Energy efficieny and beyond

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Highlights der Energieforschung 2015
Kann eine Effizienzrevolution gelingen?
29. April 2015

Energieeffizienz

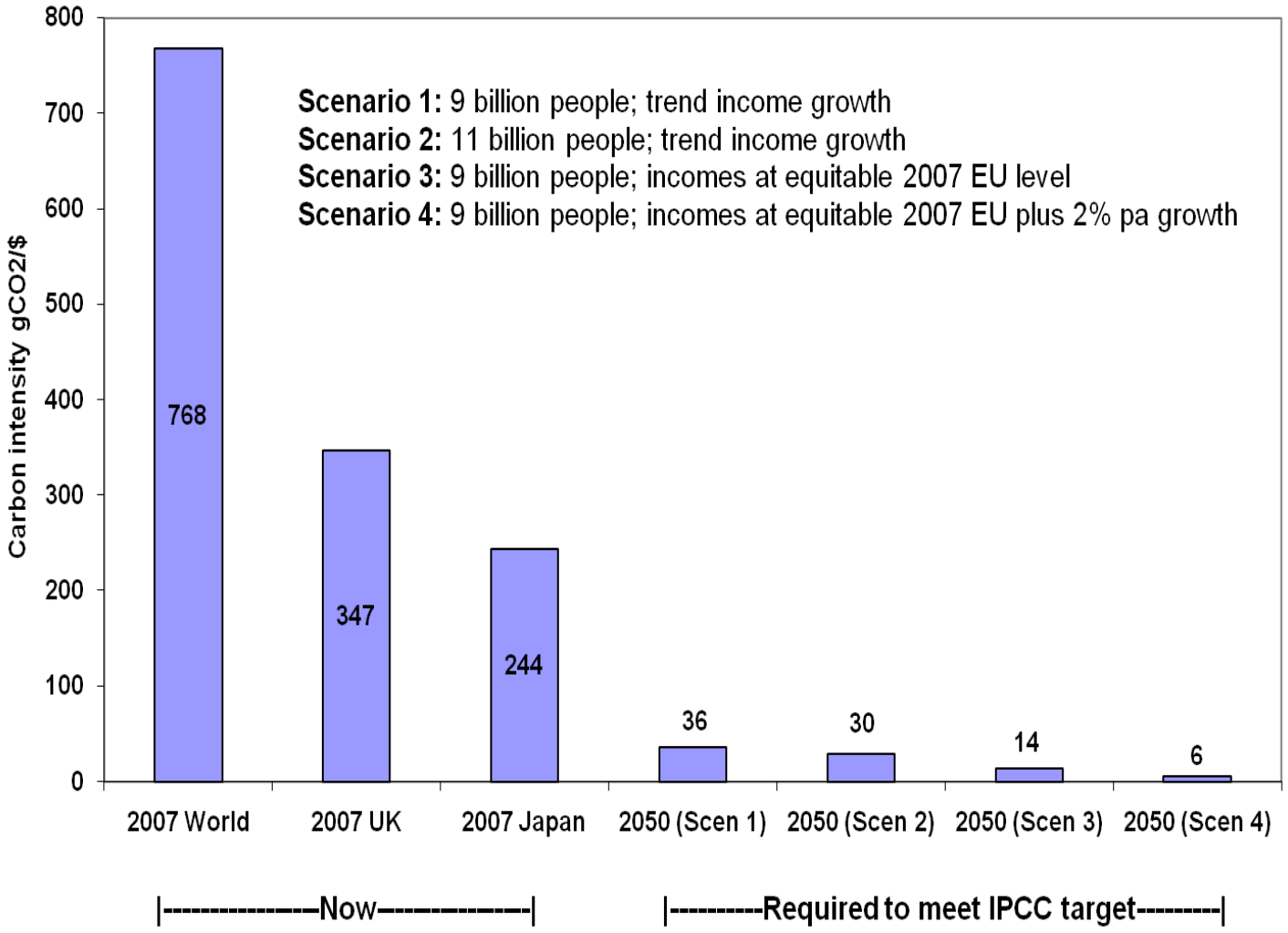
- „Die Steigerung der Energieeffizienz ist ein wichtiger Schlüsselfaktor zur Erreichung von langfristigen Energie- und Klimazielen.” (aus dem Konferenzprogramm)
- Energieeffizienz wird vielfach als Allheilmittel betrachtet, um energie- und umweltpolitische Ziele (Versorgungssicherheit, Klimaschutz etc.) kostengünstig zu erreichen
- Hoffnung, dass eine energieeffiziente Wissens-gesellschaft viel weniger Energie verbraucht; Reduktion der Energieintensität
- Kann eine Effizienzrevolution gelingen?

Kann eine Effizienzrevolution gelingen? Ausmaß der Entkoppelung nötig bis 2050

- Assume 0.7%/year population growth and 1.4%/year per capita GDP growth
- For global energy and process CO_2 emissions to fall by 50% to 85% by 2050, carbon emission per unit of GDP must fall by 82% to 94%
- Implies cut of 3.8% to 6.4%/year
  - cf -1.3%/year 1970-2000 and +0.3%/year since 2000
  - If only -1.3%/year, emissions increase by 55%
- Even if emissions and population stabilised, carbon intensity in 2050 must be less than 2% of 2000 levels
- *Is this plausible?*

Source: Sorrell 2009

Scenarios carbon intensity



Source: *Prosperity without growth*, Tim Jackson (London, Earthscan 2009)

Kann eine Effizienzrevolution gelingen?

