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Biomass usage and sustainable development

Insights from the *German Advisory Council on Global Change*

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Pro-poor Innovation Workshop
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Background

- 2008 flagship report of the *German Advisory Council on Global Change* (WBGU)
- "World in Transition: Future Bioenergy and Sustainable Land Use" (Earthscan, 2009)
- How can we capitalize on the potentials of bioenergy
  - to tackle both energy poverty and global warming?
  - *without compromising* food security, biological diversity and soil conservation?
- **www.wbgu.de**

  → Download → Flagship Reports

Who's talking?

- *German Advisory Council on Global Change* (WBGU):
  - est. in 1992 as an independent interdisciplinary scientific council of the federal government
    - 9 council members, appointed for 4-years-period
    - secretary-general with small secretariat in Berlin
  - analysis of global environmental and development challenges
    - flagship reports, special reports, policy papers
    - aggregating state of the art global change research
    - „early warning" regarding emergent trends and policy challenges
  - recommendations based on evaluation of sustainable development policies and identification of research gaps
  - furthering public awareness for issues of global change

Contents of 2008/2009 bioenergy report

- rationale for the use of bioenergy
- ecological and socio-economic requirements regarding the sustainability of bioenergy („guardrails“)
- Status quo analysis: bioenergy, land use, energy systems
- competing demands and expectations
  - food production, material biomass usage (e.g. wood products)
  - conservation requirements (e.g. biodiversity, water, soil)
- modelling sustainable global bioenergy potentials
- production & energetic use of biomass
- efficient use of biomass in energy systems
- synthesis: sustainable global bioenergy policies
- recommendations for policy makers and researchers

www.wbgu.de/wbgu_jg2008_engl.html

Key propositions

- bioenergy *as such* is neither good or bad
  - polarised public policy debate is unhelpful
  - need for a *global* perspective
  - need to look beyond *biofuels* for *transport*
- available *sustainable* potentials of bioenergy should be utilized indeed!
  - as long as threats to sustainability can be precluded
    - notably regarding food security
    - protection of vital ecosystems
    - mitigation of climate change

Relevant to transform global energy system

- at the nexus of climate change and development
- need for sustainable bioenergy
  - as a „bridge“ to substitute fossil energy
  - concerns two major drivers of climate change
    - global energy systems
    - global land use change (agriculture, forestry)
- access to energy under conditions of poverty
  - modernisation of traditional biomass usage
    - potentially quick, relatively cheap, and with great scope
  - electricity and heat at household level
    - small- and medium-scale solutions are available
    - decentralized technologies are viable, no dependence on large grids

Twofold utility of bioenergy

- mitigation of climate change
  - substitution of fossil energy, in particular coal
  - reduction of greenhous gas emissions
  - potentially even sequestration of carbon
- poverty reduction and development
  - curb energy poverty
  - modernise traditional forms of energy usage
  - avoid or decrease health risks
  - reduce pressure on ecosystems
    → protect ecosystem services that are key to development

