International Institute for Applied Systems Analysis
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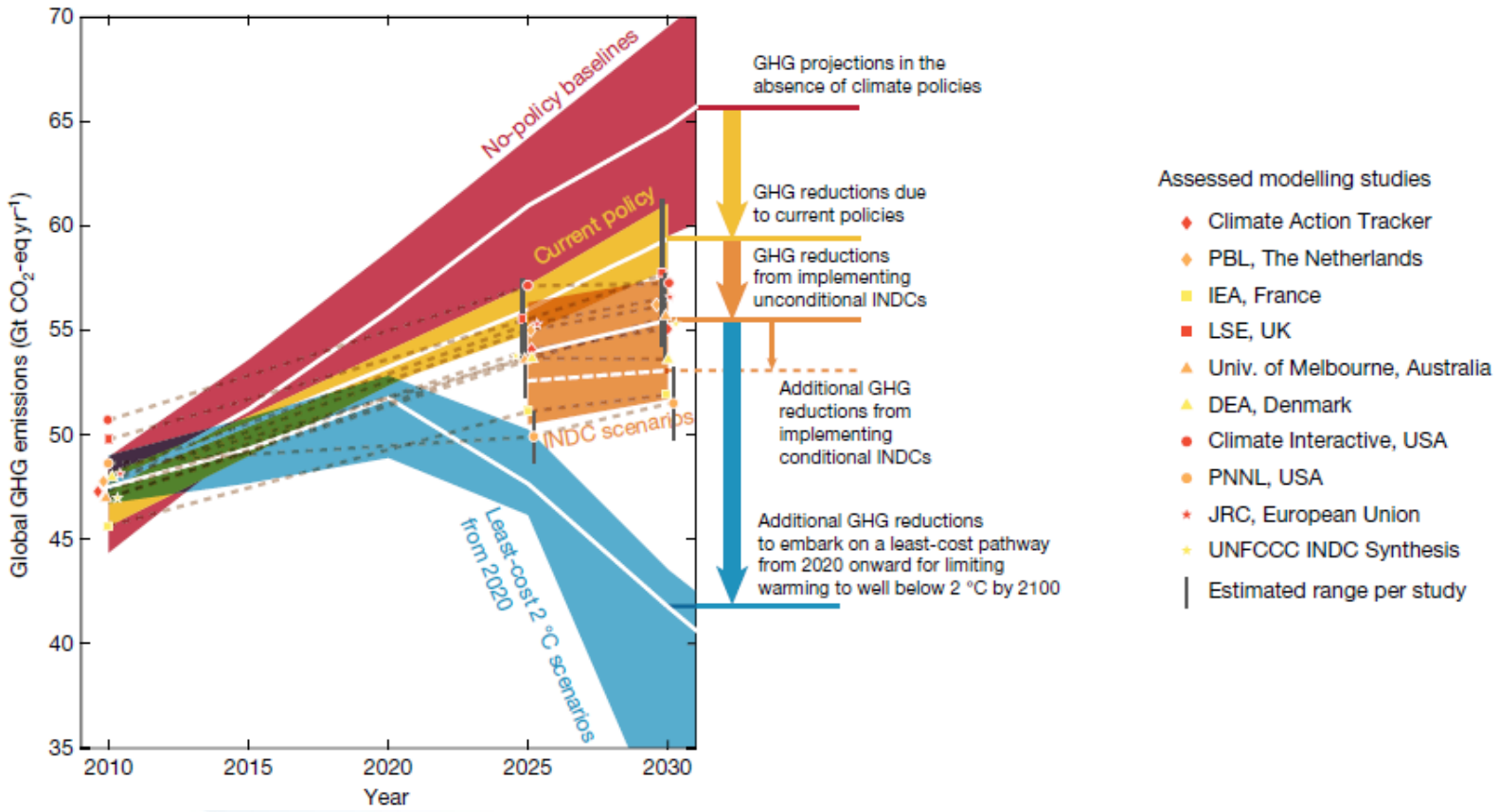
science for global insight

Interactions among the SDGs and NDCs - What has been learned about interaction effects between SDGs and Mitigation Policies?