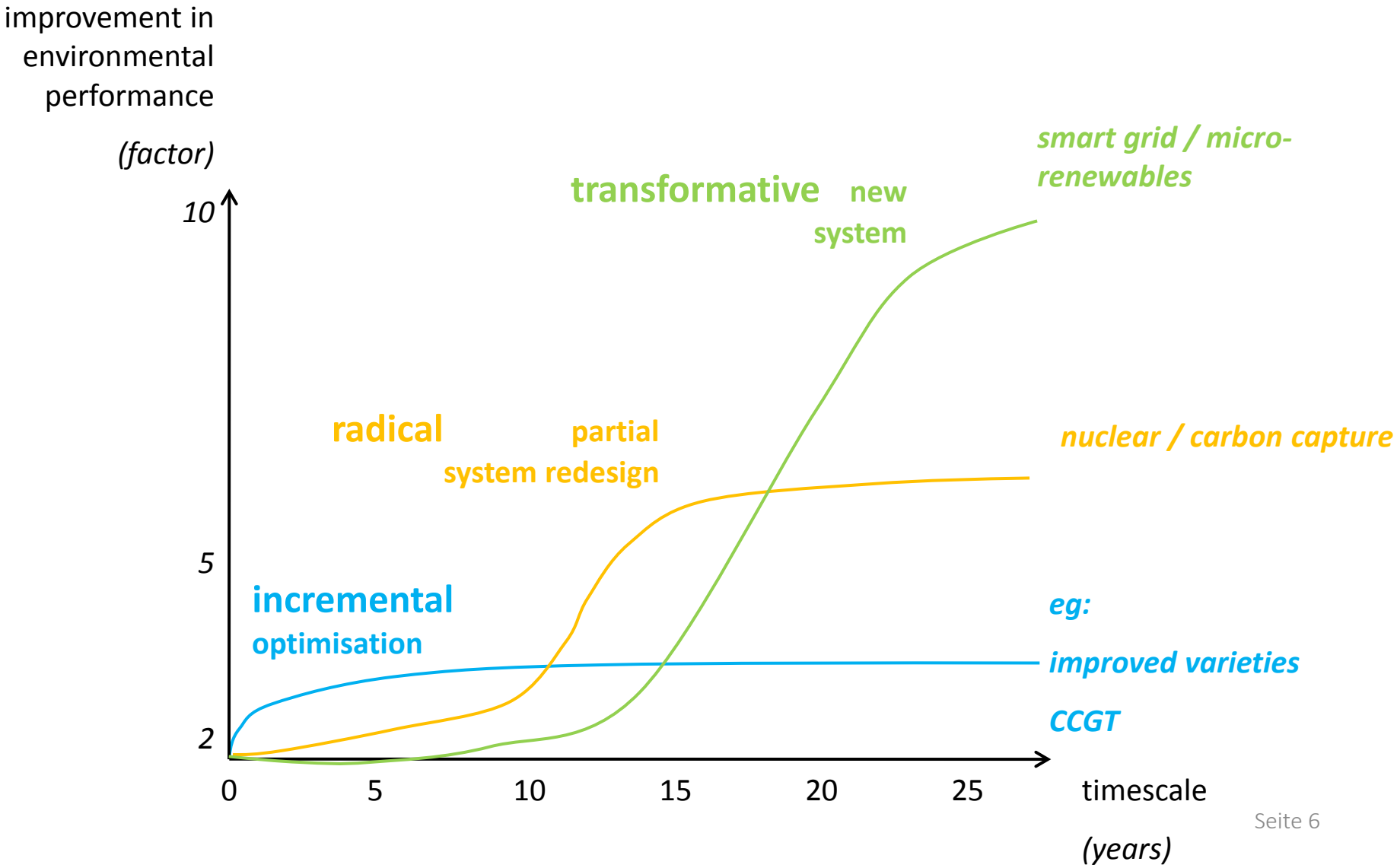
Möglich durch

- Systeminnovationen
- Tipping points

Schwierig, wegen

- direkten und indirekten Reboundeffekten
- sozial-ökologischem Nexus

Socio-Technical Transition



The Rebound Effect: An Assessment of the Evidence for Economy-wide Energy Savings from Improved Energy Efficiency

rebound study by Steve Sorrell for the UK Energy Research Centre (UKERC) from 2005-2007

quantifying rebound is challenging; not only direct, but also indirect effects (knock-on changes throughout the economy) and efficiency improvements rarely occur on their own

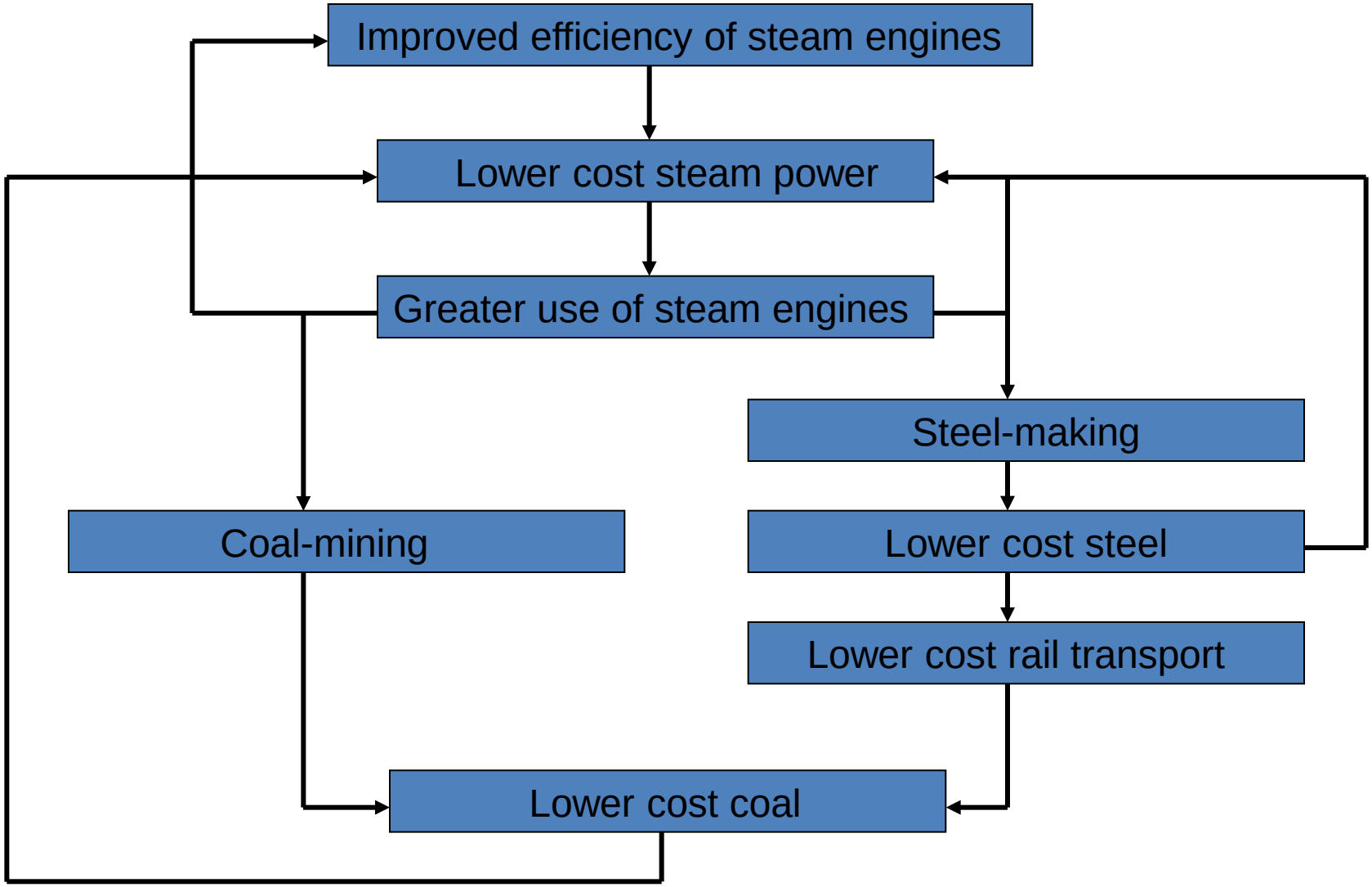
systematic review of the evidence

→ Rebound effects are significant and will limit the potential for decoupling energy consumption from economic growth