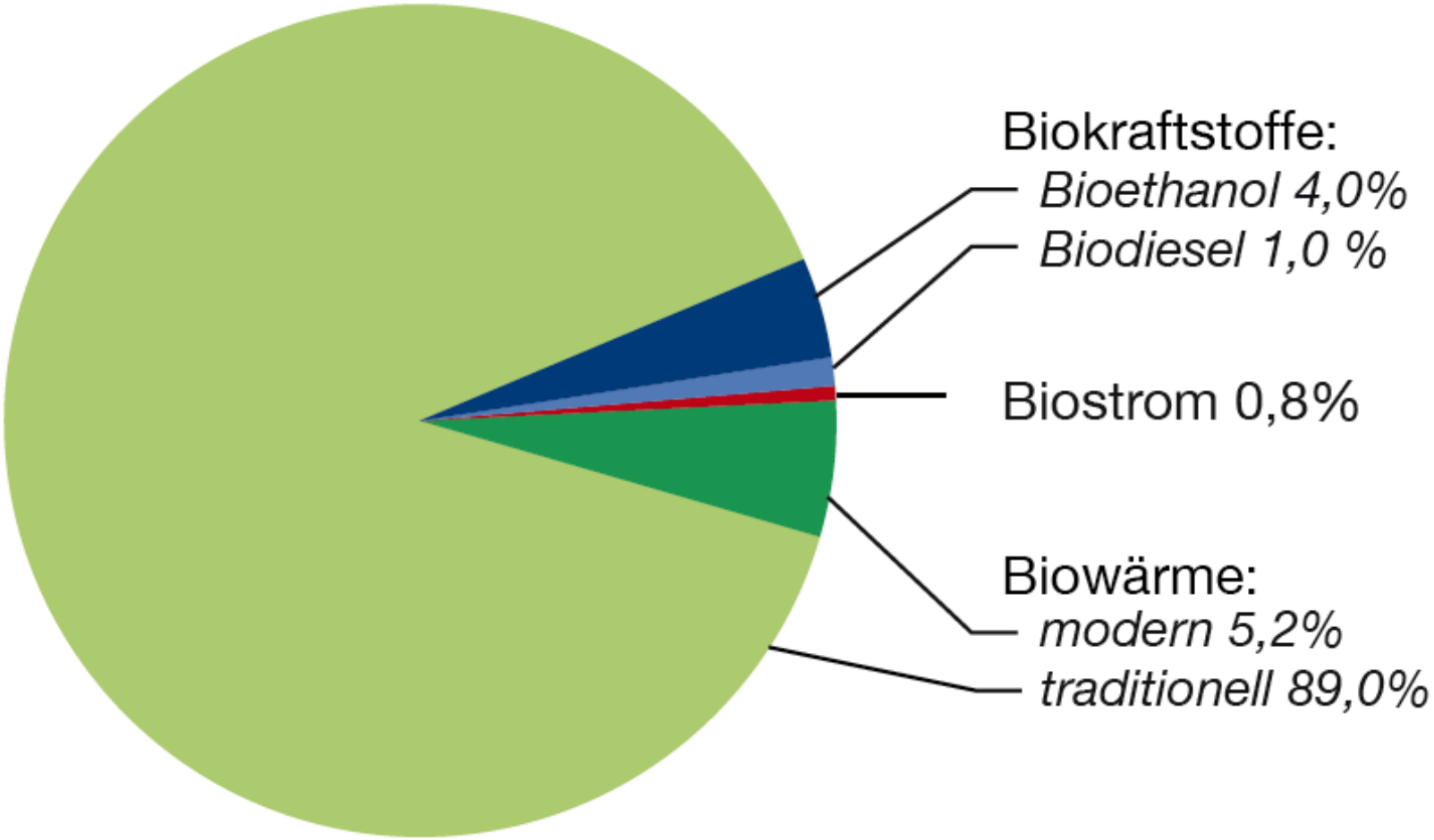
Three “sources” of bioenergy

- energy crops
  - fuel for transport: 2,2% of global bioenergy usage
  - large technical potentials (30-120 EJ p.a.)*
  - best results: generation of electricity, NOT as fuels for transport
  - risks & trade-offs: food production, nature conservation, etc.
- bio-wastes and residues
  - considerable technical potentials, yet limited knowledge
  - economic viability, importance for soil conservation
- „traditional“ biomass usage
  - roughly 10% of global consumption of primary energy
  - roughly 40% of world population depend on it
  - low efficiency, high pressure on ecosystems
  - adverse health impacts

