

How much energy is necessary to live well?

(Socio-technical provisioning systems and the LiLi
project's empirical quest for sufficiency)

Dr Julia Steinberger

Associate Professor in Ecological Economics

Sustainability Research Institute, University of Leeds

j.k.steinberger@leeds.ac.uk

With huge intellectual boosting from: William Lamb, Lina Brand Correa, Elke Pirgmaier, Ian Gough, John O'Neill, Dan O'Neill, Giulio Mattioli, Andrew Brown, Jouni Paavola, Jonathan Busch, Saamah Abdallah, Katherine Trebeck, Kate Raworth, Jonathan Cullen, Marlyne Sahakian, Monica Guillen-Royo, Henrike Rau, Shonali Pachauri, Narasimha Rao, Timmons Roberts & many others.



Outline

- Preamble: the problem statement
 - Why doing research in climate justice is often so difficult
- The solution
 - The ideas that form the basis of the “Living Well Within Limits [LiLi]” project
- The plan
 - LiLi’s research program, and moving forward as a research community

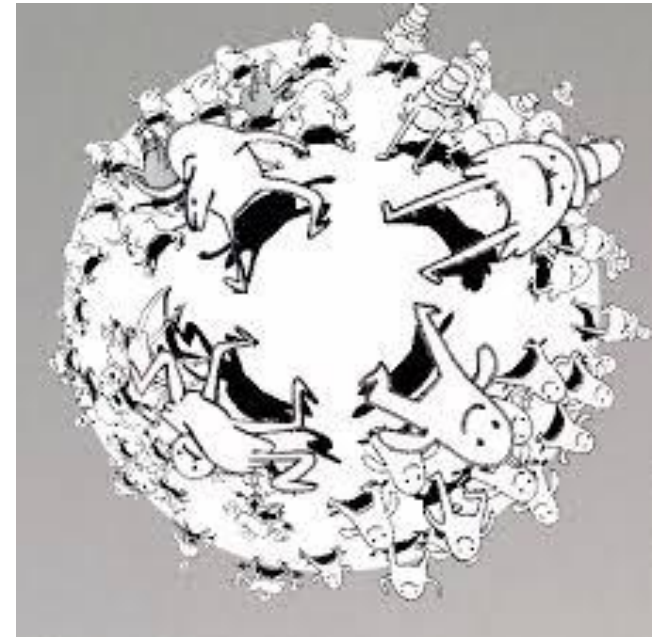
What is the ultimate goal of climate justice research?

To enable 7-11 billion people to live decent lives over the next 100-200 years without durably destroying the planetary processes necessary for human life support.*

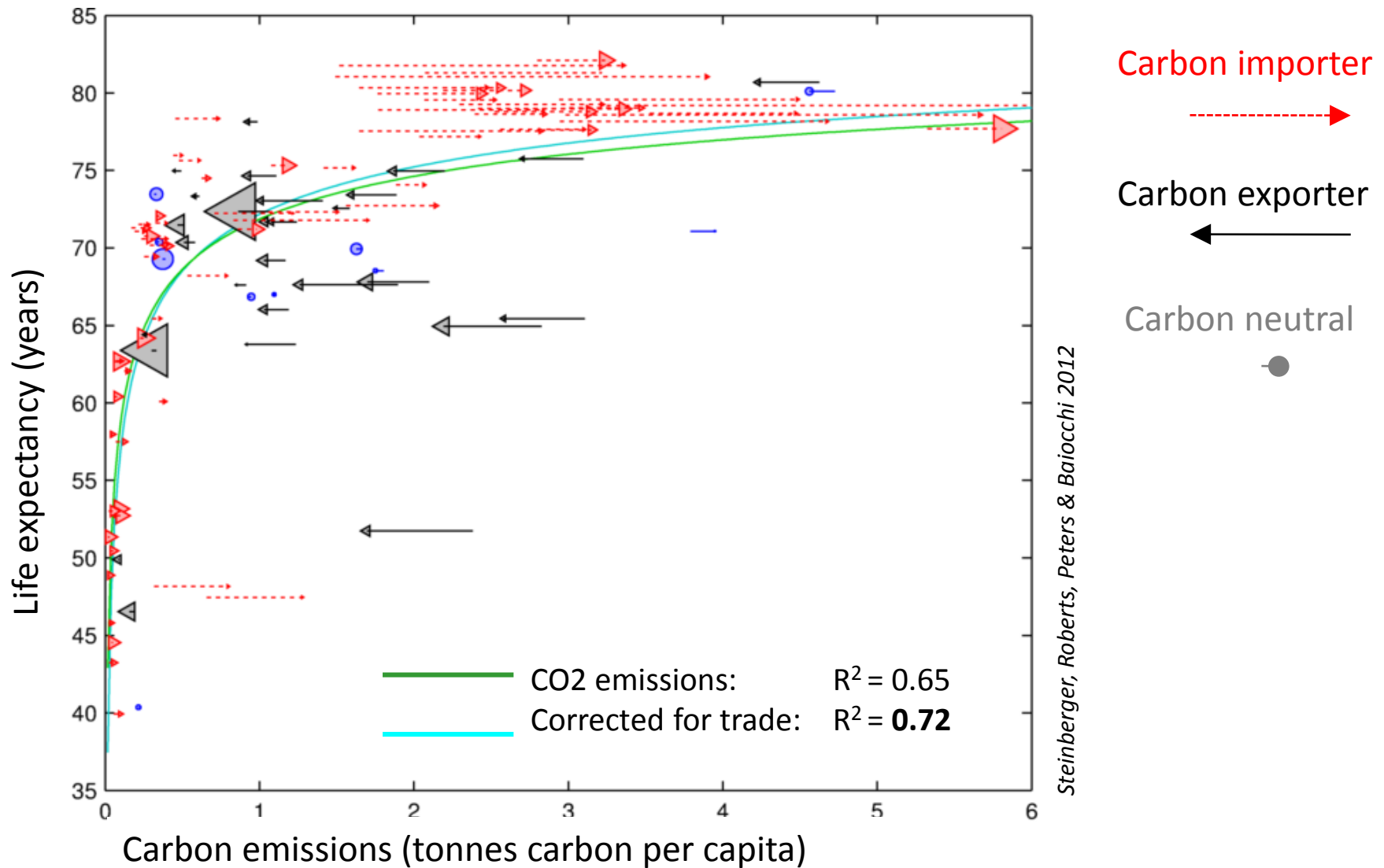
Climate change: because humans “need” **food (=agriculture)** & **energy (~fossil fuels)**.

- **Agriculture** -> land use change & methane & NO_x emissions contribute to climate change
- **Energy** -> fossil fuel combustion & leaks lead to CO₂ & methane GHG emissions.

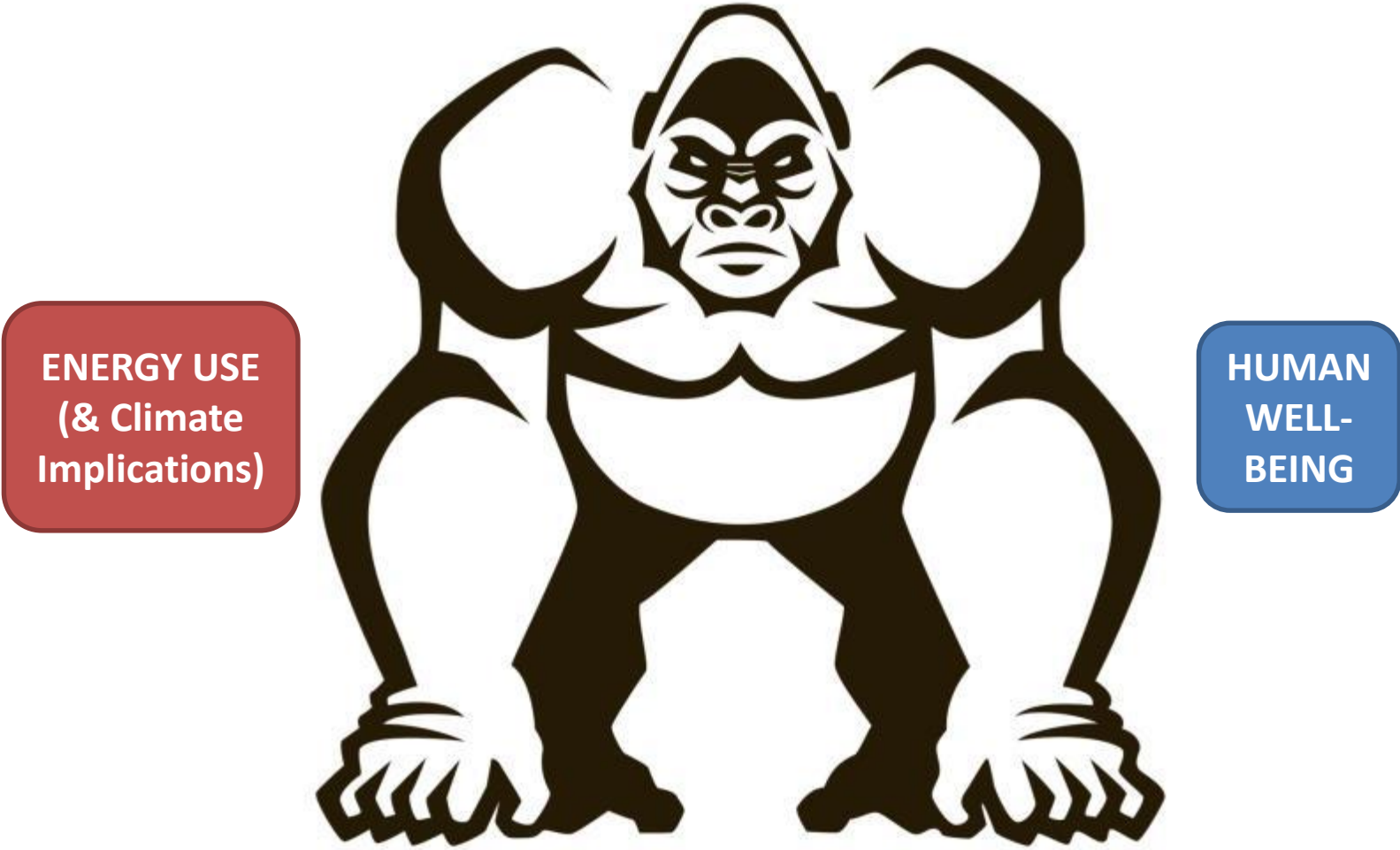
(*) Goal will likely be easier to achieve with smaller population. Also, and not coincidentally, lower birth rates are compatible with human (women’s) aspirations and freedoms.