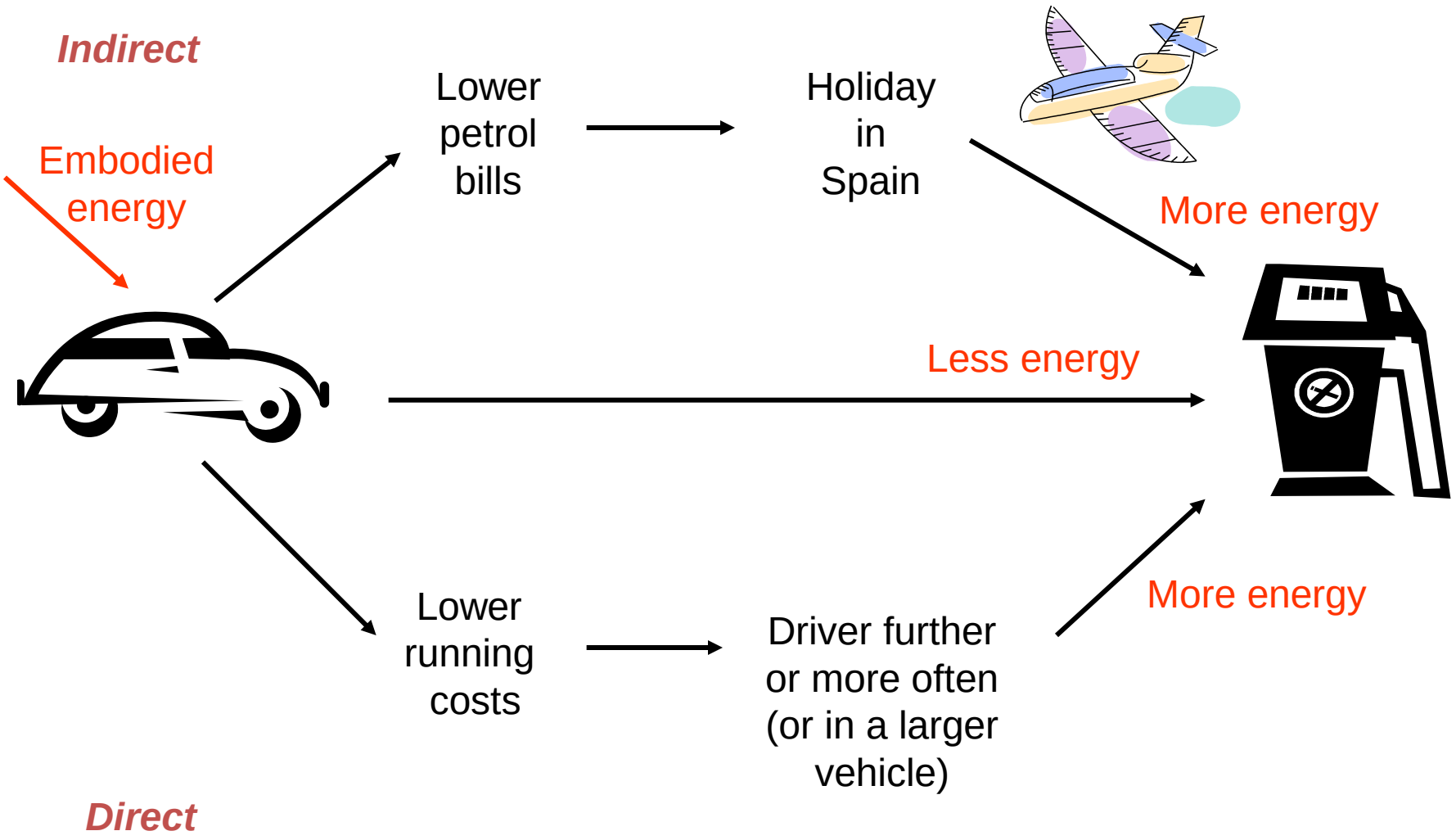
“It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth….Every improvement of the engine, when effected, does but accelerate anew the consumption of coal”