*1 Exajoule = 10^{18} Joule

Global Bioenergy Usage

Power, Electricity, Heat



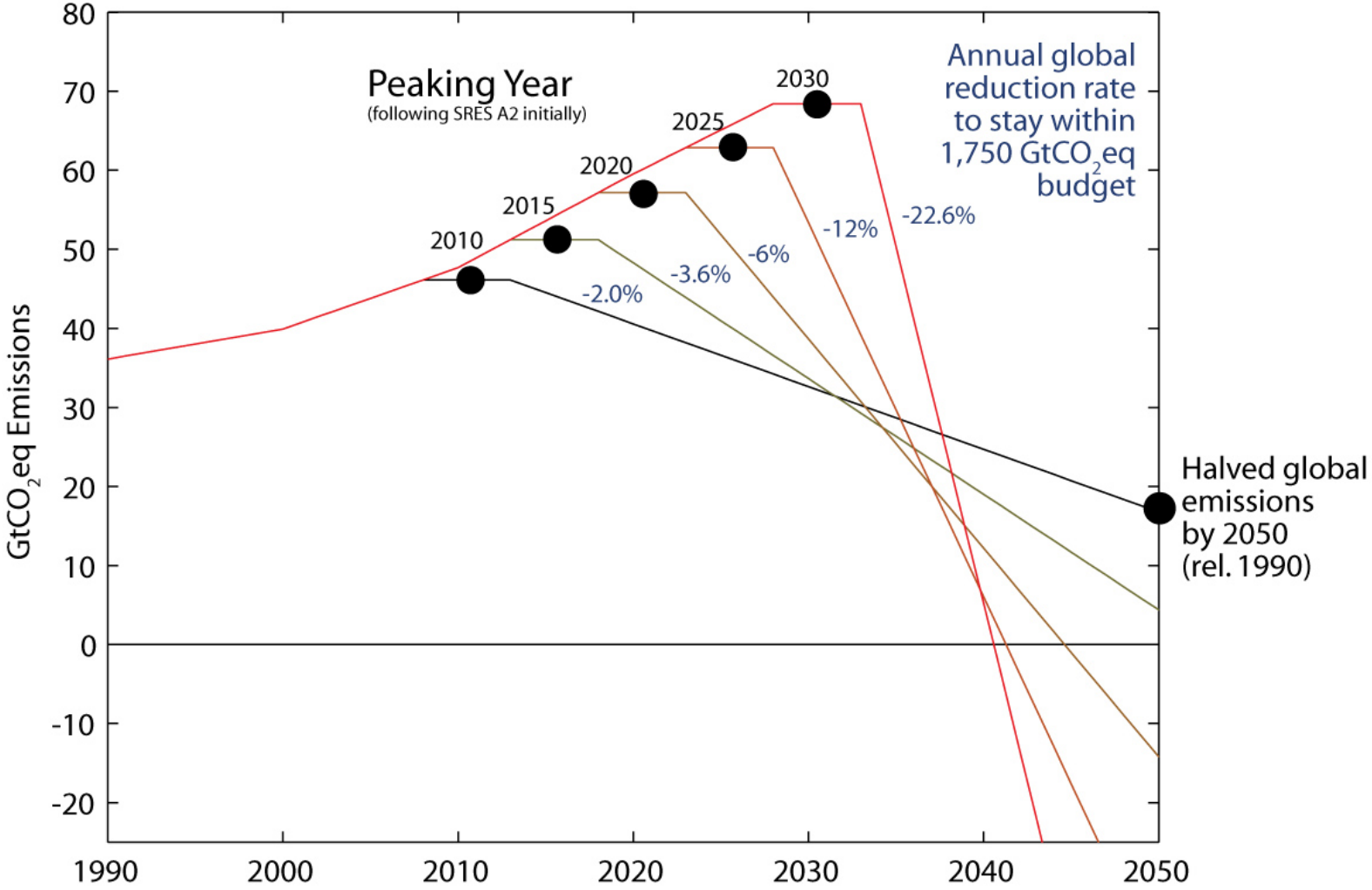
Quelle: BP 2008; REN21 2008; GWEC 2008

Urgency to mitigate climate change

- paramount importance
- anthropogenic global warming is accelerating
- while emissions are still increasing
- catalytic feedbacks & increasing risk of „tipping points“
- severe implications for adapation capacities, development prospects and human security

- all mitigation potentials must be tapped, including bioenergy: every ton counts!

Low Carbon Development: time is tight!



