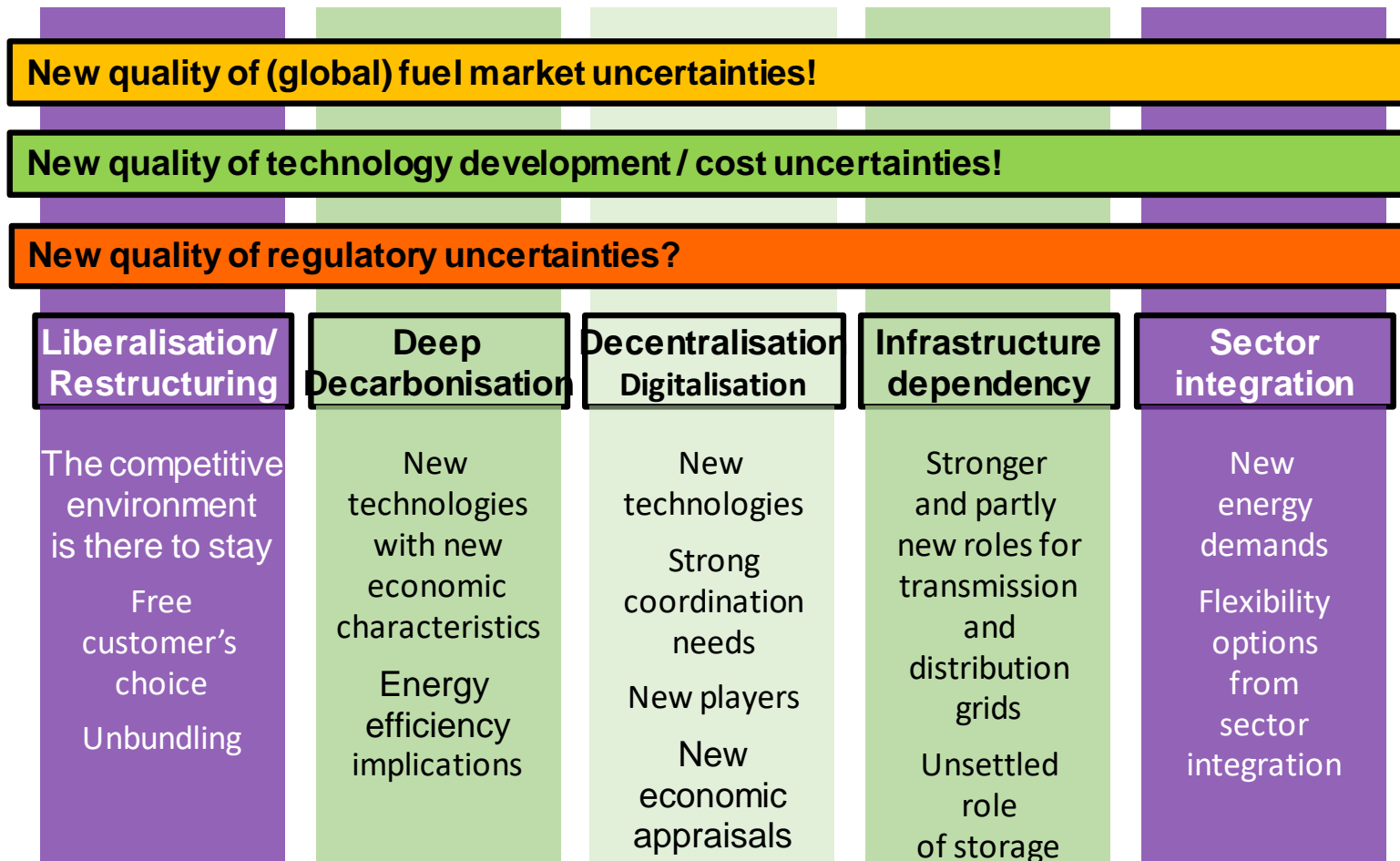
# Reminder: It's about avoiding major risks/costs



Source: Parry et al. (2011) "Millions at Risk" Glob. Env. Change. Graph adapted by M. Meinshausen.  
Note: The original graph presented temperature levels above 1990, not above pre-industrial. Thus, a 0.6°C temperature difference has been added.  
Furthermore, the original graph presented temperature levels in 2080 for different CO2 equivalence (E) stabilization scenarios.  
For a climate sensitivity of 2.5°C (as underlying the work of Parry et al.), the 2080 temperature level for the S550 CO2eq emission path has been about 1.4°C above 1990 (2°C above pre-industrial).

- dangerous climate change will cause huge risks and major economic (and other ...) costs
- latest research (Kikstra et al 2021) estimates damage costs at levels of ~3,000 USD/t CO2
- there are also other risks/costs of non-sustainable energies ...
- avoiding these costs is the major benefit of energy transition

# Transformation in a multi-dimensional environment



- There are more megatrends underway beyond deep decarbonisation
- Different benefits (and costs) but also significant uncertainties will arise from these different megatrends

# Benefits and costs – structural back-casting

- We don't know how the future energy system will look like exactly but we can structurally describe in a relative robust way
  - zero-carbon, low polluting, low risk
  - much more distributed and coordination-intensive
  - much more capital-intensive (with much lower operation costs)
  - much more infrastructure-intensive
  - much more consumer-driven
  - much more sensitive to public acceptance
- Benefits and costs and their distribution will differ for the different dimensions – and over time

# Benefits and costs – the macro-perspective

- Lessons from manifold modelling exercises for Europe and Germany
  - total system costs between business-as-usual and a climate neutral energy system will differ by relatively small margins only (long-term  $\pm 10\%$ , medium-term  $\pm 5\%$ ), essentially depending on assumptions on fossil fuel prices, technology learning etc.
  - upfront costs will, however, increase significantly (due to the capital-intensive nature of the future system), major investments and financing of these investments needed
  - import dependency will decrease significantly but won't disappear (hydrogen & derivatives ...)
  - countries with significant shares of (clean solution) industries in total GDP will face more challenges during the transition phase but will also have significant opportunities for additional creation of value added

# Benefits and costs – the bottom-up perspective (1)

- Entities who can adapt relatively quickly (i.e. with a view to the modernization/investment cycles)
  - clear short-term benefit and full access to financing: sufficiently high (effective) carbon prices, sufficiently low electricity prices, highly competitive technologies available, removing non-economic barriers
  - long-term benefit and full access to financing: increasing (effective) carbon prices, decreasing electricity prices, not yet fully competitive technologies, phase-in support needed to use windows of opportunity and avoid lock-in
  - clear short-term or long-term benefits but limited access to financing: financing support needed
  - predictability of costs for providing energy services as a major benefit

# Benefits and costs – the bottom-up perspective (2)

- Entities who can't adapt relatively quickly (i.e. with a view to the modernization/investment cycles)
  - long-term benefits only
  - targeted compensation for increasing (effective) carbon prices, accelerating adaptation/investment opportunities
  - the key battleground of distributional policies



# Not to forget: ancillary benefits (and challenges)

- Many clean energy options will provide significant ancillary benefits
  - lowering or even eliminating local air pollution
  - improving health situation
  - more liveable cities
  - more competitive businesses
- Many clean energy options (i.e. in the private sector) need significant complementary action due to spill-over effects
  - with a view to the real estate sector and spatial patterns of housing
  - with a view to land use and land availability
  - with a view on mobility

# Thank you very much

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