W.S. Jevons, *The Coal Question, 1865*

Jevons' Paradox holds in important cases



Rebound effects - consumers

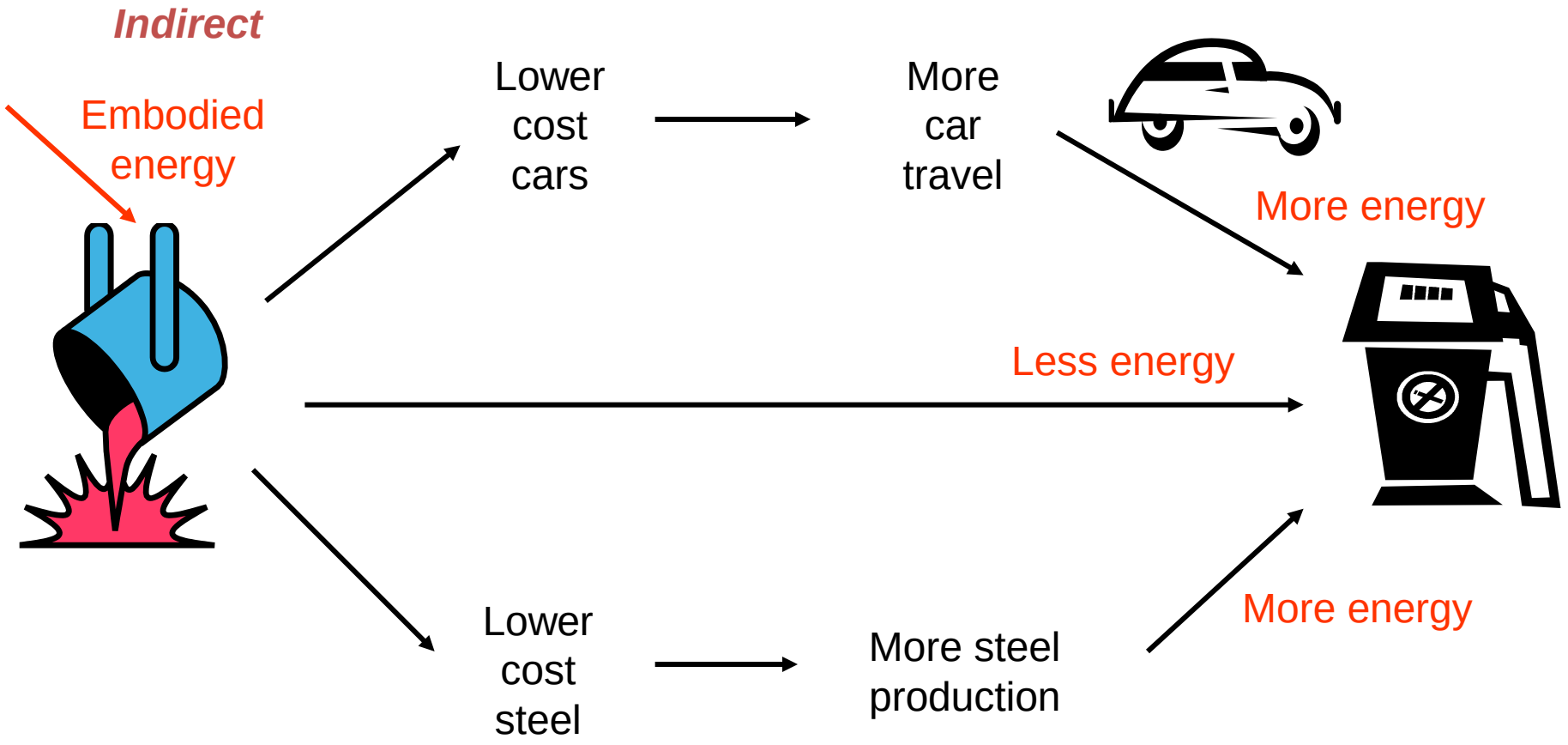


Source: Sorrell 2007

Reinforcement of rebound effects

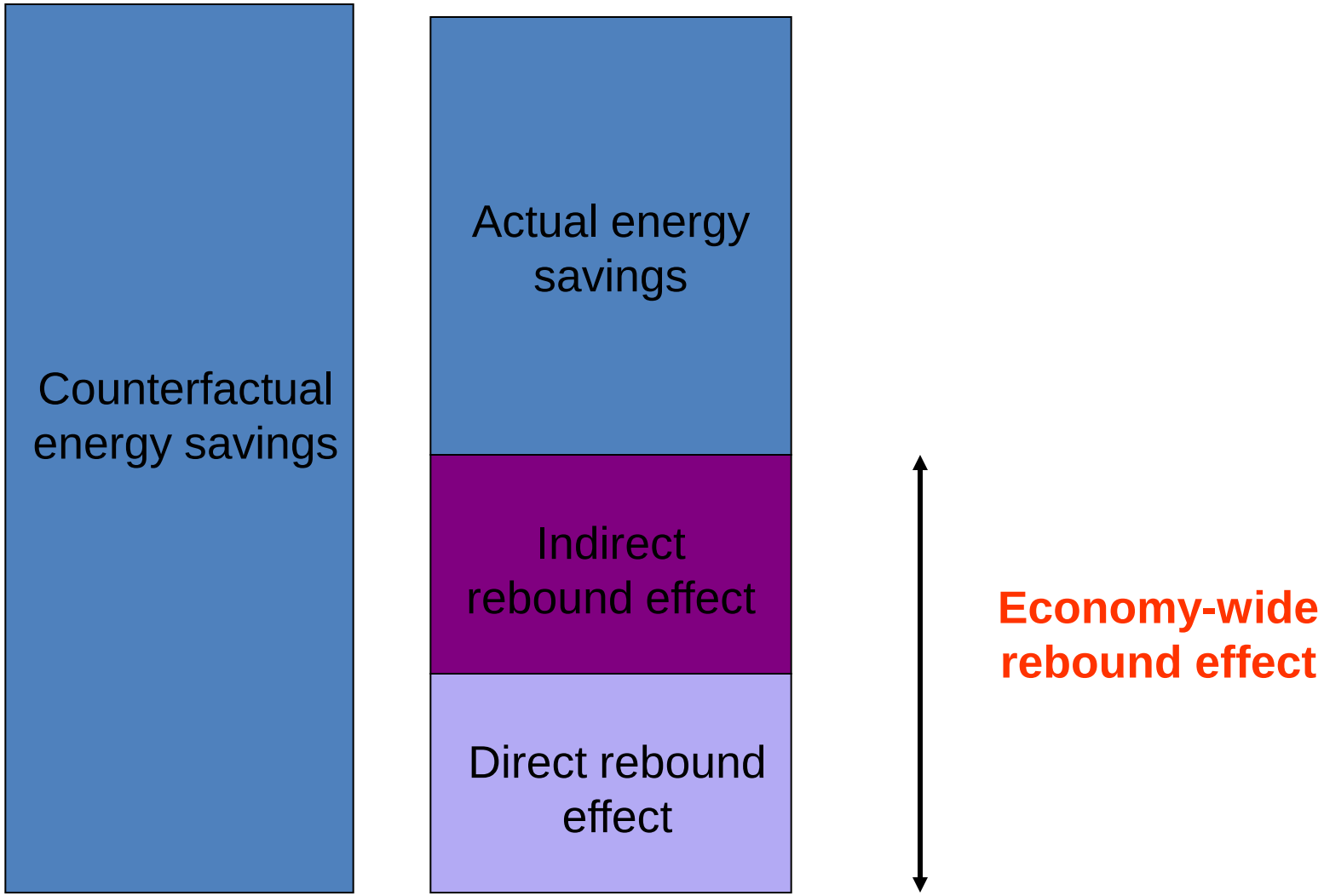
Source: Sorrell 2007

Rebound effects - producers



Source: Sorrell 2007

Economy-wide rebound effect



Source: Sorrell 2007

Two blind spots

- Energy efficiency may be measured in a variety of ways for a variety of system boundaries
  - So rebound effects depend on how energy efficiency is defined
- Improvements in energy efficiency rarely occur in isolation
  - So rebound effects need not be small just because the share of energy in total costs is small