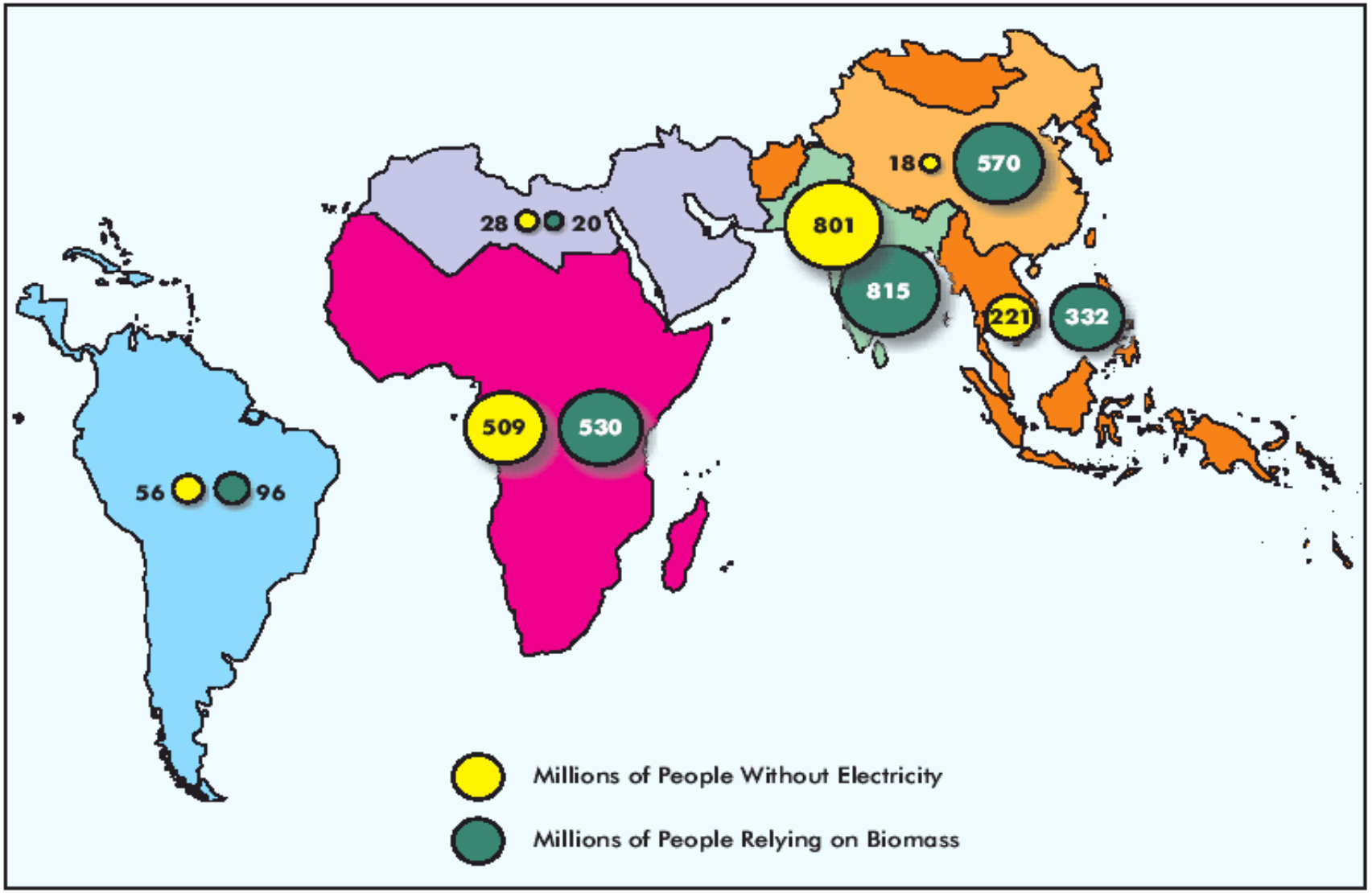
Quelle: PIK 2009

Reduction of GHG through biomass usage

- common assessments (e.g. EU guideline):
  - relate GHG potential to net energy
  - ignore required quantities of biomass
- limiting factor of sustainable bioenergy is
  - not energy demand, which could be potentially substituted
  - but supply of biomass that qualifies as sustainable
- comparative assessments of mitigation potential must consider
  - spatial requirements for biomass production
  - quantitiy of biomass required for energy production
  - basis for development of reasonable standards

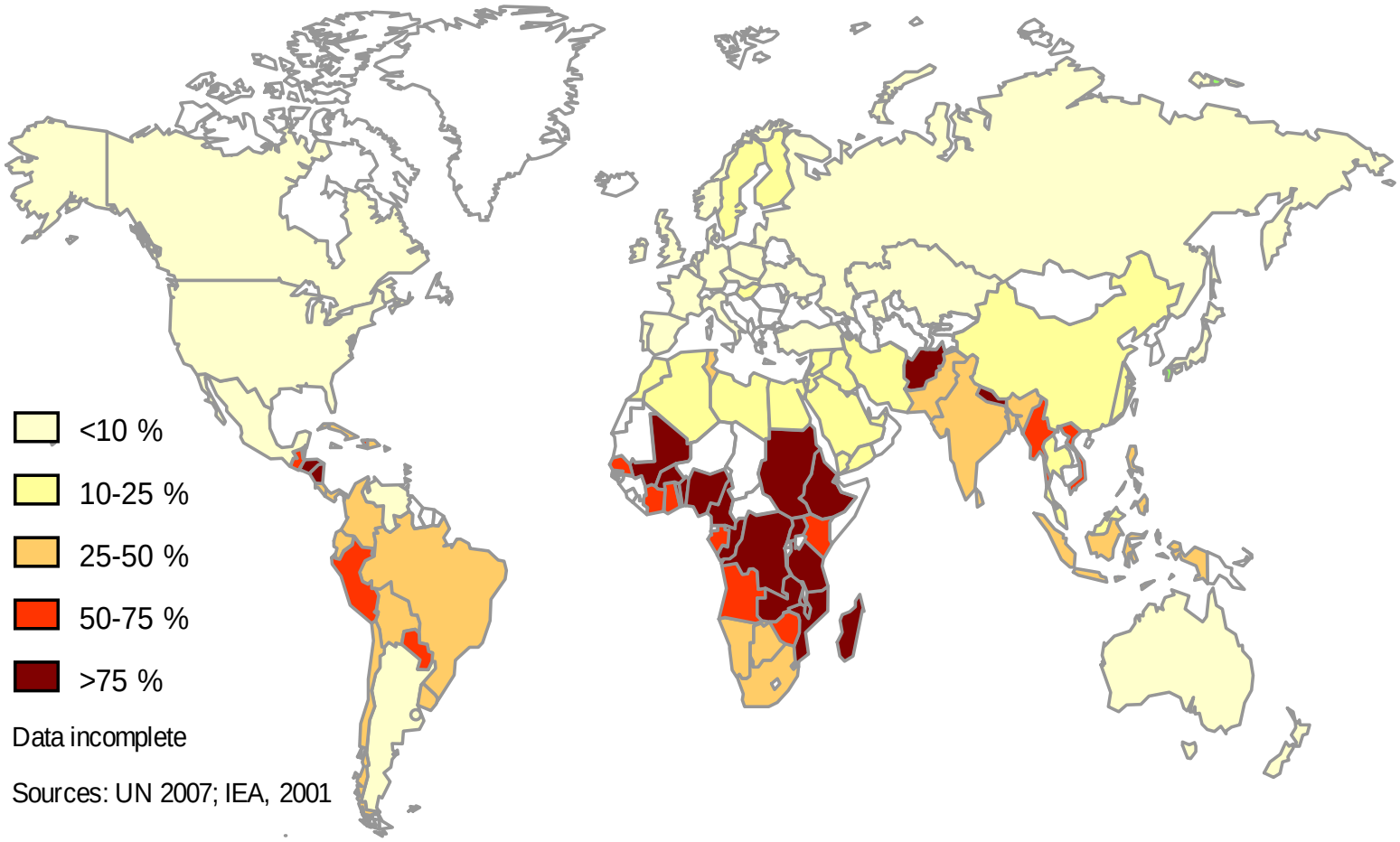
(WBGU 2009: ch. 9.2.1.1)