Keywan Riahi, Volker Krey
IIASA, Austria

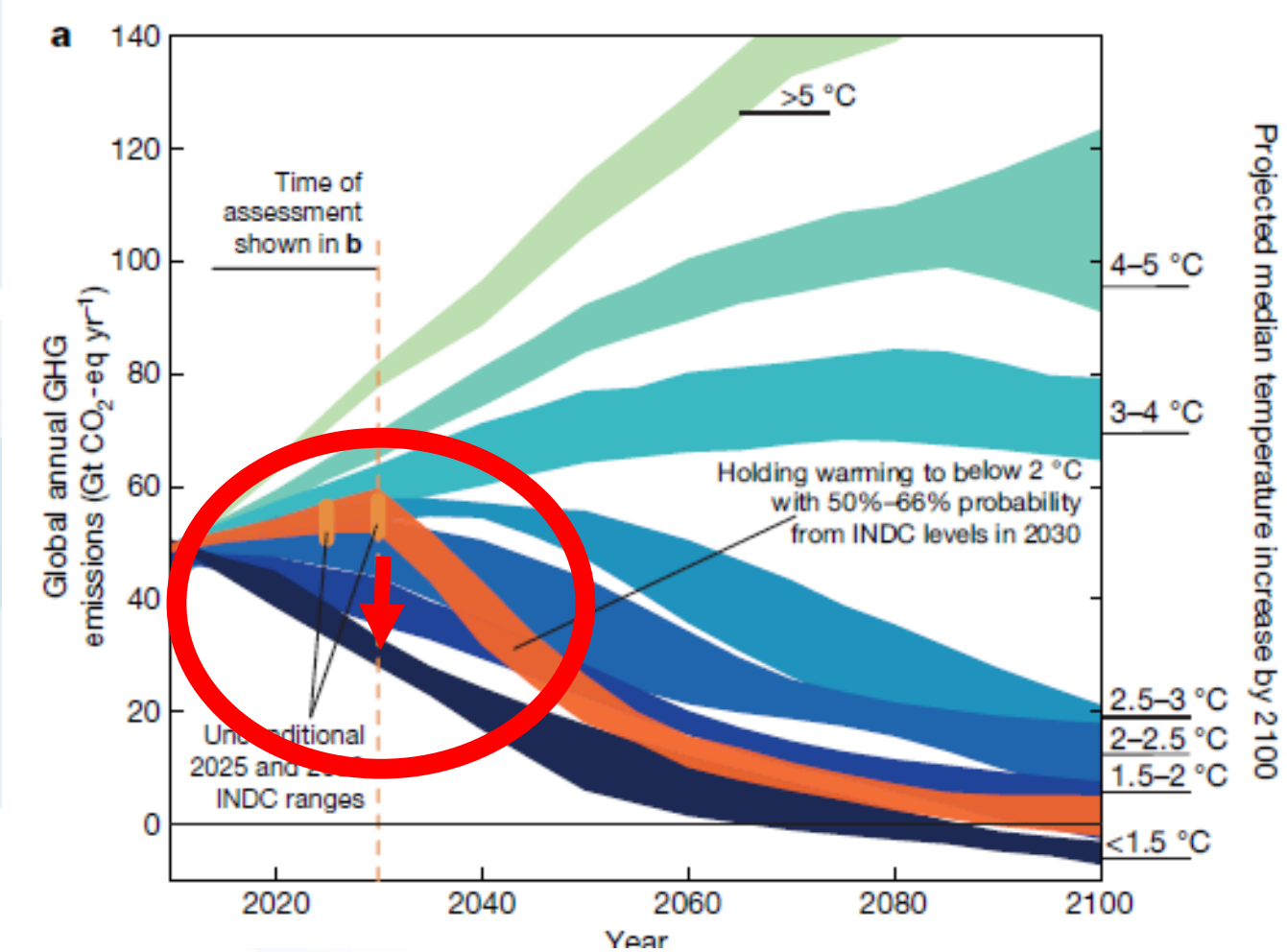
Snowmass: Assessing Transformation Pathways Post-Paris and Implications for IA Research - 20 July 2016

Effect of the INDCs on GHG Emissions



Rogelj et al, Nature, 2016

INDCs are clearly not consistent with 1.5C or 2C



Rogelj et al, Nature, 2016


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
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SUSTAINABLE DEVELOPMENT GOALS