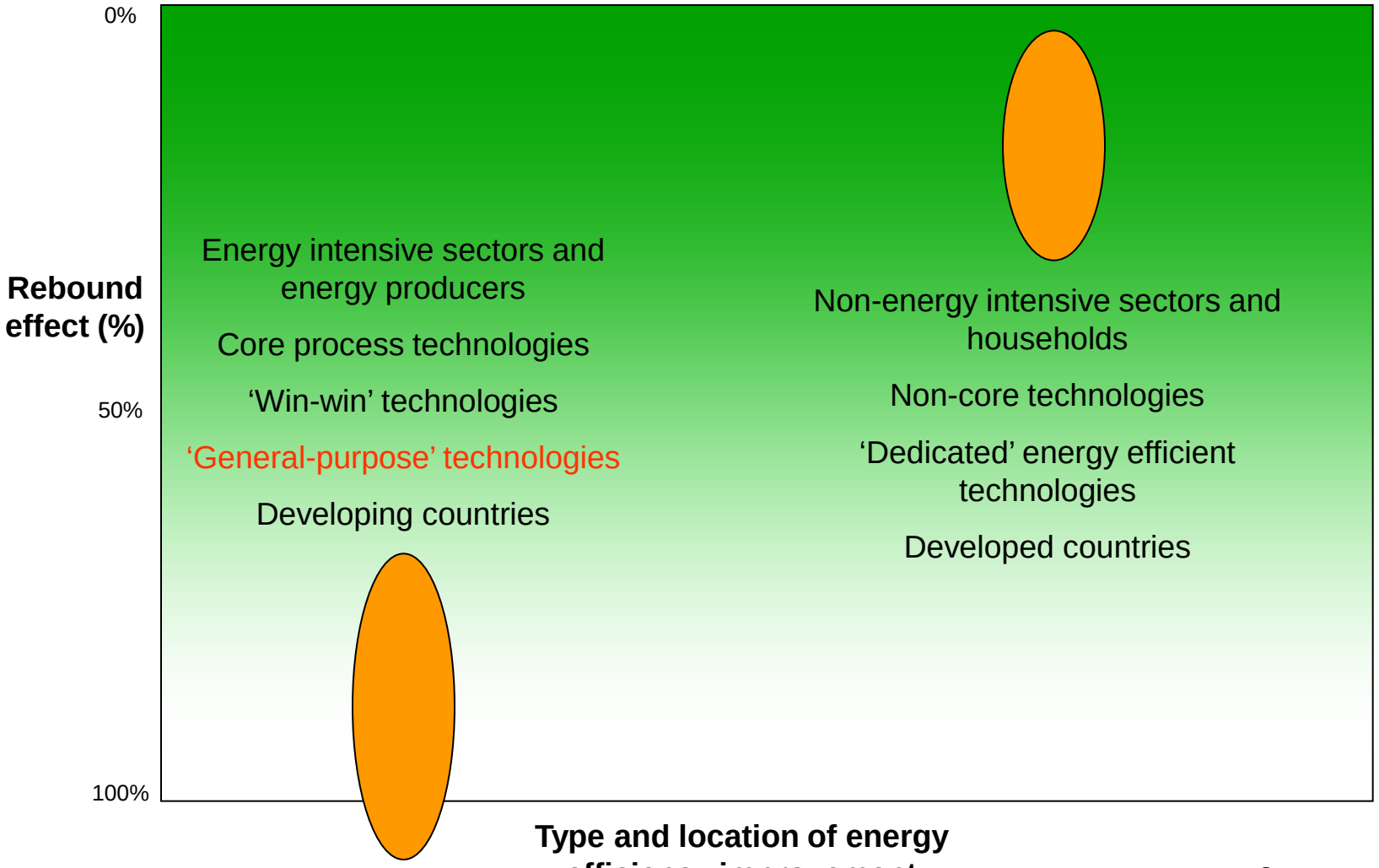
Source: Sorrell 2007

Rebound effects matter…

- *Direct*: 30% or less for car travel and space heating/cooling. Smaller for most other household energy services
  - *But*: Only limited time periods studied. Marginal consumers ignored. Only subset of variables measured. Few studies of producers and/or households in developing countries.
- *Economy-wide*: Diverse modelling studies suggest 30% to >100%
  - *But*: Depends on nature and location of energy efficiency improvement. Sensitive to assumptions. Assumes only 'pure' energy efficiency improvements
- Variable, significant and probably larger than current studies suggest

Source: Sorrell 2007

…but their magnitude is an empirical question



Source: Sorrell 2007

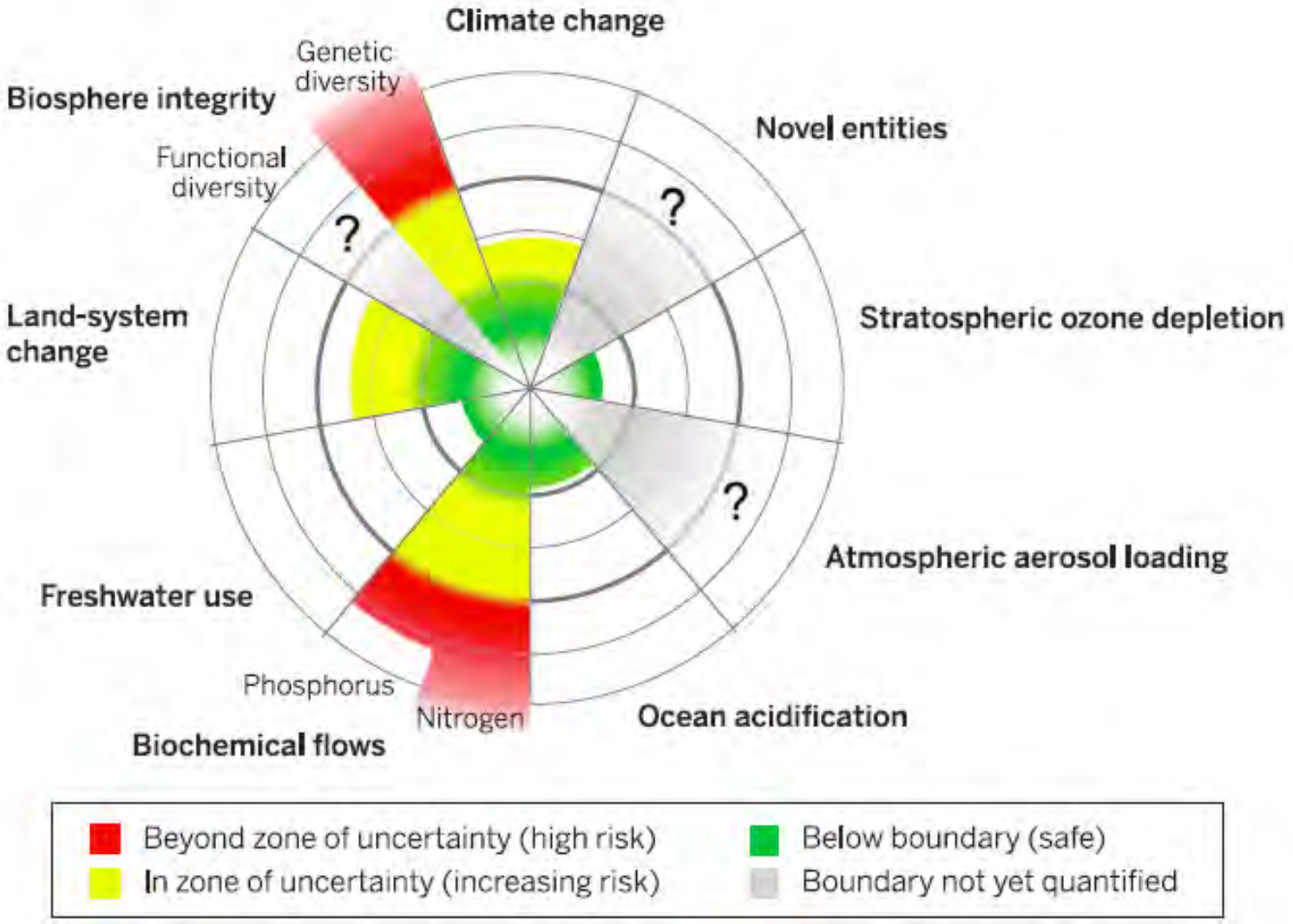
Empirische Schätzung von Rebound Effekten

Author	Effects captured	Efficiency or sufficiency	Area of consumption	Estimated rebound effects
Lenzen & Day (2002)	Income	Efficiency & Sufficiency	Food; heating	45-123%
Alfreddson (2004)	Income	Sufficiency	Food; travel; utilities	7-300%
Brannlund (2007)	Income and Substitution	Efficiency	Transport; utilities	120-175%
Mizobuchi (2008)	Income and Substitution	Efficiency	Transport; utilities	12-38%
Thiesen et al (2008)	Income	Sufficiency	Food	~200%
Kratena (2010)	Income and Substitution	Efficiency	Transport; heating; electricity	37-86%
Chitnis *et al* (2011)	Income	Sufficiency	Transport, heating, food	7-51%
Thomas (2011)	Income	Efficiency	Transport, electricity	7-25%
Murray (2011)	Income	Efficiency & sufficiency	Transport, lighting	5 – 40%