Sufficiency and carbon emissions: Taking trade into account

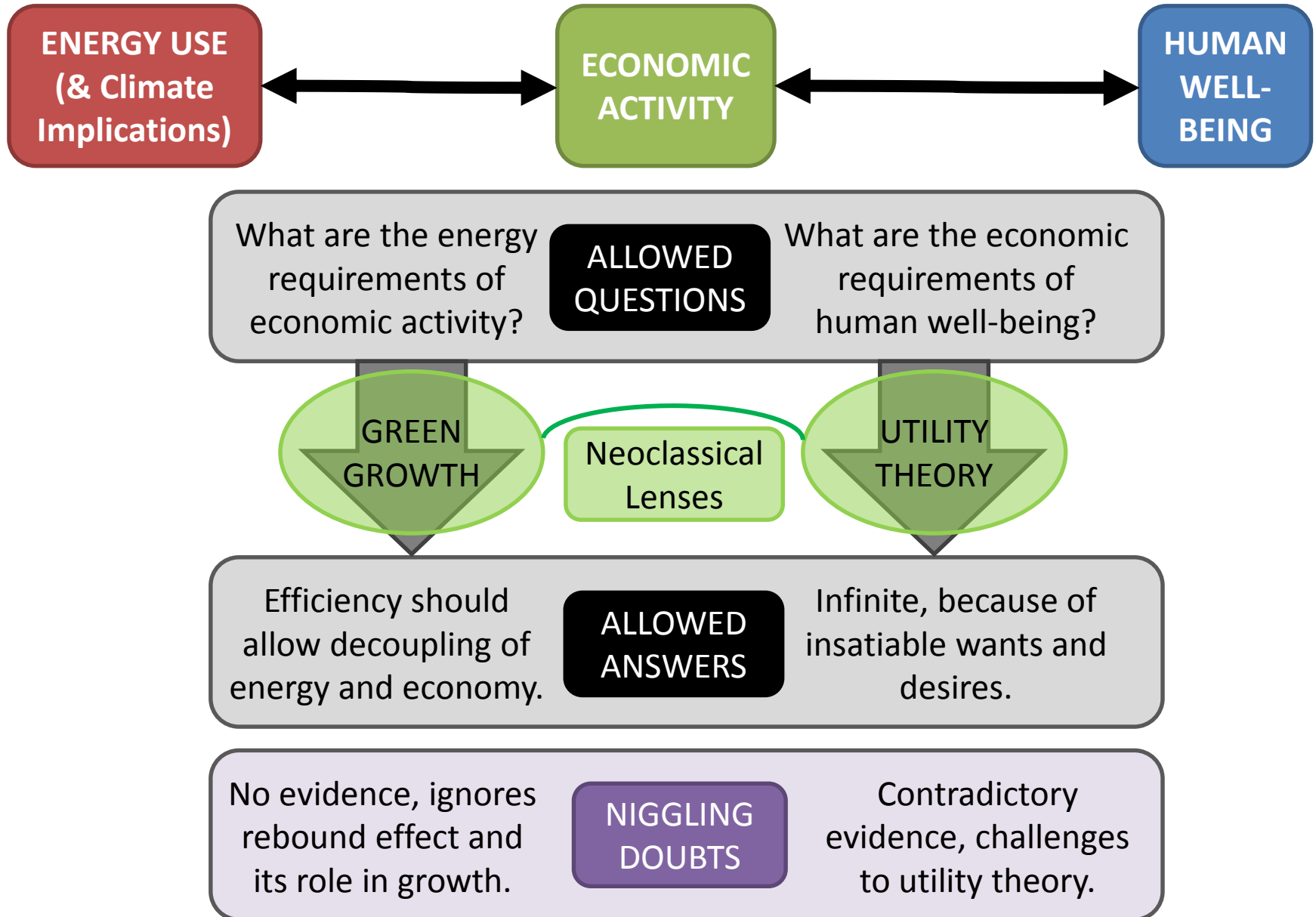


Economic growth as the monkey in the middle



... where the monkey is an 800 pound gorilla
*“Where does an 800 pound [=363 kg] gorilla sit?
Wherever he wants to.”*

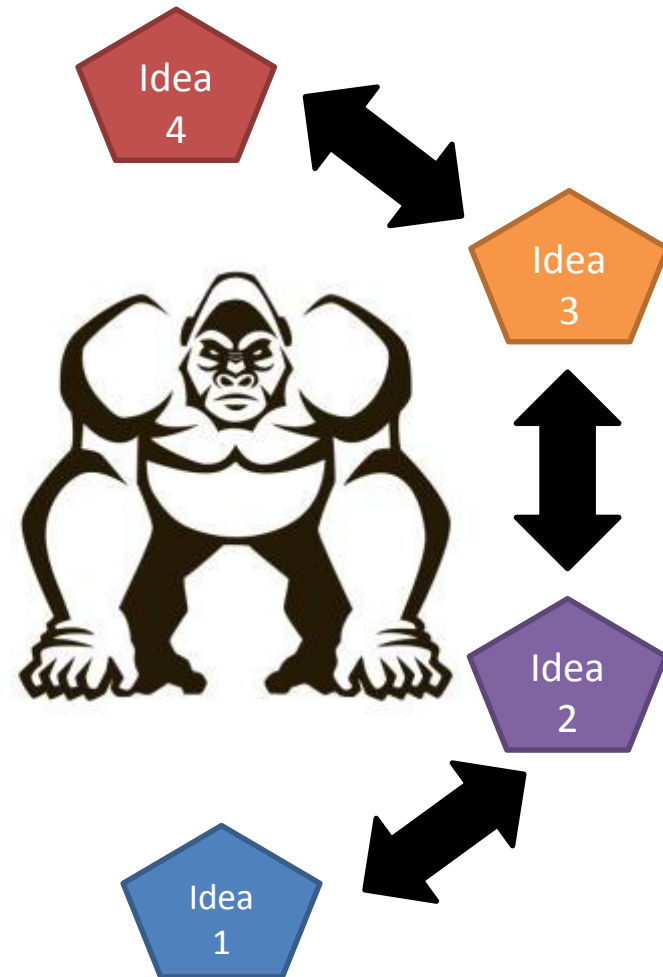
Economics as the disciplinary currency of exchange



Ideas that form the basis of the “Living Well Within Limits (LiLi)” project

Stepping stones in a conceptual pathway around mainstream economics

1. **Needs**-based understanding of human well-being;
2. “**Satisfiers**” of human needs as flexible, culturally & historically specific;
3. **Provisioning systems** and heterodox economic view of supply chains;
4. **Energy services** rather than energy supply.



Approaches to human well-being

HUMAN
WELL-
BEING

(Sort of) following Gasper 2004:

1. Pleasure or satisfaction (Hedonic)

- a. **Objective:** Economic utility maximisation, “preferences”, satisfaction of wants & desires
- b. **Subjective:** Balance of positive & negative feelings (maximise positive, minimise negative): **happiness**
- c. **Subjective:** Life Satisfaction (can measure Eudaimonic as well)

2. Opulence (Consumerist Hedonic)

- **Objective:** Material living standards, consumption.

3. Human Needs (Eudaimonic)

- **Objective:** theorised, **participatory** and/or politically determined (Doyal & Gough 1991, Max-Neef 1991)

4. Capabilities (Eudaimonic)

- **Objective:** opportunities and freedom (Sen & Nussbaum)

Confusing mix
of theory &
method &
disciplinary
perspectives.



*Needs approaches are the most promising for sustainability, because they allow **intergenerational comparisons and satiability.***