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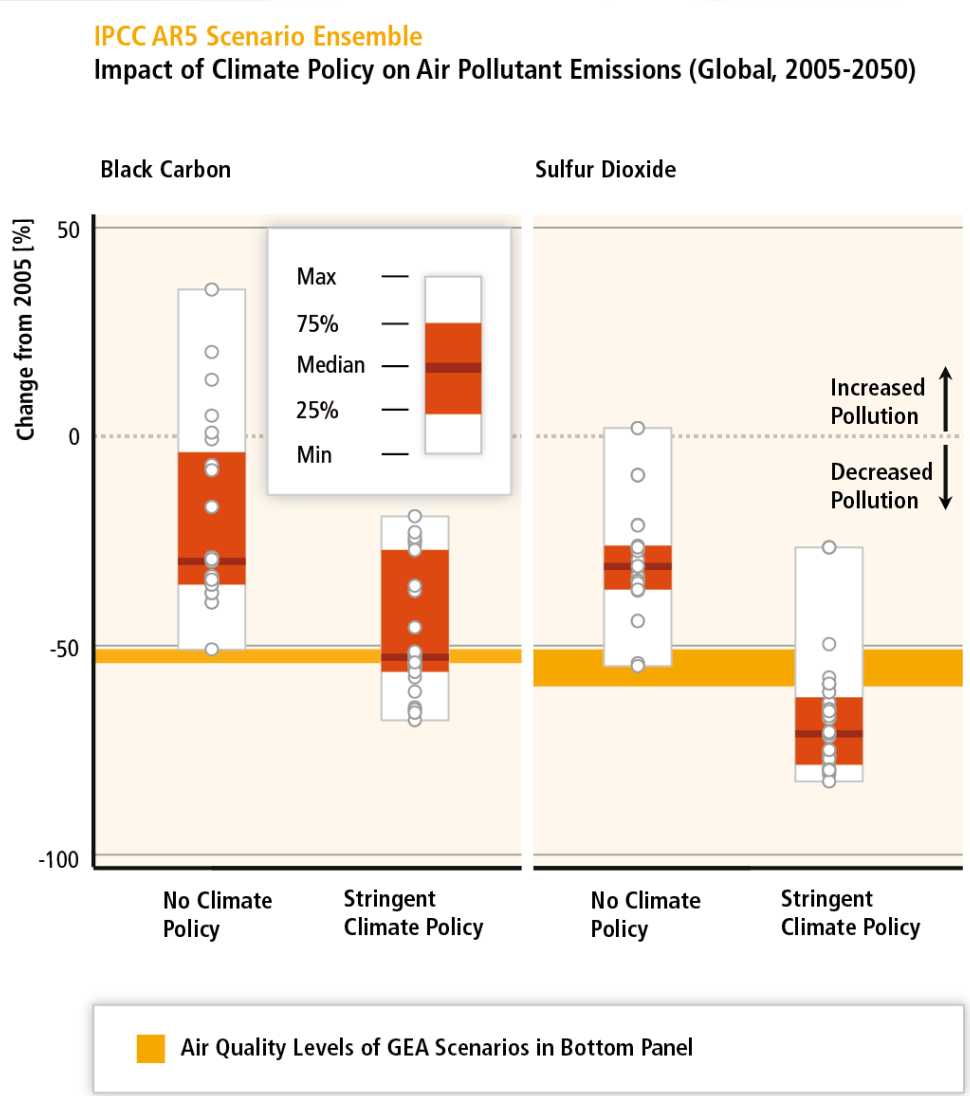
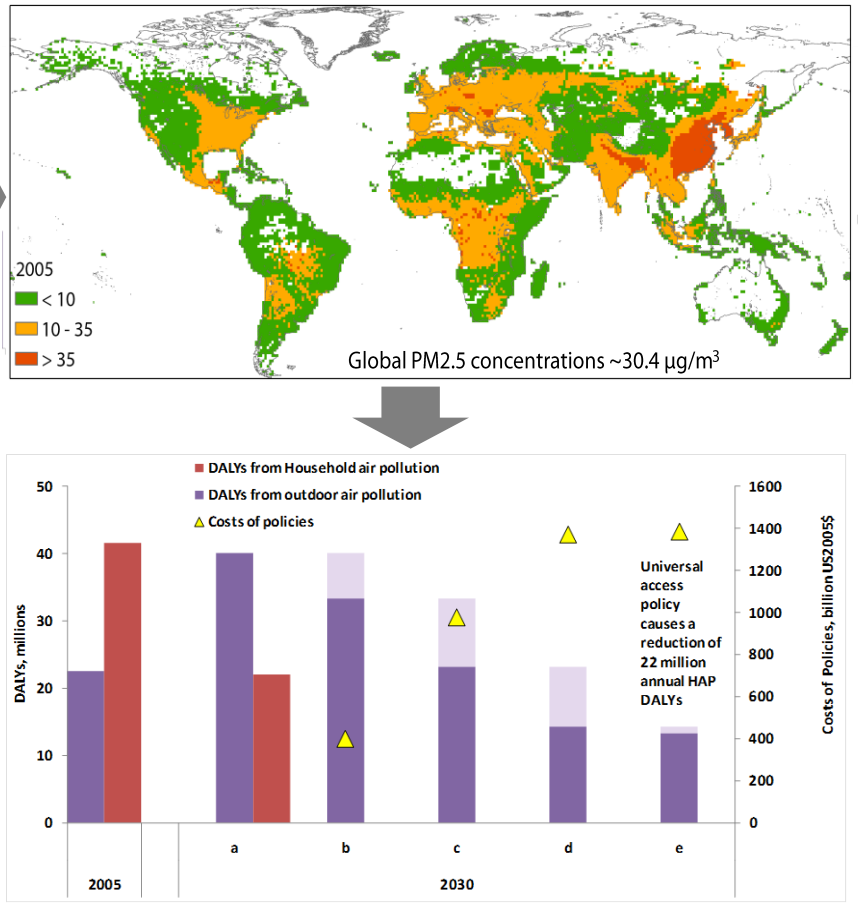
SUSTAINABLE DEVELOPMENT GOALS