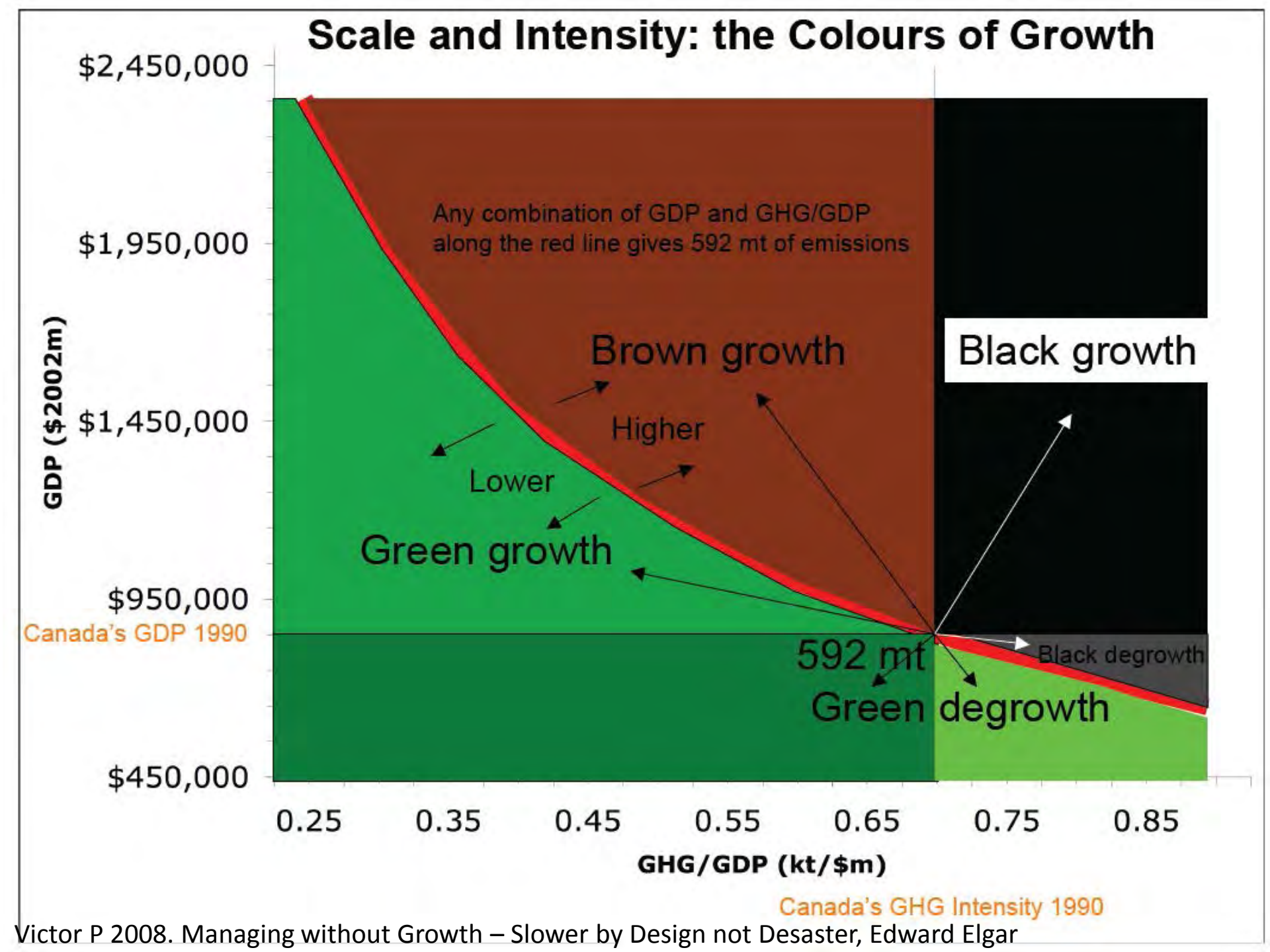
Note: Diverse approaches and methodologies weaknesses; results may refer to energy, carbon, GHG

Quelle: Sorrell (2011)

Earth system boundaries and human interference

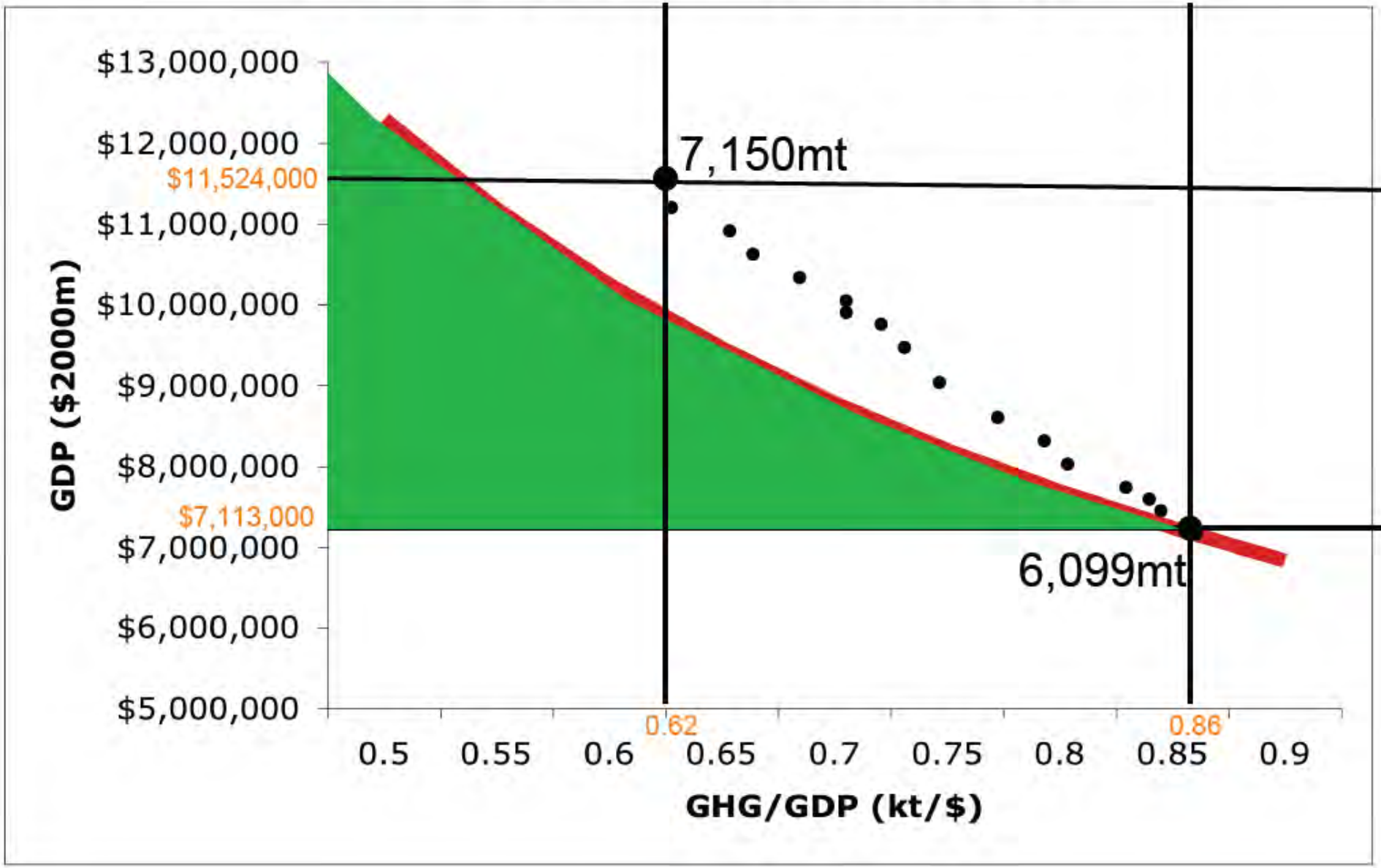


Source: Steffen et al. 2015



Victor P 2008. Managing without Growth – Slower by Design not Desaster, Edward Elgar