Energy poverty in developing regions



2.5 billion people depend exclusively on traditional biomass usage for cooking!

SHARE OF TRADITIONAL BIOMASS IN PRIMARY ENERGY CONSUMPTION



Modernising biomass usage is pro-poor!

- access to energy = precondition to fight poverty
- benefits of modernised biomass usage are undisputed:
  - improved cooking stoves → increase energy efficiency x 2-4
  - saving fuelwood → reduces pressure on ecosystems
  - slows down local deforestation → less emissions, soil conservation
  - less indoor air pollution → avoids adverse health impacts
  - reduces opportunity costs (e.g. education)
- considerable leverage to significantly improve livelihoods of hundreds of millions quickly and at low cost!

The case of Uganda

- high dependence on traditional biomass usage
  - 93% primary energy = traditional biomass
  - 82% fuelwood, 6% charcoal, 5% residues
  - 80% household energy (notably cooking)
- potential for modernisation
  - 85% rural population → 3-stone-fires
  - 2001: 2,7% households with improved cooking stoves
  - 2007: 8% households (note: population growth!)
  - supported, among others, by EUEI and GTZ
- conclusion
  - considerable success story
  - yet plenty of room for improvement!
  - replication elsewhere?

Pro-poor opportunities of biomass usage

- improved energy efficiency in traditional usage
  - essential to curb energy poverty
  - e.g. improved stoves for wood and charcoal usage
- energy crops on degraded land
  - limited yields, but...
  - improve soil quality
  - avoid degradation and desertification
  - potential source of income
- decentral generation of electricity
- diffusion of adequate technologies
  - improved stoves, small-scall biogas plants
  - local production and usage of fuel (e.g. Jatropha)
  - appreciation of residues and wastes

Potential trade-offs of bioenergy

- food security: land use conflicts, price effects
- biological diversity: monocultures, deforestation
- soil & water: degradation, overconsumption
- climate: additional emissions from land use change

Sustainability standards for bioenergy
(minimum requirements according to WBGU)

- net-emissions reduction („life cycle“)
  - min. 30t CO2eq per TJ of used primary biomass
  - including direct and indirect land use changes
- avoidance of indirect land use change
- conservation of protected areas & areas of high ecosystems value
- conservation of soil quality and soil fertility
- sustainable usage of residues (notably in forestry)
- sustainable water management
- consistent application of precautionary principle with regard to GMOs
- adherence to norms and standards of ILO