Air Quality and Health

Air Quality Co-Benefits



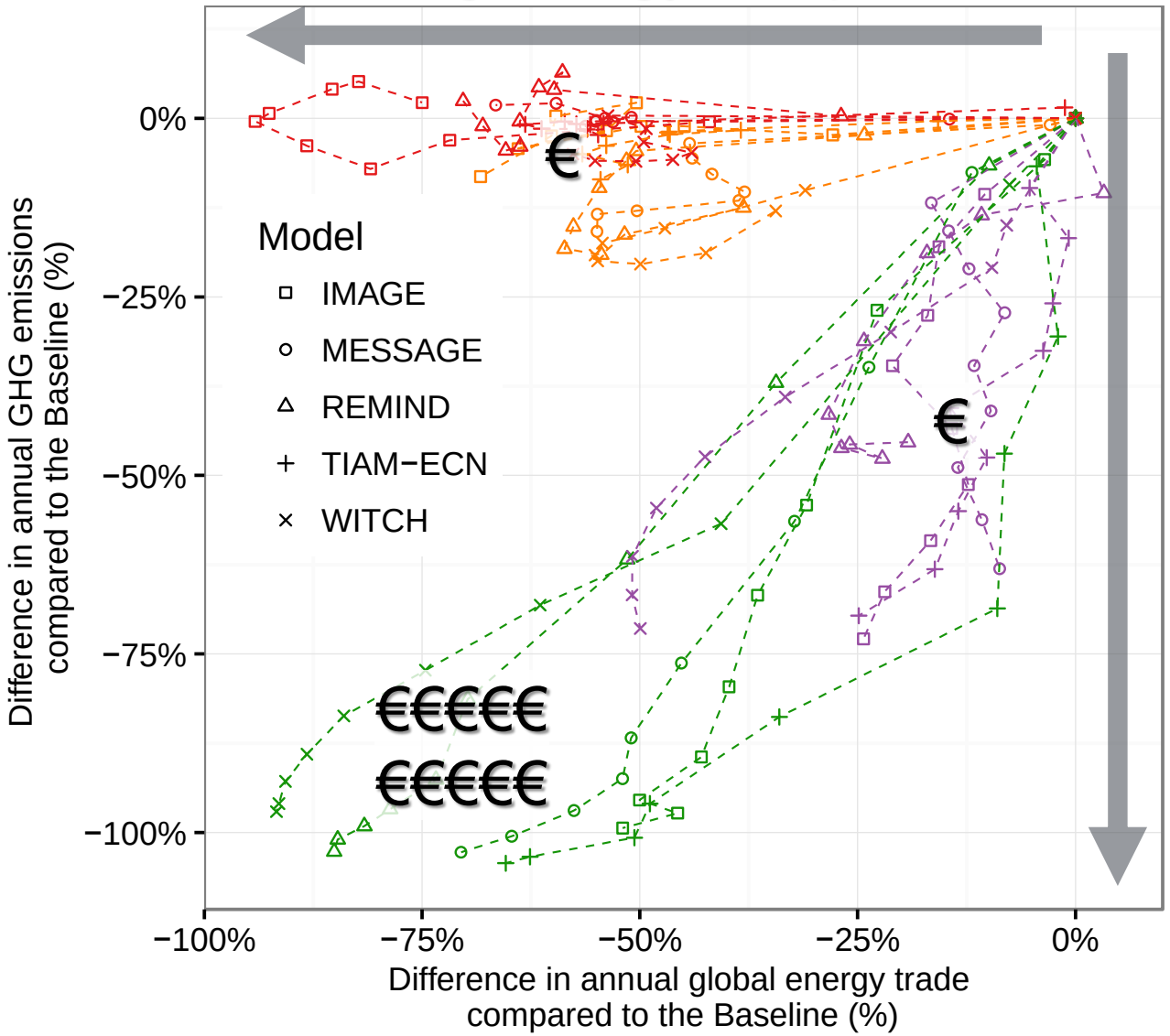


Source: IPCC WGIII AR5, Figure SPM.6/6.33

Source: Rao, Pachauri et al., 2013

Energy Security

increasing energy independence