USA's Economic Growth
Scale and Intensity 1990-2007



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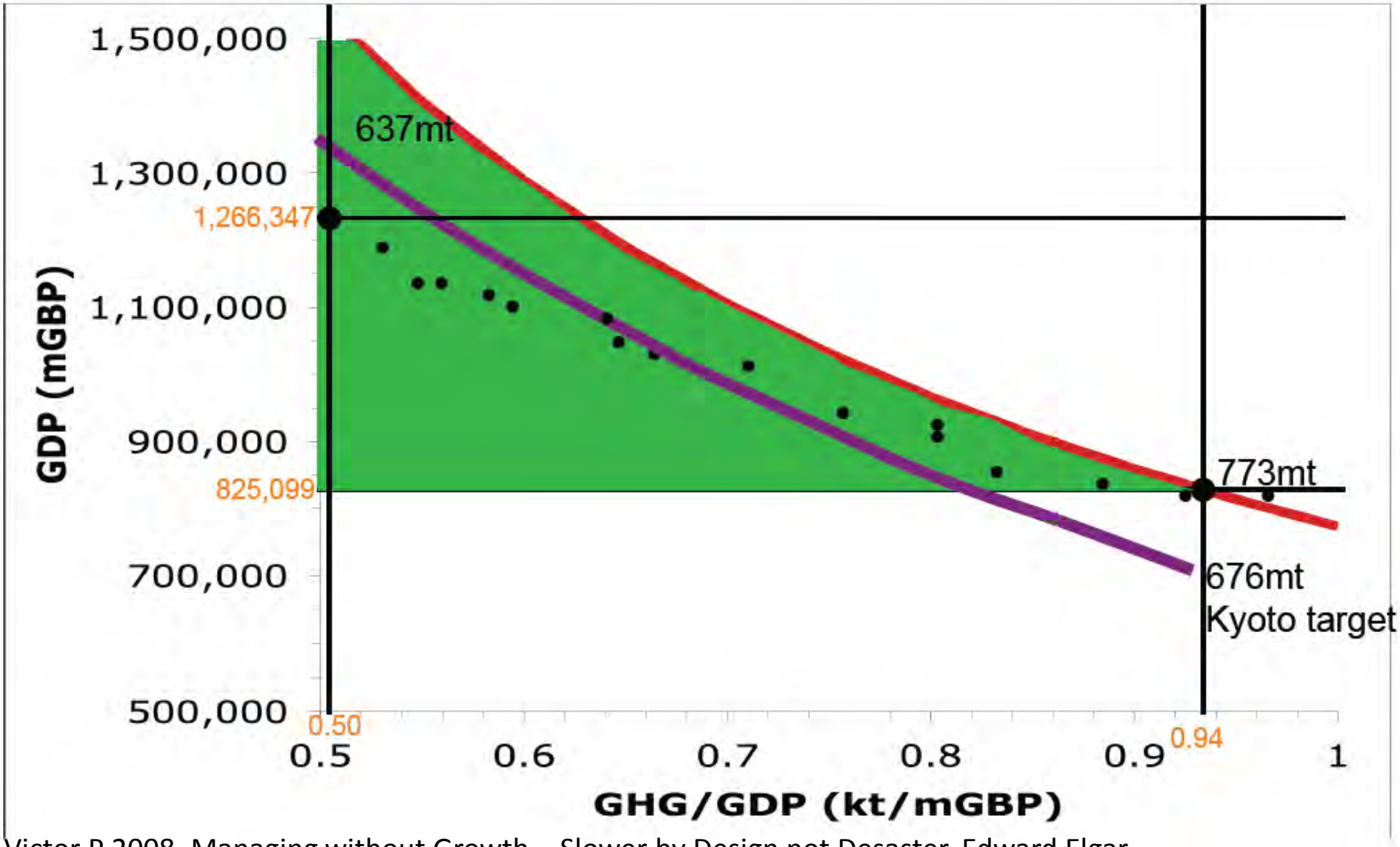