~ J O'Neill 2012

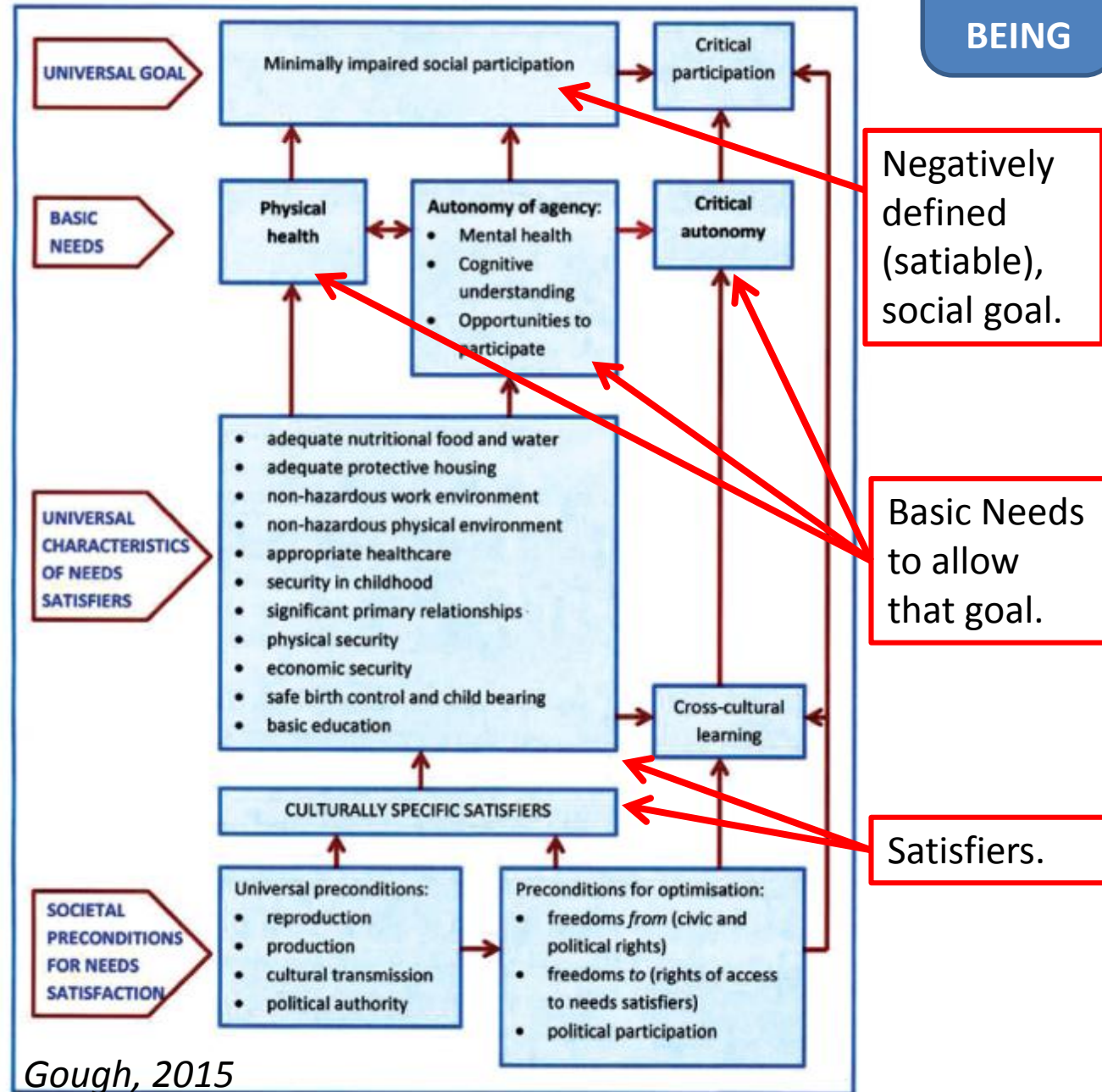
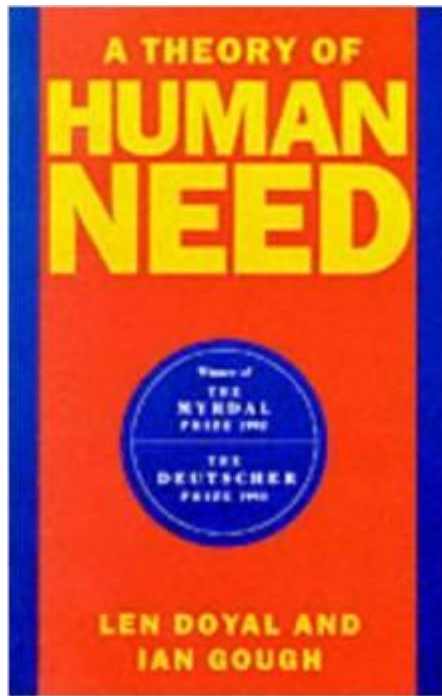
Theory matters: social vs individual assessment of well-being

HUMAN
WELL-
BEING

| | Most suited to sustainability research, social focus | Dominant in policy & research, individual focus |
|---------------------------------|---|---|
| Well-being assessment | Eudaimonic (flourishing) | Hedonic (maximising pleasure, minimising pain) |
| Objective and/or non-individual | <ul style="list-style-type: none"> ➤ Outcomes: health, education, political participation, etc. ➤ Means (satisfiers): public expenditure budgets on health & education, available infrastructure and vital services (hospitals, schools, trained doctors and teachers, etc.). ➤ Community participatory method: Max-Neef's Human-Scale Development matrix of needs and satisfiers. | <ul style="list-style-type: none"> ➤ Income & expenditure studies (well-being as maximising utility through consumption, as making choices given budgetary constraints). |
| Individual & subjective | <ul style="list-style-type: none"> ➤ Evaluative assessment | <ul style="list-style-type: none"> ➤ Happiness ➤ Satisfaction (satisfaction with life) |

Human Need framework: strong sust.

HUMAN WELL-BEING



Gough, 2015

Satisfiers

SATIS-
FIERS

Common concept across Human Needs approaches.

Max-Neef human-scale development matrix

| Needs: | BEING (personal or collective attributes) | HAVING (institutions, norms, tools) | DOING (personal or collective action) | INTERACTING (spaces or atmospheres) |
|---------------|--|---|--|---|
| Subsistence | | | | |
| Protection | | | | |
| Affection | | | | |
| Understanding | | | | |
| Participation | | | | |
| Idleness | | | | |
| Creation | | | | |
| Identity | | | | |
| Freedom | | | | |

Not the only type
of need satisfier!

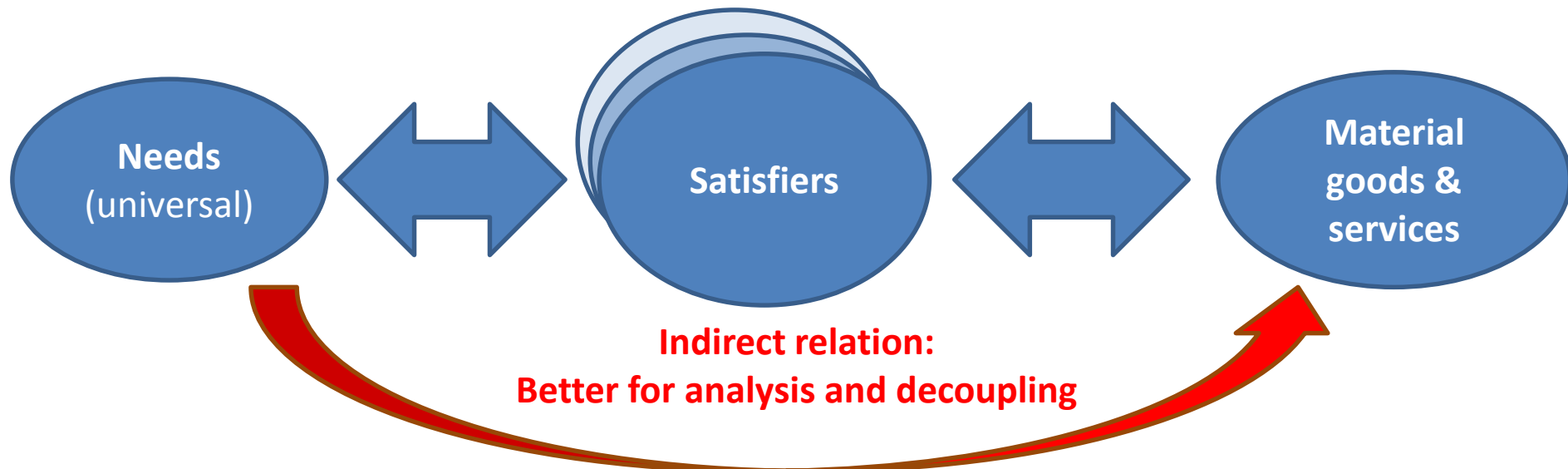
SATISFIERS

Gough & Max-Neef: **satisfiers** as intermediates between needs and material goods (=environmental impacts)

Conventional economics:



Human-Scale Development & Human Needs



Analysing satisfiers: help needed

PROVI-
SIONING
SYSTEMS

Satisfiers sound
like a great
analytic tool!
I wonder what
they consist of ...

[5 minutes of
literature search
later...] I wonder
what they *don't*
consist of ???



Satisfiers aspects:

- Both social and physical;
- Economic and household level;
- Welfare state, political system, environment, culture, religion;
- Etc Etc Etc.

So what approach can
we use to study them?

Provisioning systems = Core mission of heterodox economics

- “**Aristotle's oikonomy** included the study and practice of diverse domains It included as well the discussion of meaning and value, of ethics and aesthetics, as an integral part of this ‘**art of living and living well.**’”
Cruz, Stahel & Max-Neef 2009
 - “... economics is the study of the on-going economic process that **provides the flow of goods and services required by society to meet the needs** of those who participate in its activities ... **[Economics is] the science of social provisioning.**” *Gruchy 1987*
- “[The economy is] an instituted **process of interaction between man and his environment, which results in a continuous supply of want-satisfying material means** . . . The human economy, then, is embedded and enmeshed in institutions, economic and noneconomic. **The inclusion of the noneconomic is vital.** For religion or government may be as important for the structure and functioning of the economy as monetary institutions or the availability of tools and machines themselves that lighten the toil of labor.” *Polanyi 1968*

Social side: Systems of Provision

Fine & Leopold 1993, Fine 2002

PROVI-
SIONING
SYSTEMS

- **Structures:** governance rules and hierarchies of decision-making (key laws and regulations, regional scales of responsibility).
- **Processes:** stages of policy-making, formal procedures for decision-making, project development and communication between actors.
- **Agents:** the most important actors responsible for shaping provision.