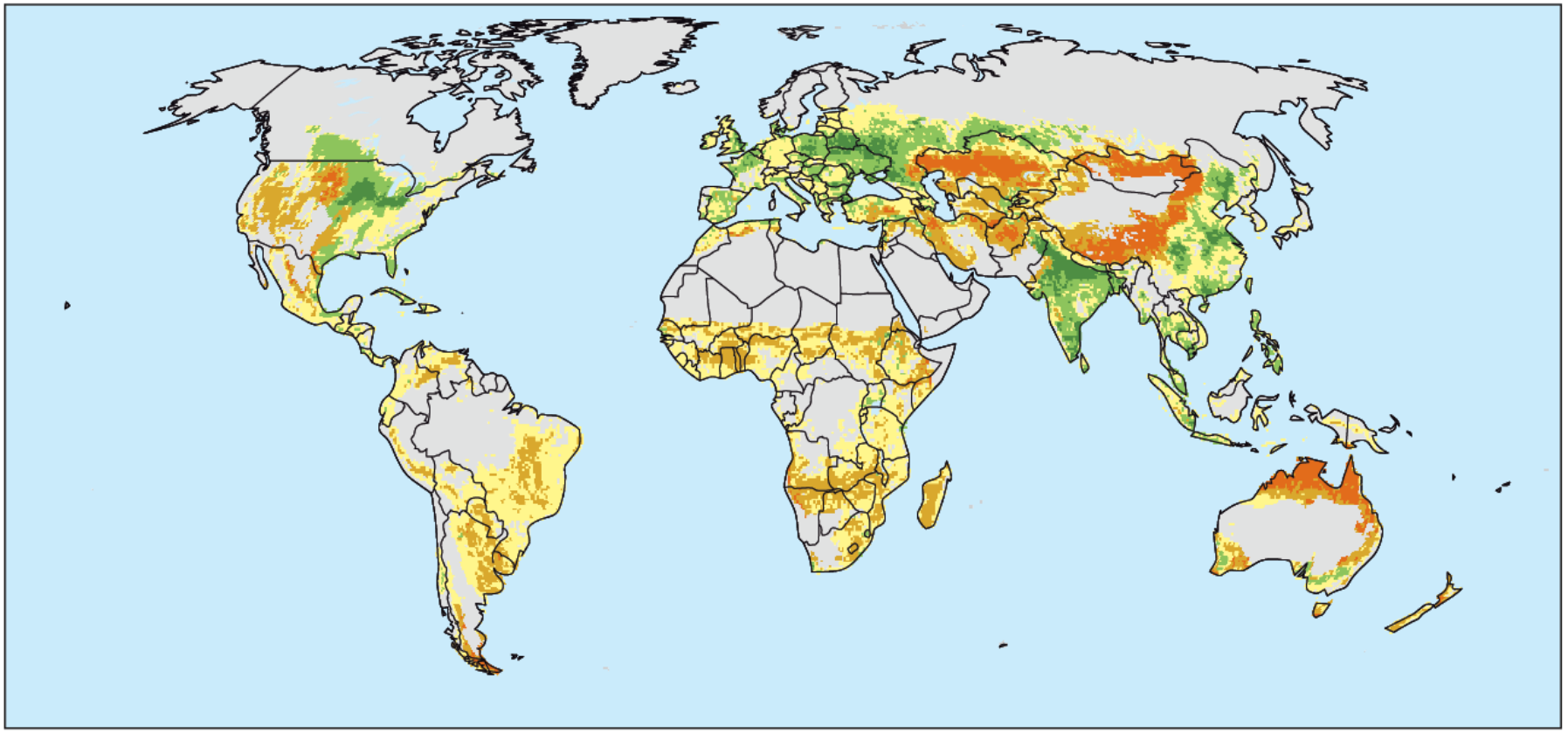
Required framework conditions to realize *technical* potentials of bioenergy

- suitable political environment, inter alia
  - minimum level of security and political stability
  - minimum capacity for political regulation and law enforcement
  - Proxy: *Failed State Index*
- suitable economic environment, inter alia
  - minimum level of investment
  - adequate infrastructure and logistical capacities
  - Proxy: *Global Competitiveness Index*