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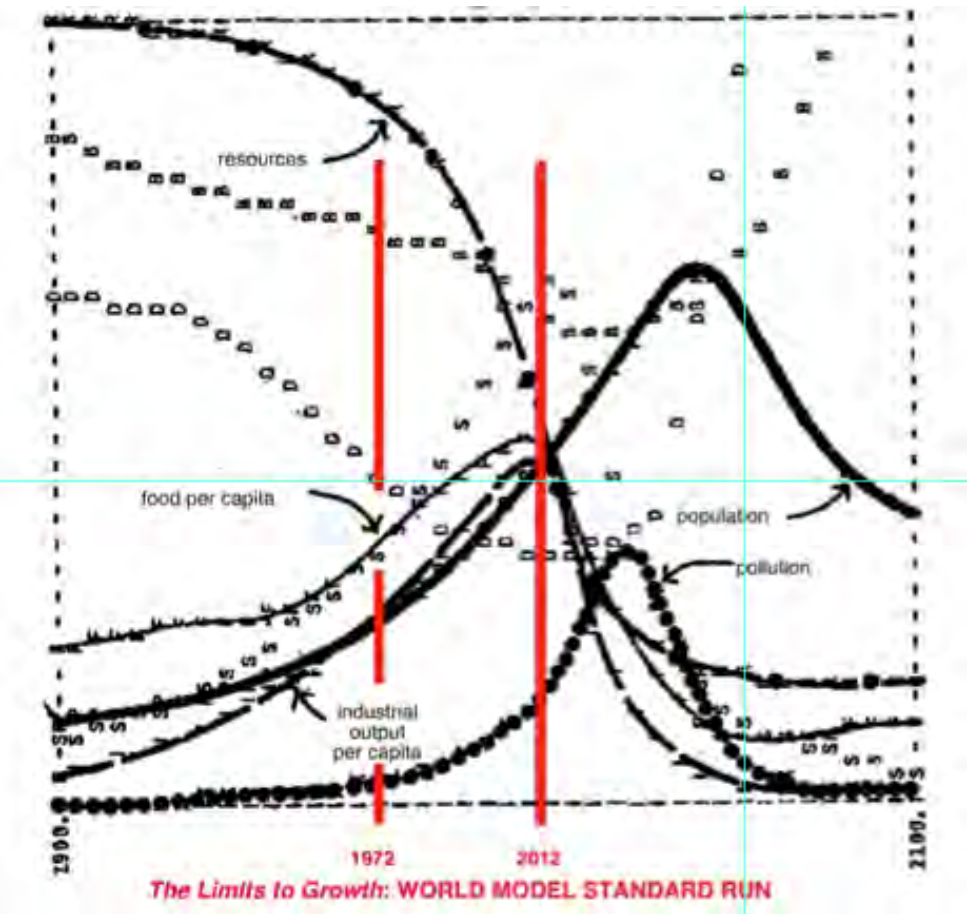
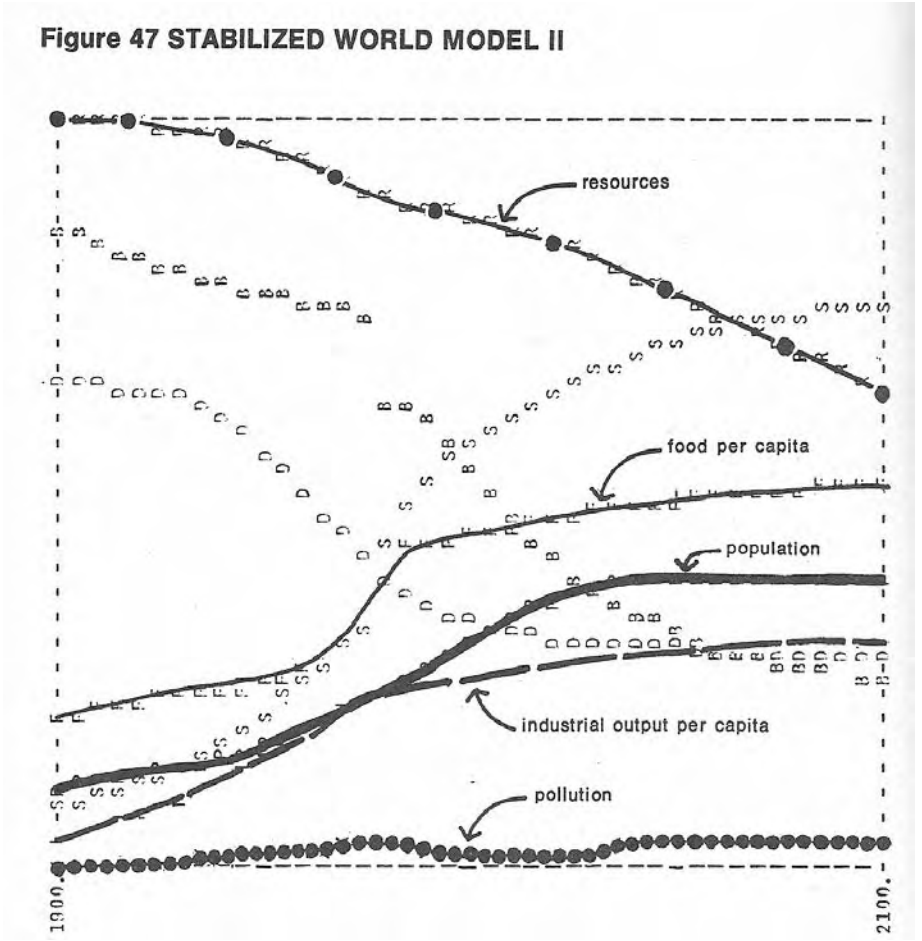
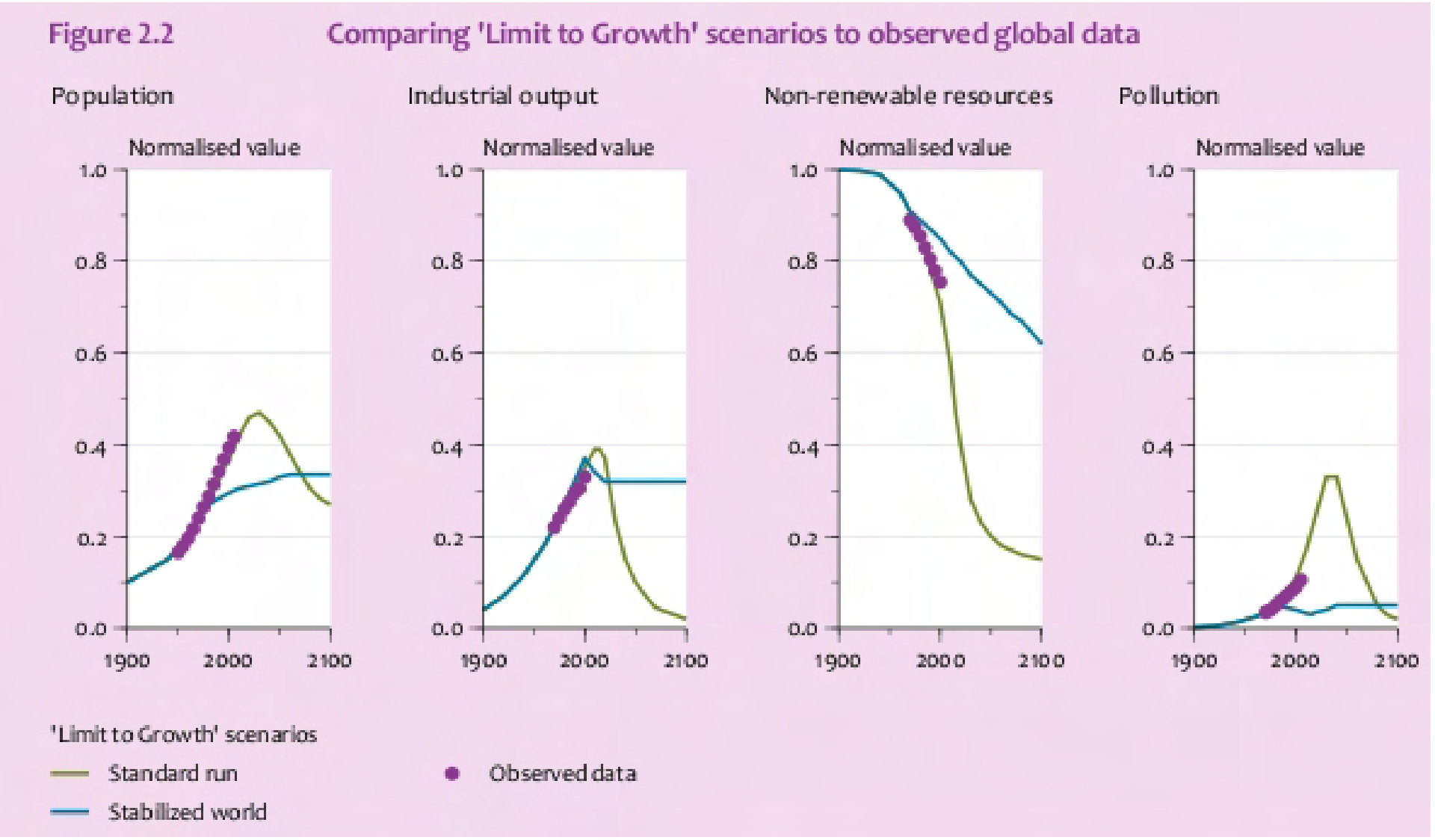
Limits to Growth model runs





Source: Meadows et al 1972



From: *Growing within Limits*, Netherlands Environmental Assessment Agency, October 2009, p 23

Warum ökologisch korrekter Konsum die Umwelt nicht retten kann

- Armin Grünwald:
  - Sie trennen Ihren Müll, kaufen Gemüse aus der Region und fahren einen Kleinwagen. Aber was, wenn dieses Handeln der Umwelt wenig oder gar nichts nützt?
  - Mehr und mehr wird die Verantwortung für eine nachhaltige Entwicklung in den privaten Bereich abgeschoben – das kann im besten Fall wenig zielführend und im schlimmsten sogar kontraproduktiv sein.
  - Denn Nachhaltigkeit ist eine Aufgabe der politischen Systeme.
  - Das heißt nicht, dass der einzelne Mensch in diesem Geschehen keinen Platz hat.
  - Seine Aufgabe ist es aber, politisch für die Nachhaltigkeit einzutreten – jenseits von Stromsparen und ökologisch korrektem Konsum.
- Gordon Walker: Beyond individual responsibility. In: Social practices, intervention and sustainability

Sozial-ökologischer Nexus

- Paradox: je untragbarer Umweltprobleme warden, desto weniger Toleranz herrscht für Sorgen um die Umwelt
- John Maynard Keynes in anderem Kontext: “party of catastrophe” – untragbare Angst verbreiten ohne Lösungen anzubieten, die für die Mehrheit von Bürger/inn/en umsetzbar sind.
- Umweltprobleme sind soziale Probleme, die sich großteils aufgrund von Einkommen und Ungleichheit ergeben.

Vielen Dank für Ihre Aufmerksamkeit!
Ich freue mich auf Ihre Kommentare und Fragen.

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