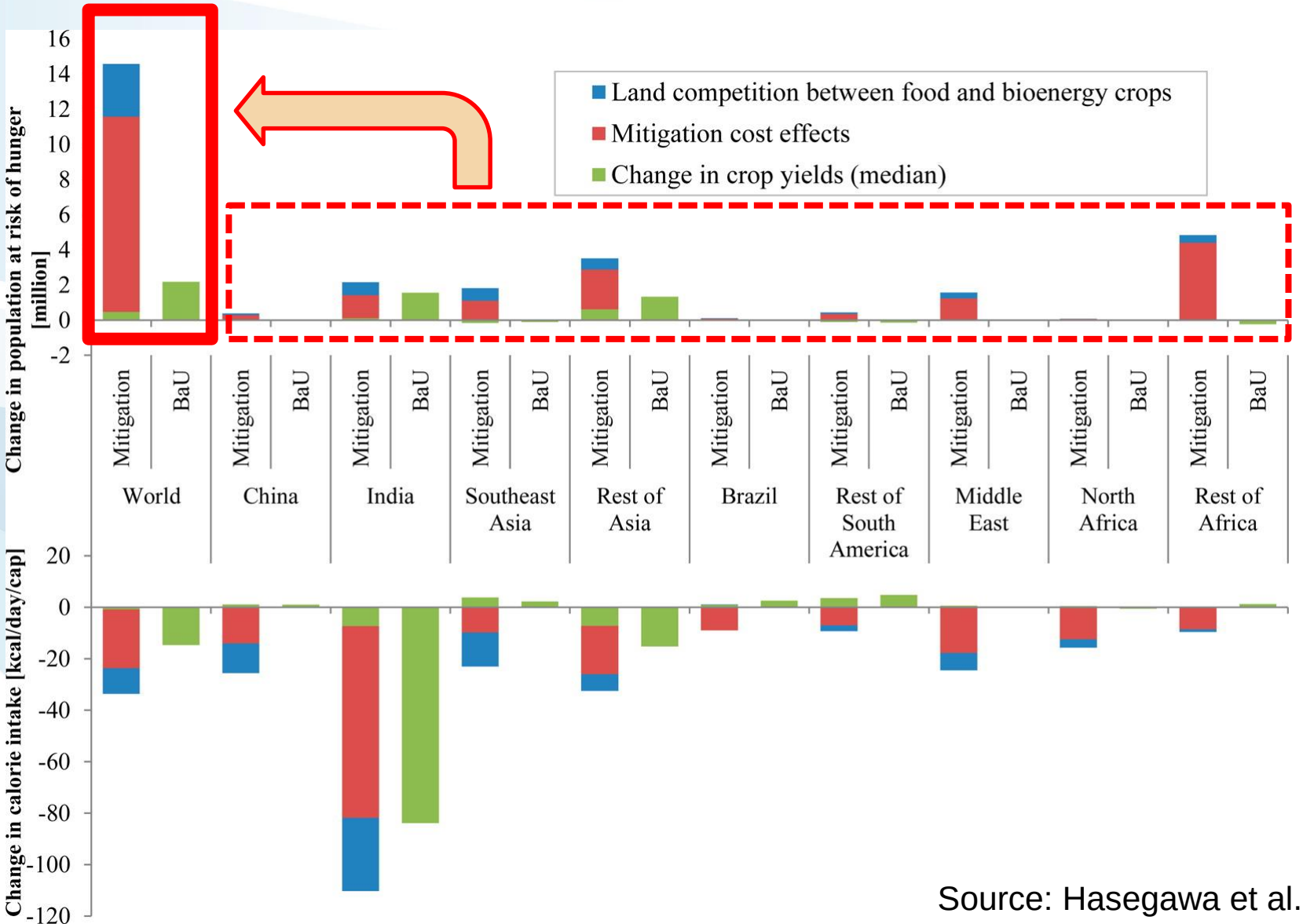
increasing climate protection

- 2ºC
- Climate Pledges
- Energy independence
- Oil independence

Source: Jewell et al. 2016, Nature Energy

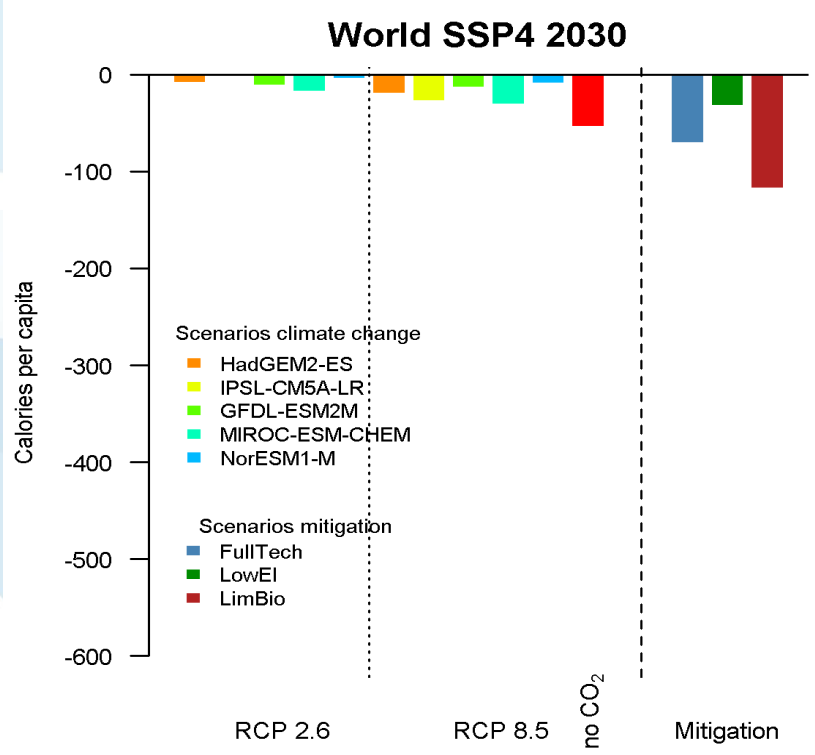
Food Availability