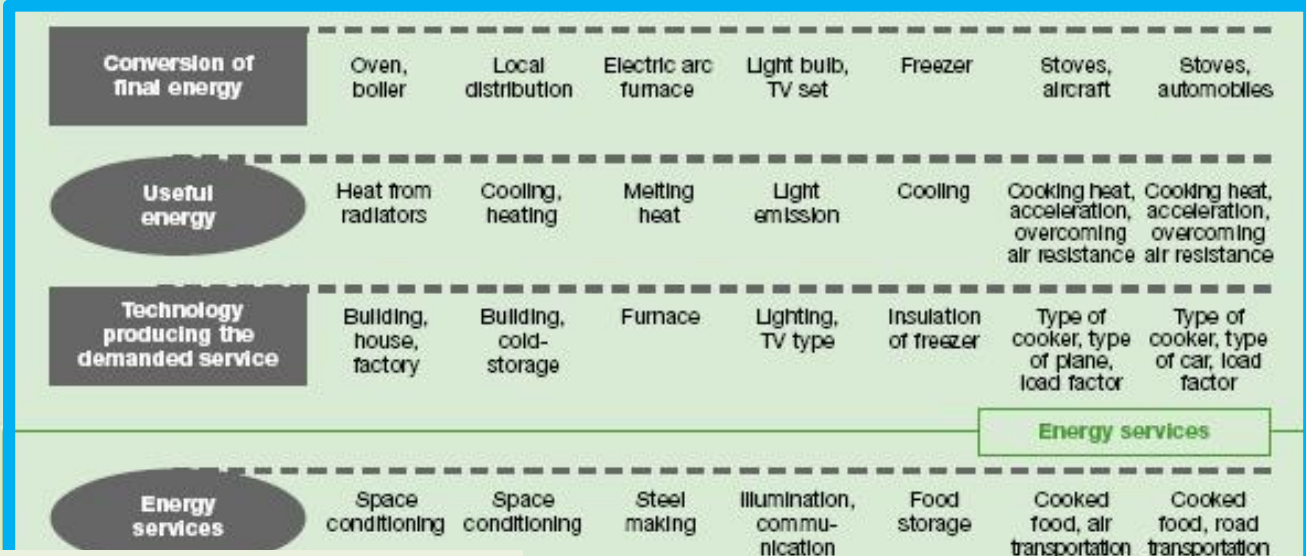
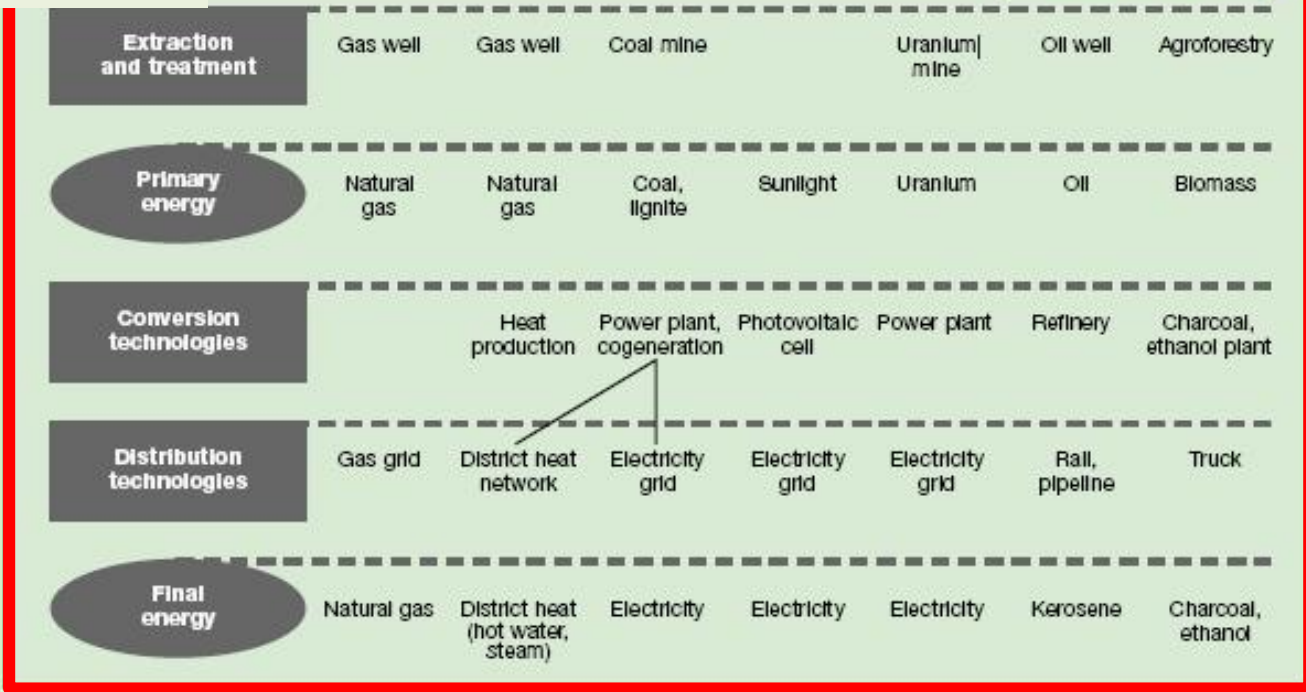
Physical provision: Energy Services