Global technical bioenergy potentials

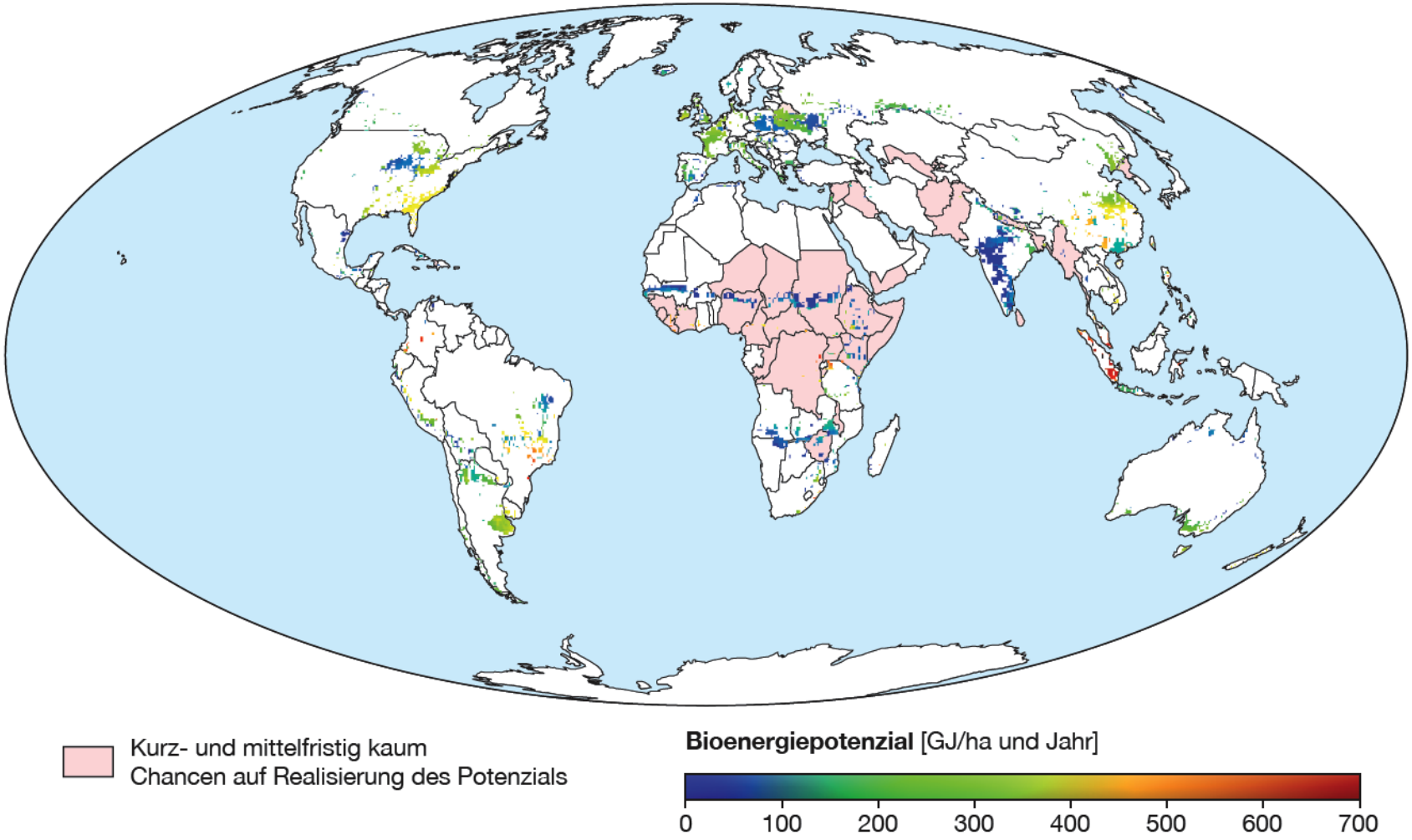
- WBGU model for sustainable bioenergy excludes:
  - spaces required to protect **biological diversity**
  - agricultural space to warrant **food security**
  - spaces that are indispensable as **carbon sinks** (notably rainforests and wetlands)
- even so:
  - roughly **10% of global energy demand** could be met!
  - mostly in Latin America and the Carribean (22-24%)
  - considerable technical potentials also in Africa, South Asia and other developing regions

Land used for agricultural purposes



Quelle: UNEP 2007

Bioenergy potentials & fragile states



Quelle: WBGU 2008

Bioenergy: “Think Global, Act Local!”

- **global perspective**
  - in principle indispensable to help mitigate climate change
  - yet, few „across-the-board“ recommendations can be made
- **local context**
  - case-by-case assessment at local level
  - suitable technologies: acceptance, capacities?
  - usage with maximum mitigation potential
  - e.g. energy crops for transport or electricity?
    - China: predominantly fossil production of electricity
    - Uganda: electricity mostly from hydropower

Key Recommendations

1. **No promotion or subsidies for biofuels for transport**
   - including „second generation“ biofuels
2. **Promote electricity generation from sustainable biomass**
   - substitution of coal-based electricity
3. **Develop and implement effective global standards**
   - both for production and usage of biomass (EU → G20 → UN)
   - institutional interlinkages with international climate policy
4. **Partnerships to pursue integrated joint strategies**
   - sustainable bioenergy + food security + agriculture
   - policy coherence and credibility as keys to success

Pro-Poor Recommendations

1. Curb energy poverty

- transformation of traditional biomass usage by 2030
- anchor fight against energy poverty with MDGs
- prioritize through integration in PRSPs

2. Further transformation of global energy policies

- „Big Push“ for diffusion of efficient stoves, biogas plants etc.
- increase acceptance for decentralised modern energy systems
- build capacities to maintain decentralised modern energy systems
- provide suitable microfinance