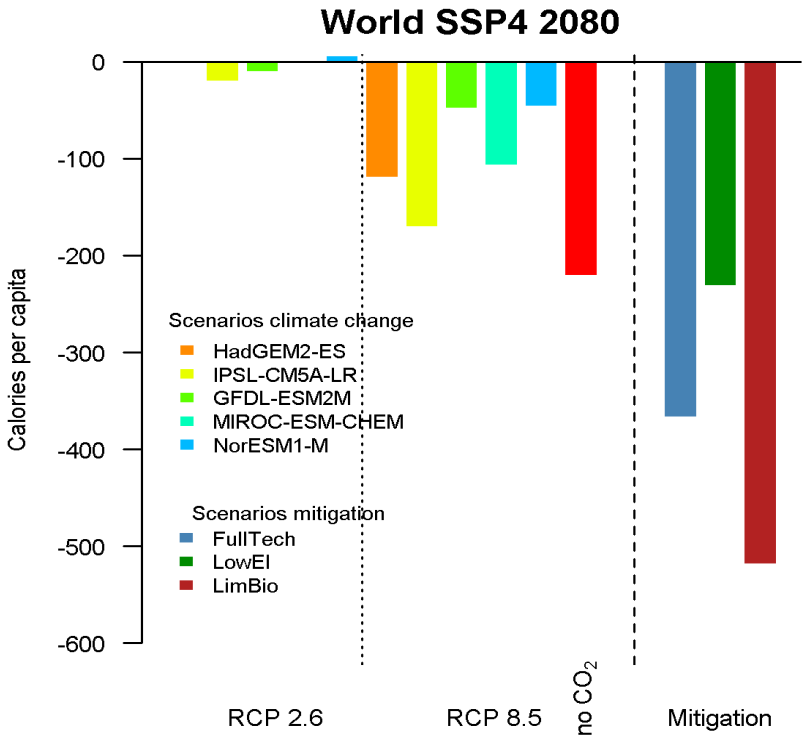
Food availability and hunger



Source: Hasegawa et al. 2015

Food availability





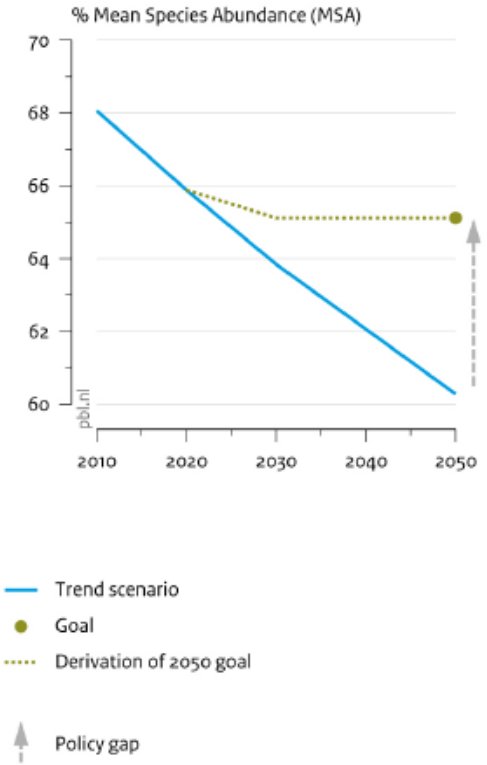
Source: Havlík, Valin et al. 2015, WB

Biodiversity

Technical potential exists…. Food and biodiversity