ENERGY SECTOR

Energy system

Energy sector

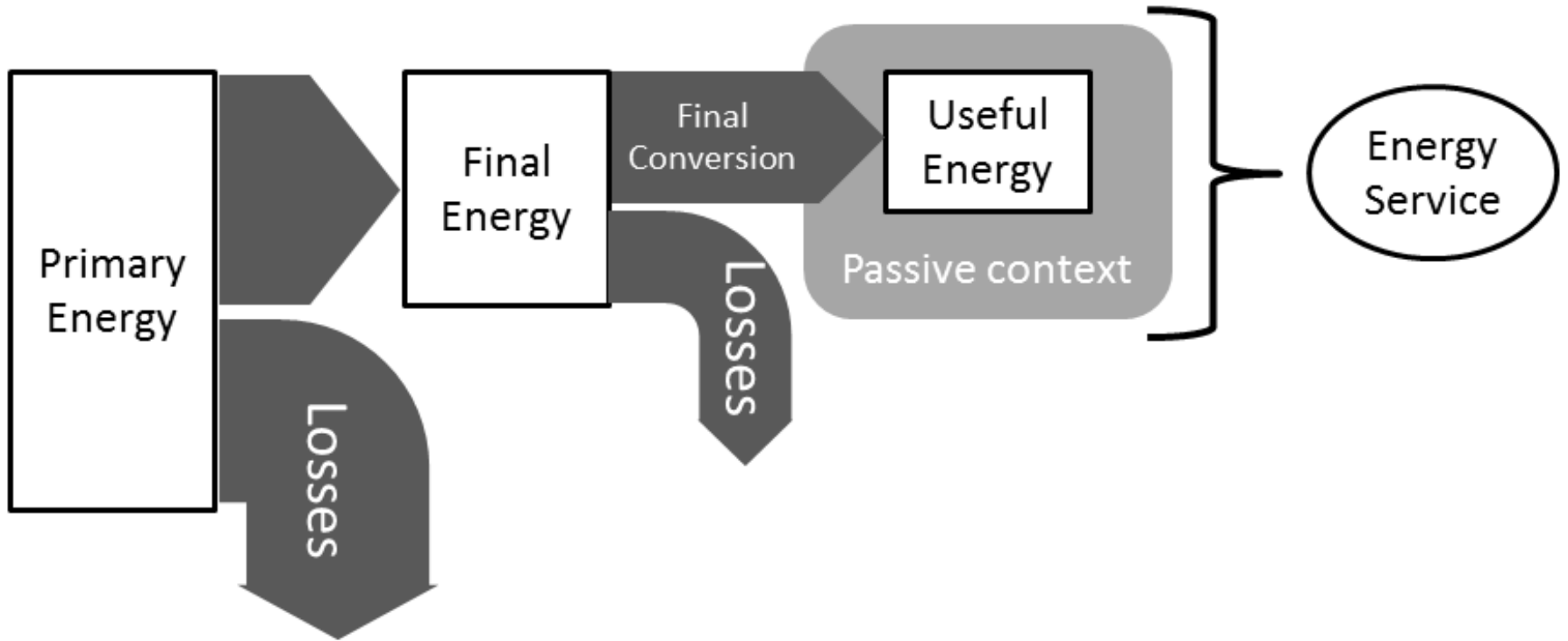
ENERGY SERVICES



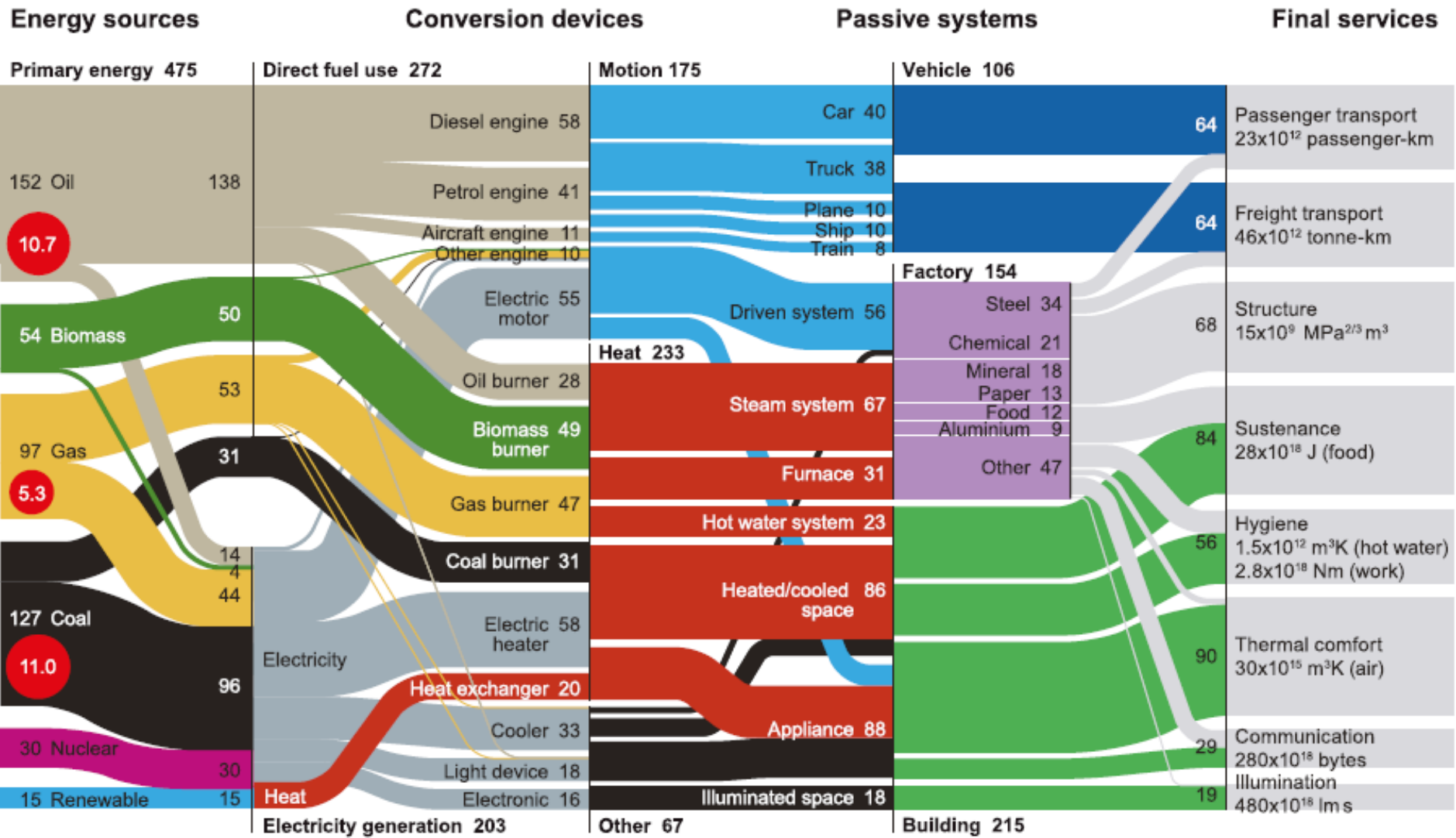
END USER AND PASSIVE SYSTEM

Source: Jochem et al 2000

Physical provision: energy services



ENERGY SERVICES



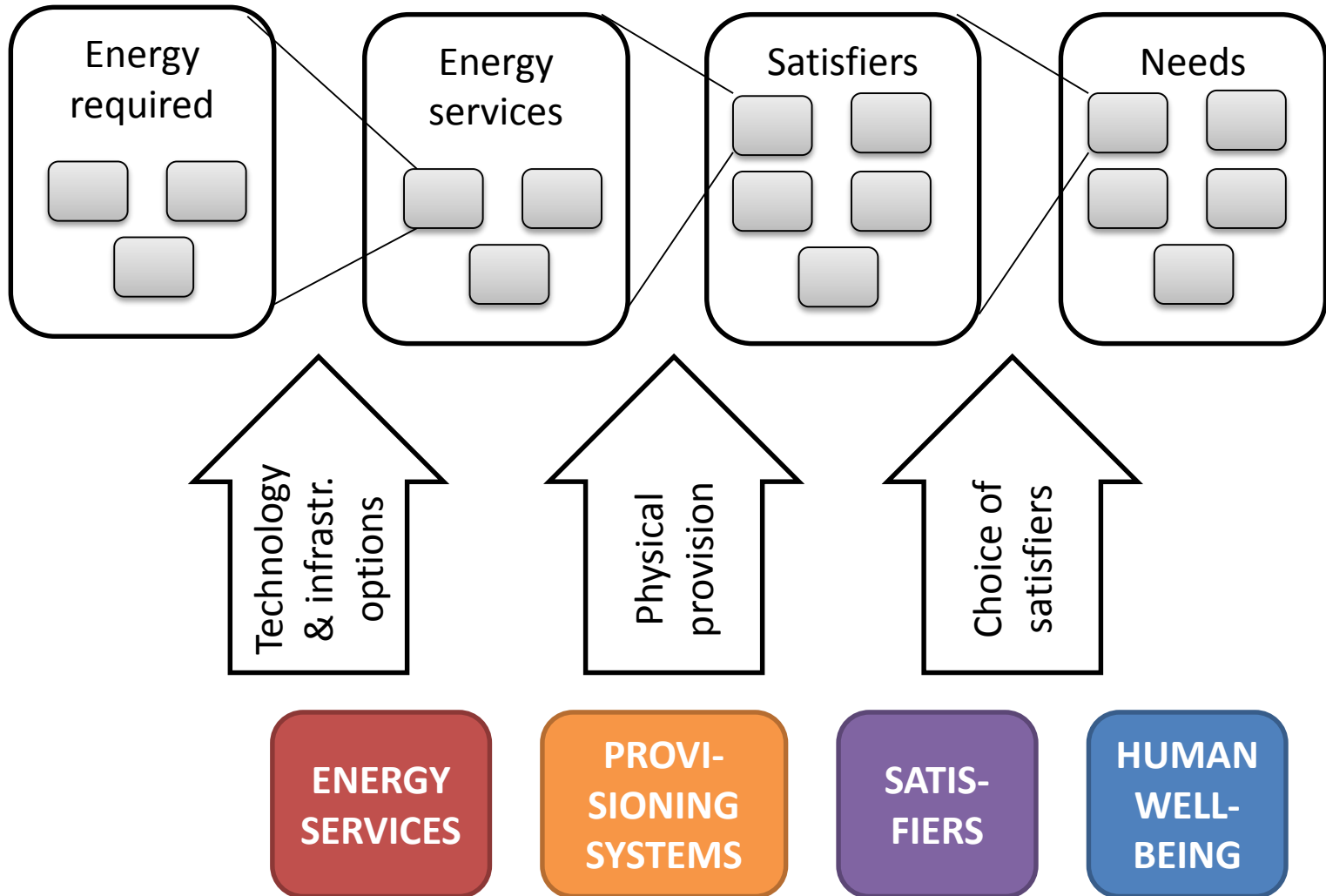
Annual global flow of energy in 2005, EJ [10¹⁸ joules]

Annual global direct carbon emissions in 2005, Gt CO₂ [10⁹ tonnes of CO₂]

Cullen et al 2010

Connecting energy supply, physical provision, services, satisfiers & needs.

Living Well
Within
Limits [LiLi]



Putting the pieces together: The LiLi framework

Living Well
Within
Limits [LiLi]

BIOPHYSICAL INPUTS

Planetary Processes

Hydrological cycle,
Carbon cycle,
Solar radiation,
Biodiversity,
Nitrogen cycle,
Etc.

Natural Resources

Energy,
Materials,
Land,
Water,
Etc.

PROVISIONING SYSTEMS

Physical

Infrastructure,
Technology,
Land use,
Supply Chains.

Social

State,
Markets,
Communities,
Institutions,
Norms,
Culture,
Distribution.

SOCIAL OUTCOMES

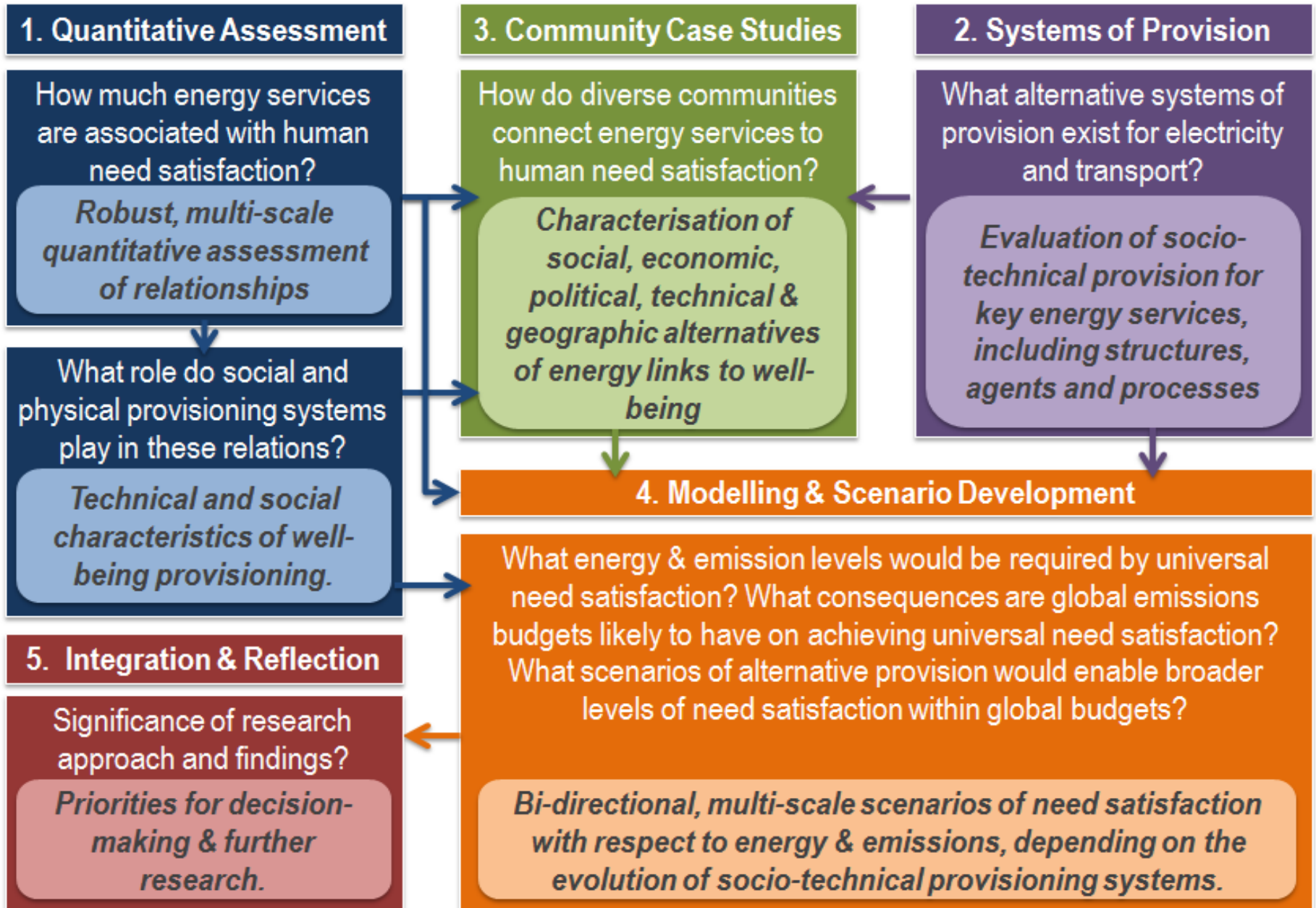
Need satisfiers

Food & water,
Housing,
Healthcare,
Education,
Relationships,
Economic security,
Physical safety,
Childhood safety,
Safe birth control &
childbearing.