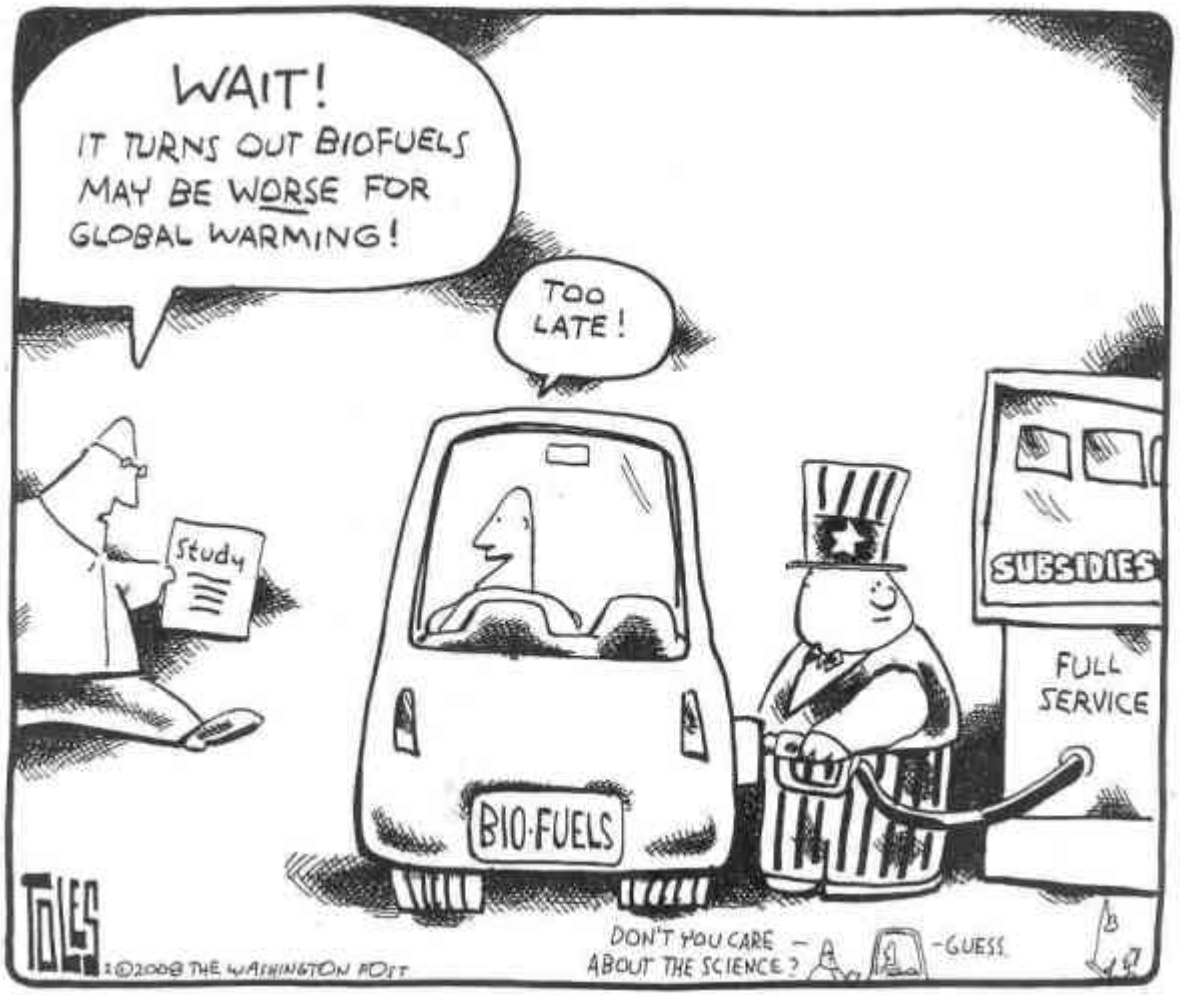
3. Exploit issue linkages with international climate policy (UNFCCC)

- rectify and adjust Kyoto-style greenhouse gas accounting
- include and facilitate small-scale CDM-projects

The Future Challenge: “peak soil”

- future land use conflicts reach beyond „food vs. fuel“
  - global population dynamics require increased food production
  - meat consumption is on the rise globally
  - biomass demand is rising for material usage, too (peak oil + low carbon)
  - net-loss of arable land seems probable as a result of climate change and desertification → decreasing yields?
  - land requirements for nature conservation & protection of ecosystem services
- energy-agriculture only advisable as a temporary „bridge“
  - cultivation of energy crops should decrease by 2050
  - high potential for land use conflicts to escalate at local levels
- **Need for effective and fair global land use management**
  → emerging challenge for global governance!

Thank you!



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