Global biodiversity and options to prevent biodiversity loss

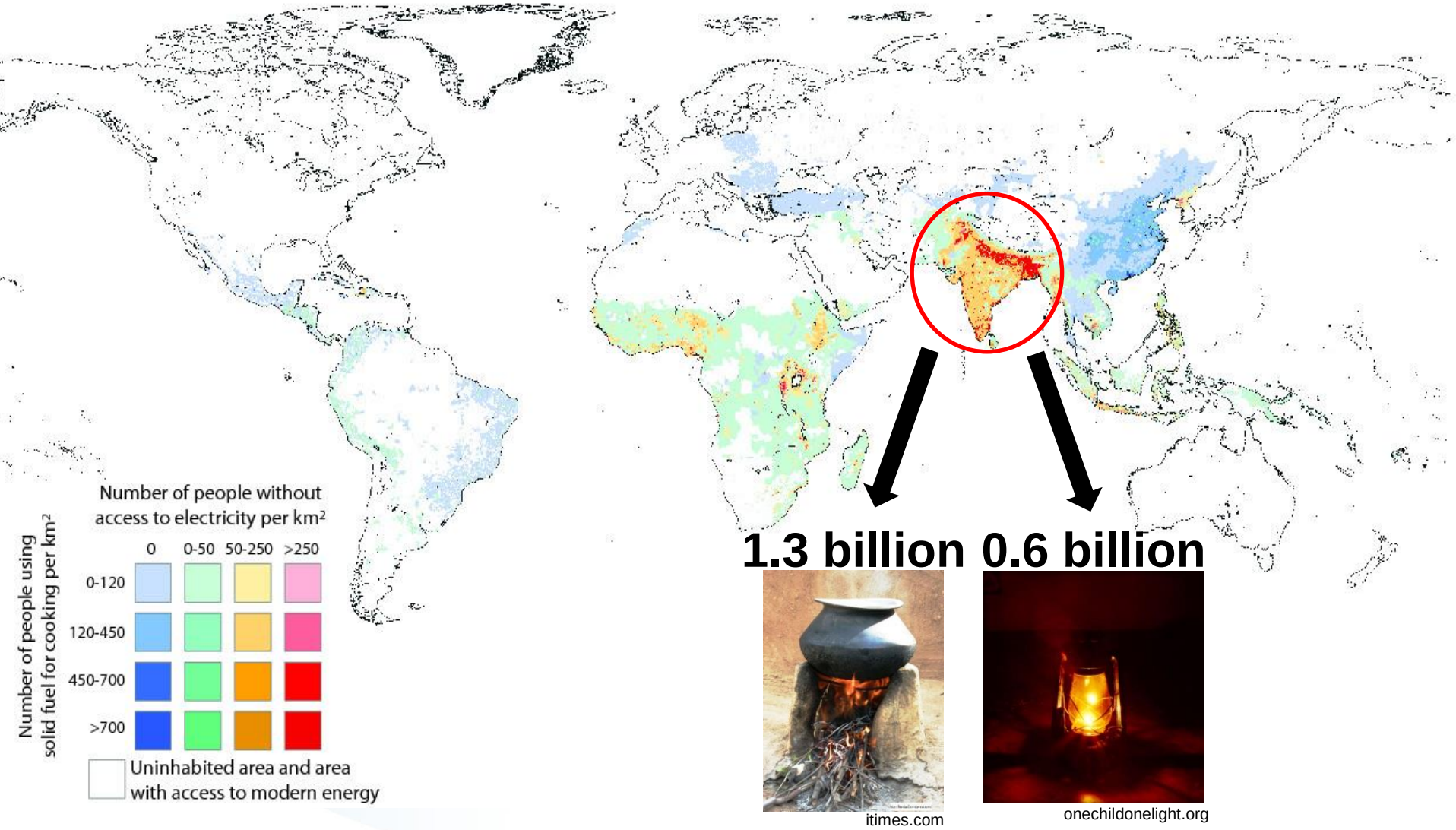
Global biodiversity



Source: van Vuuren et al., 2012

Energy Poverty

Energy Poverty in South Asia