Well-being

Physical &
mental health,
Autonomy of
agency,
Cognitive understanding,
Social participation,
Life satisfaction,
Etc.

LiLi research questions and outcomes



LiLi subprojects: quantitative

| | Top-down international | Income classes | Household-level (urban-rural) |
|--|--|---|---|
| Biophysical Inputs | Energy supply (primary-final-services); Corresponding GHG emissions; Including corrections for international trade. | For both income classes & household-levels: Direct energy use (residential & private vehicle); Indirect energy use (through expenditures); Associated GHG emissions. | |
| Physical Provisioning | Infrastructure networks & access; Diffusion of major appliances Climate and human settlement characteristics; Technological efficiency, energy services, exergy analysis. | Same data as for top-down, if available disaggregated by income. | Household location, climate & settlement characteristics; Ownership of appliances; Connectivity to key infrastructures |
| Social Provisioning | Government type, welfare state regimes Governance and institutional quality Equity, income, joblessness Political and cultural participation National health and education expenditures Prevalence of doctors and medical facilities Culture and religion. | Expenditure data on health, education and communication as a proxy for the availability & affordability of key social support systems.. | Same data as for income classes; Employment status and sector; Household demographics Income, expenditure Political orientation Religion |
| Universal characteristics of need satisfiers | Food and water consumption & access; Infant mortality; Immunisation rates; Fertility and reproductive health; Years in school; Literacy; Economic and other deprivation; Indebtedness; Safety/crime. | Same data as for top-down, if available disaggregated by income. | Nutritional status; Water & sanitation access; Health status; Educational status; Economic security (debt, reliable income); Safety perception |
| Well-Being | Life expectancy; Mental health, Happiness ; Life satisfaction. | Same data as for top-down, if available. | Happiness & life satisfaction, if available in micro-data. |

LiLi Systems of Provision of Personal Transport & Residential Electricity

Living Well
Within
Limits [LiLi]

- Both final energy categories highly related to well-being, over decades
 - Steinberger et al 2017 (in preparation)
- Both connected to many types of human need satisfiers, and to larger political/infrastructure priorities & decisions.
 - Mattioli 2016
- Comparative SoP studies in case study countries can point to diversity & alternatives.

2. Systems of Provision

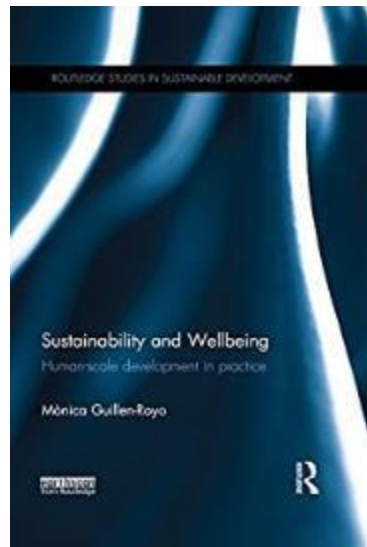
What alternative systems of provision exist for electricity and transport?

Evaluation of socio-technical provision for key energy services, including structures, agents and processes

LiLi case studies: 6 countries, participatory methodology

Living Well Within Limits [LiLi]

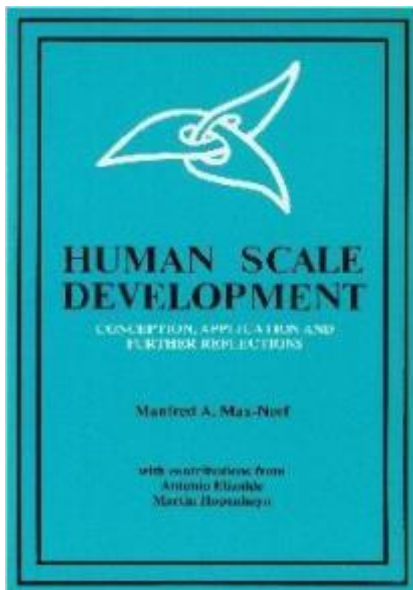
Manfred Max-Neef



Monica Guillen-Royo



Lina Brand Correa



3. Community Case Studies

How do diverse communities connect energy services to human need satisfaction?

Characterisation of social, economic, political, technical & geographic alternatives of energy links to well-being

LiLi modelling & scenarios

Living Well
Within
Limits [LiLi]

4. Modelling & Scenario Development

What energy & emission levels would be required by universal need satisfaction? What consequences are global emissions budgets likely to have on achieving universal need satisfaction? What scenarios of alternative provision would enable broader levels of need satisfaction within global budgets?

Bi-directional, multi-scale scenarios of need satisfaction with respect to energy & emissions, depending on the evolution of socio-technical provisioning systems.

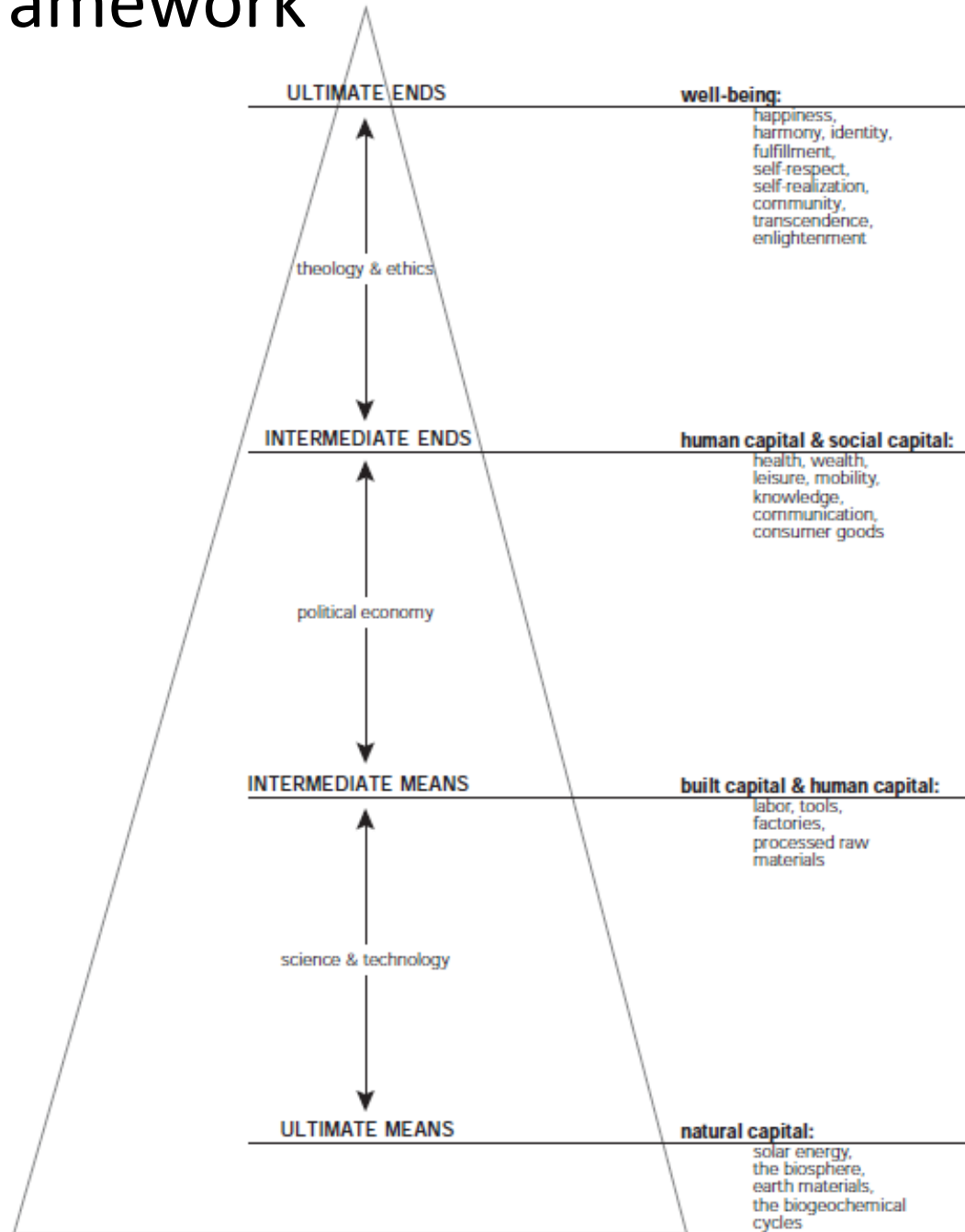
LiLi outcomes?

1. Changing terms of debate in energy studies & climate change
 - Moving from economic cost/benefit to human priorities
2. Establishing some (more or less?) robust connections between disparate fields of research
 - Hopefully communicating convincingly and recruiting others along the way.
3. Obtaining research results that allow us to think in new ways about climate justice challenge.

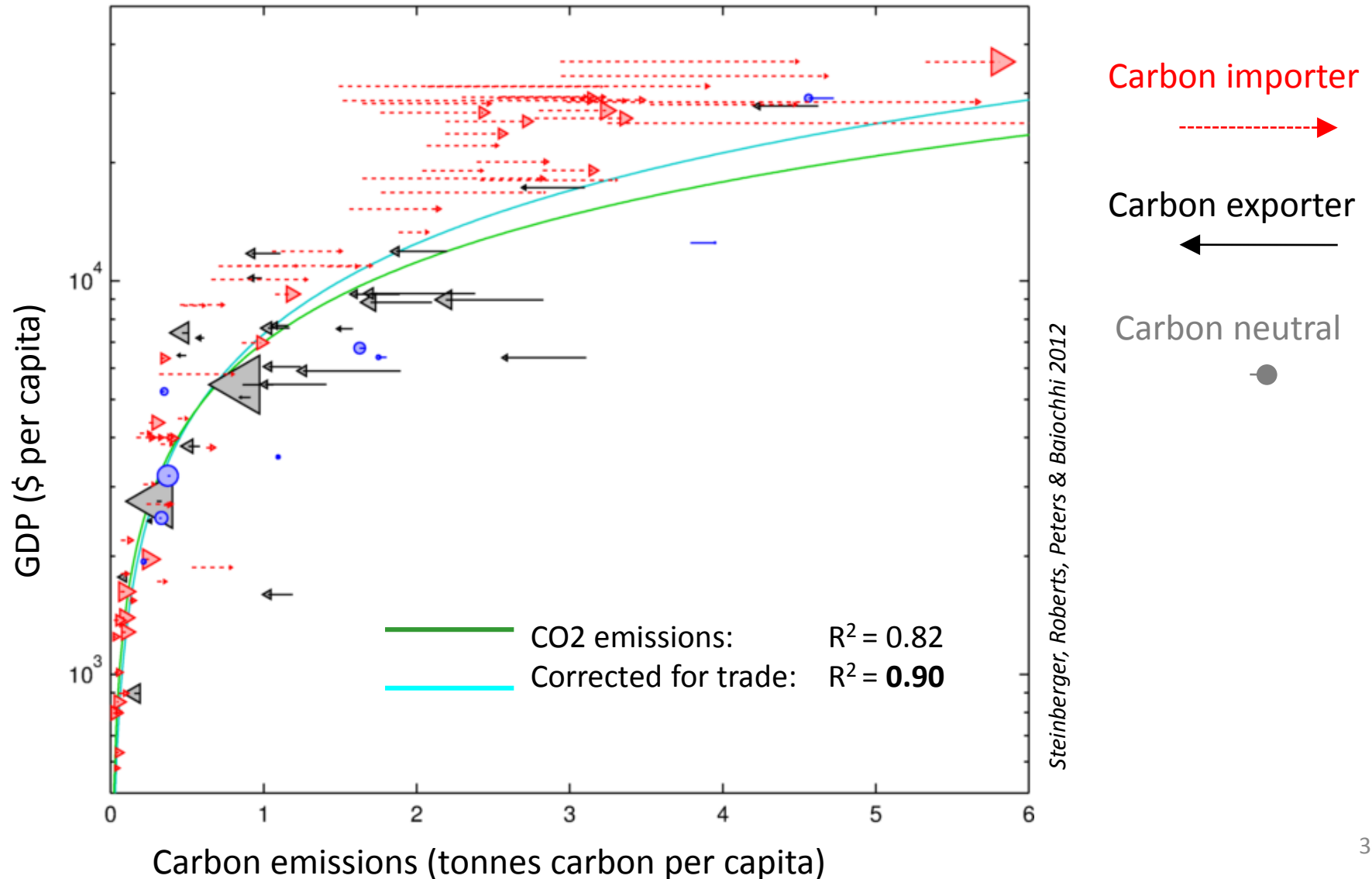
Thank you.

- Any questions?

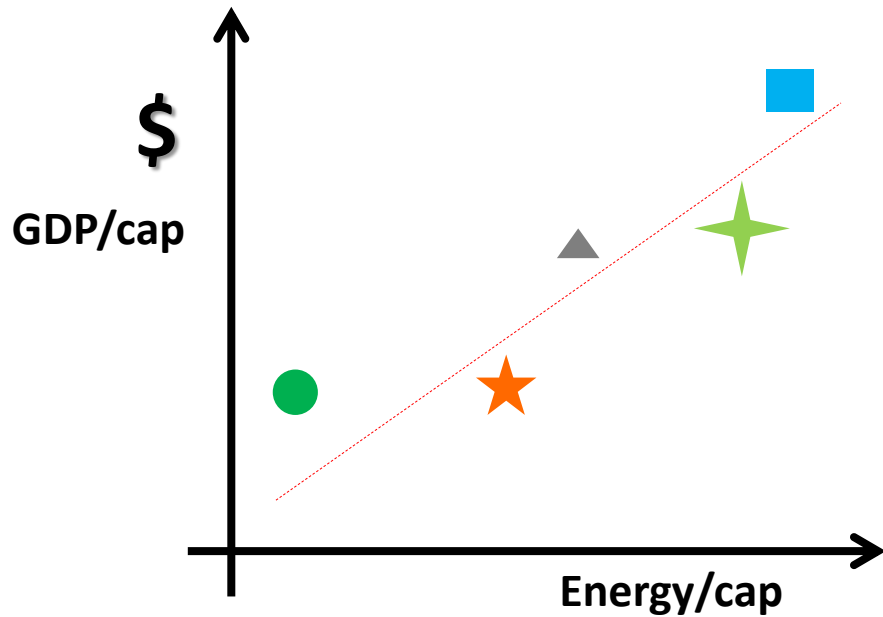
Daly ends-means framework



Income and carbon emissions: Taking trade into account



Relation between carbon/energy and human and economic development



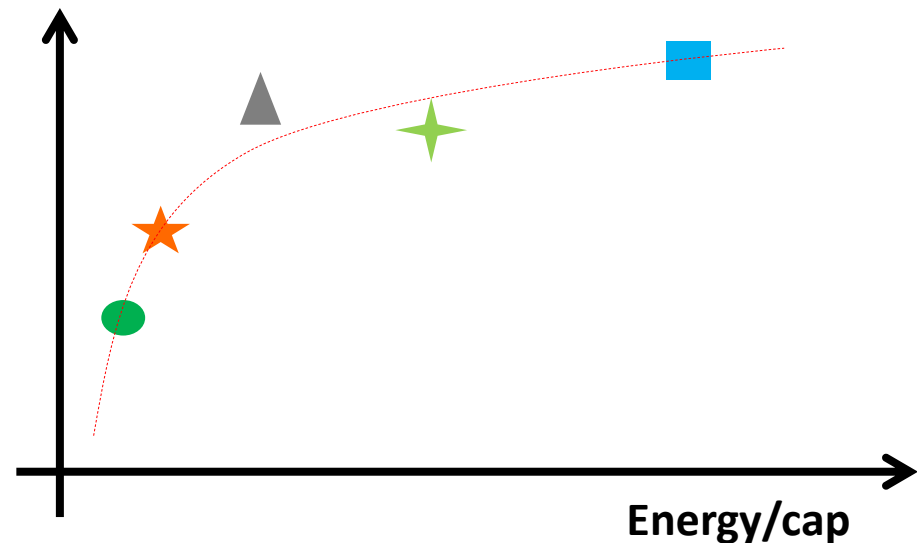
Economic development:

Linear relation with energy/carbon,
 $\log(\text{GDP}/\text{cap}) = a + b * \log(\text{EorC}/\text{cap})$



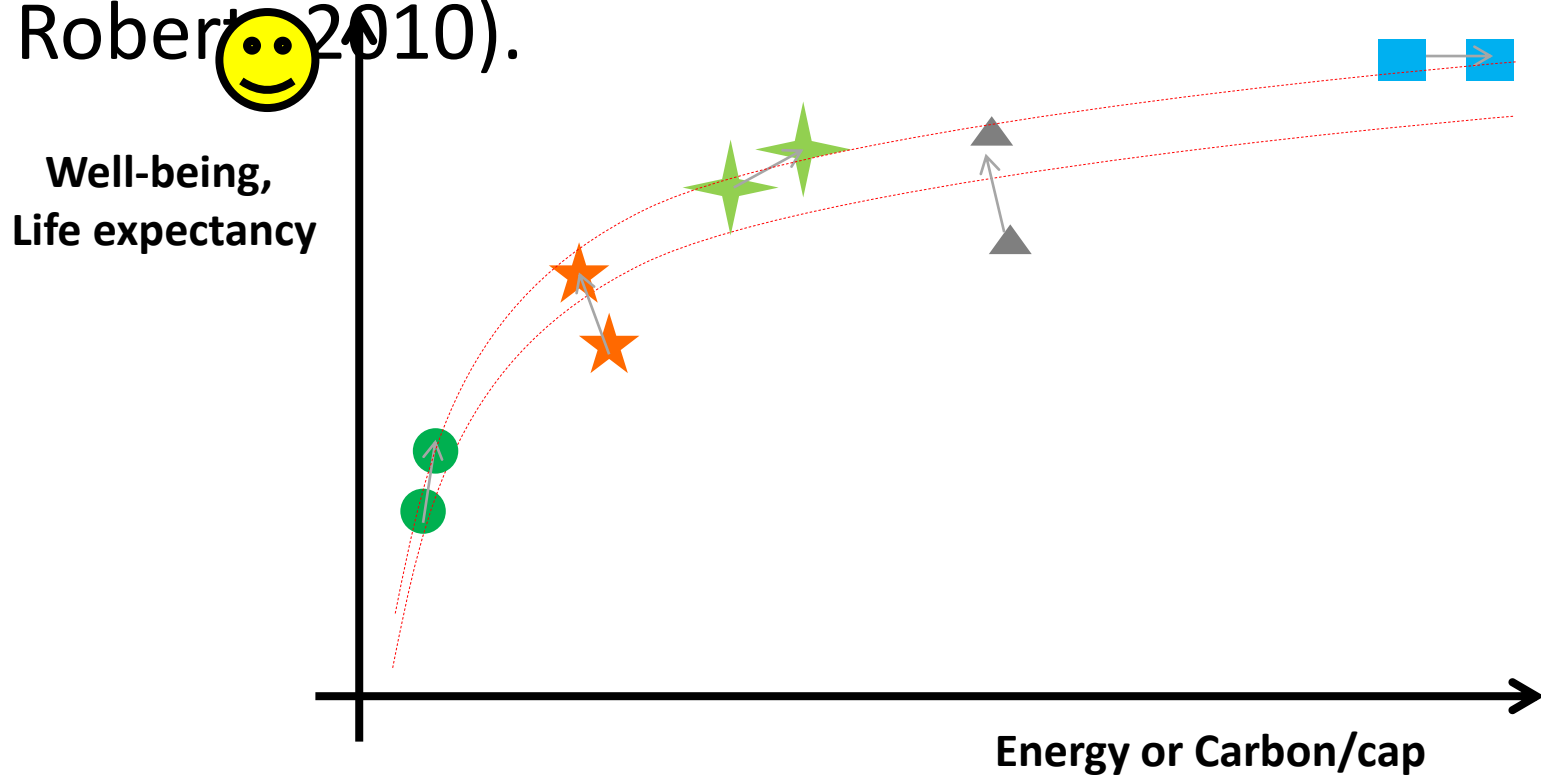
Human development/wellbeing:

Saturation relation with energy/carbon,
(slightly) more complicated function.



Dynamics of decoupling

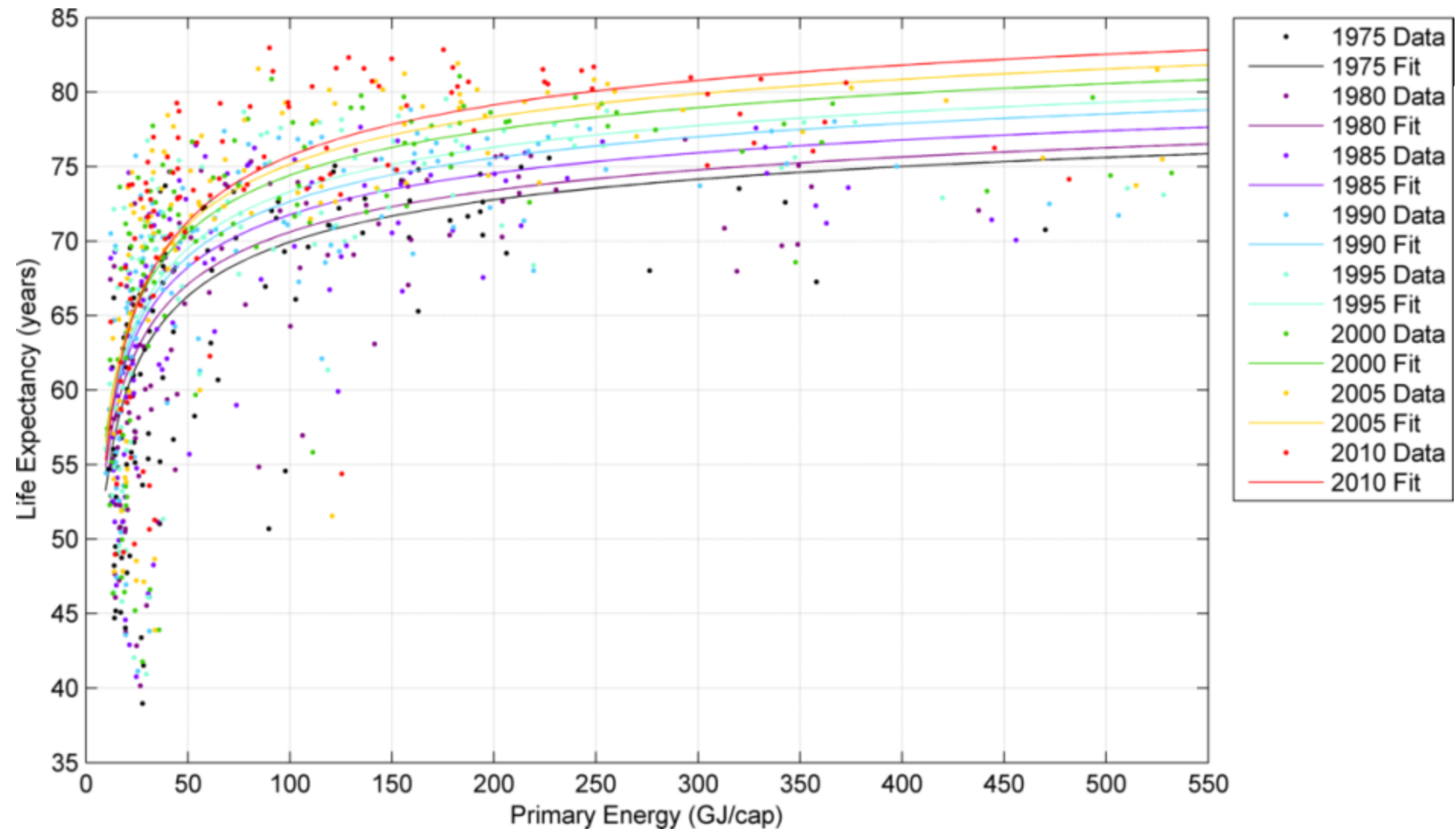
- Change in relationship over time (Steinberger & Robert  2010).



International trend \neq deterministic development pathway.

Relation between well-being and energy/carbon itself changes. ³²

How much energy is required to live a long (enough) life?



Steinberger & Roberts 2010 (data update)

Sustainability = Goldemberg's Corner

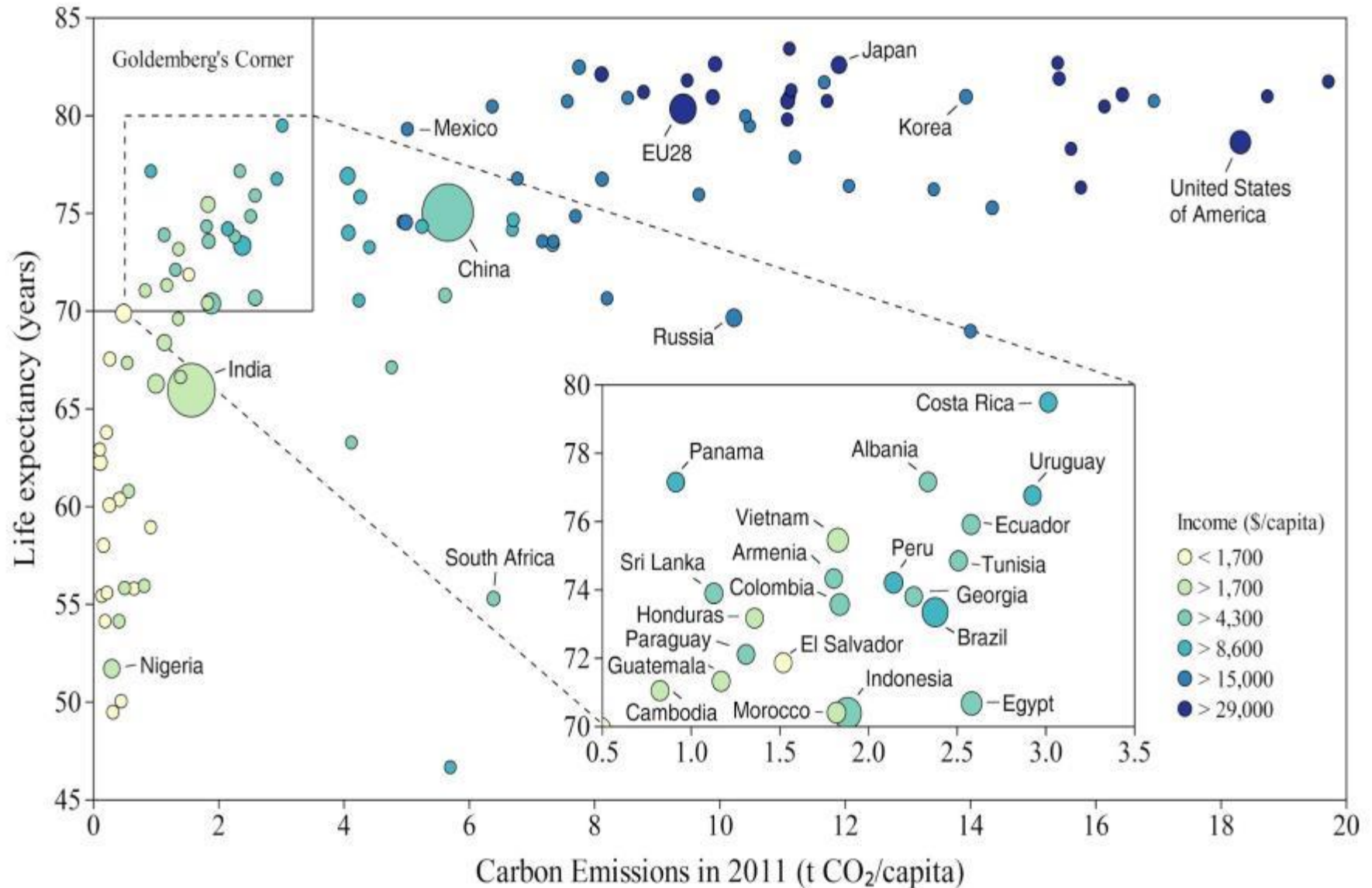


Figure W. Lamb 2015 based on Steinberger et al 2012

Is it possible for all countries to move to sustainable “Goldemberg Corner”?

- Conduct cluster analysis on drivers of carbon emissions: clusters represent groups of

| Driver | Trade-corrected CO ₂ /cap | |
|---------------------|--------------------------------------|---|
| | Cluster | Description |
| Income (GDP/cap) | 1 (20 countries) | Core: wealthy consumers |
| Climate | 2 (18 countries) | Semi-periphery: Transitioning producers |
| Export share of GDP | 3 (29 countries) | Periphery 1: moderate income and closed economy |
| Population growth | 4 (9 countries) | Periphery 2: moderate income and open economy |
| Urbanization | 5 (10 countries) | Periphery 3: least developed |
| Population density | | |

g conditions.

Result in terms of human development performance

All clusters are represented in Goldemberg Corner, except for core wealthy consumers.