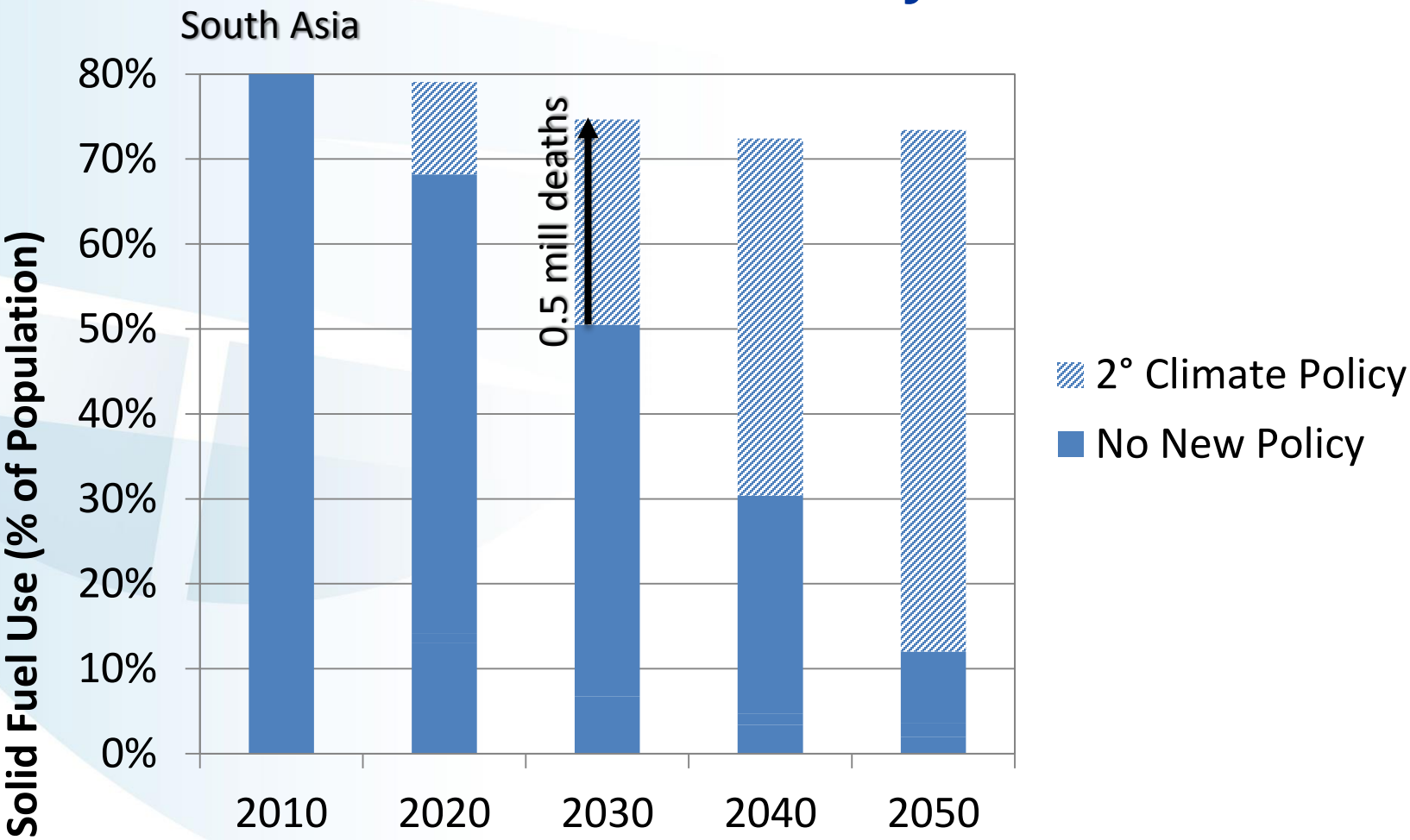


itimes.com

onechildonelight.org

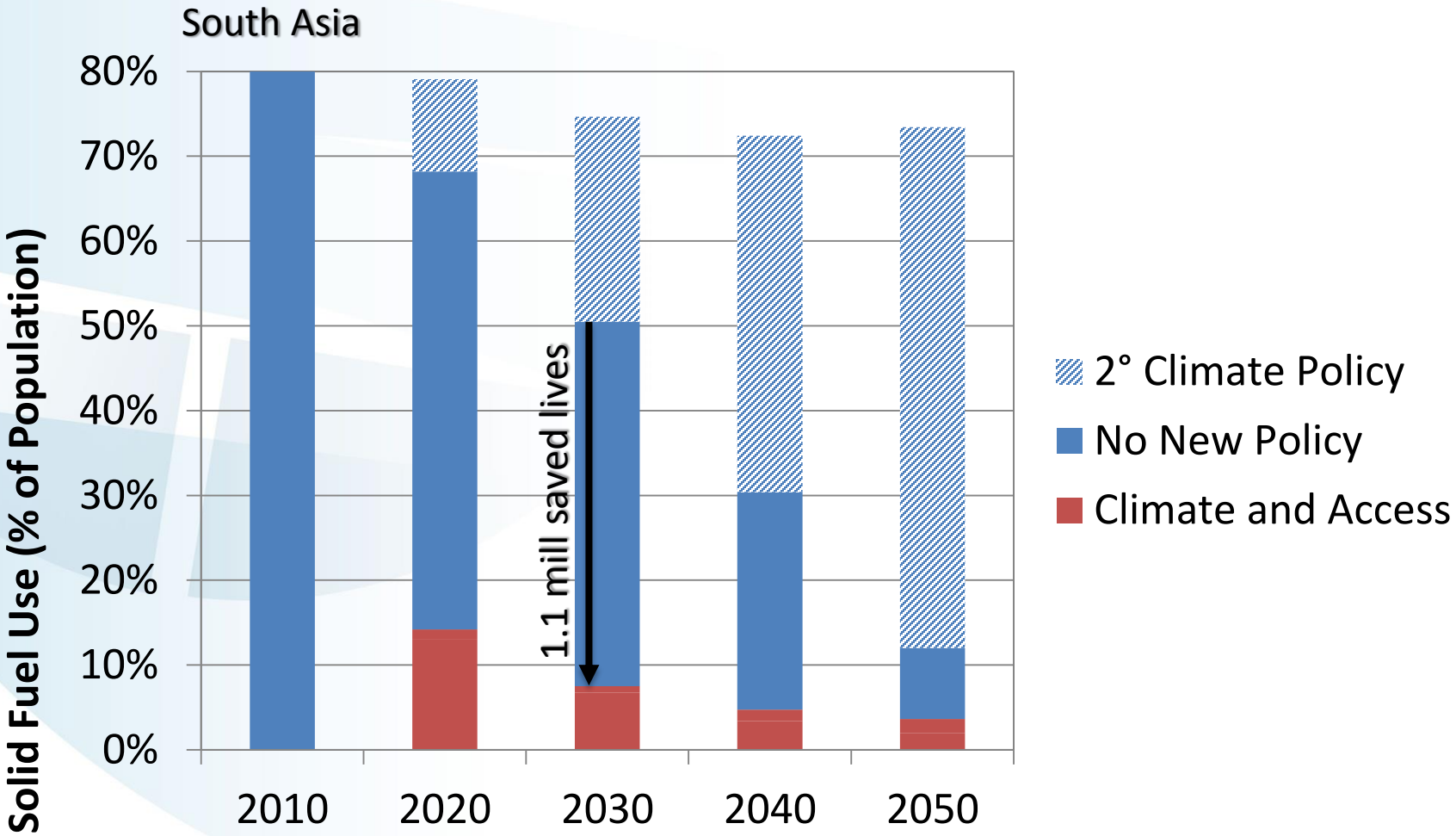
Source: Pachauri et al. 2012, GEA

Solid Fuel Dependence
Effect of 2°C Climate Policy



Source: Cameron et al., Nature Energy, 2016

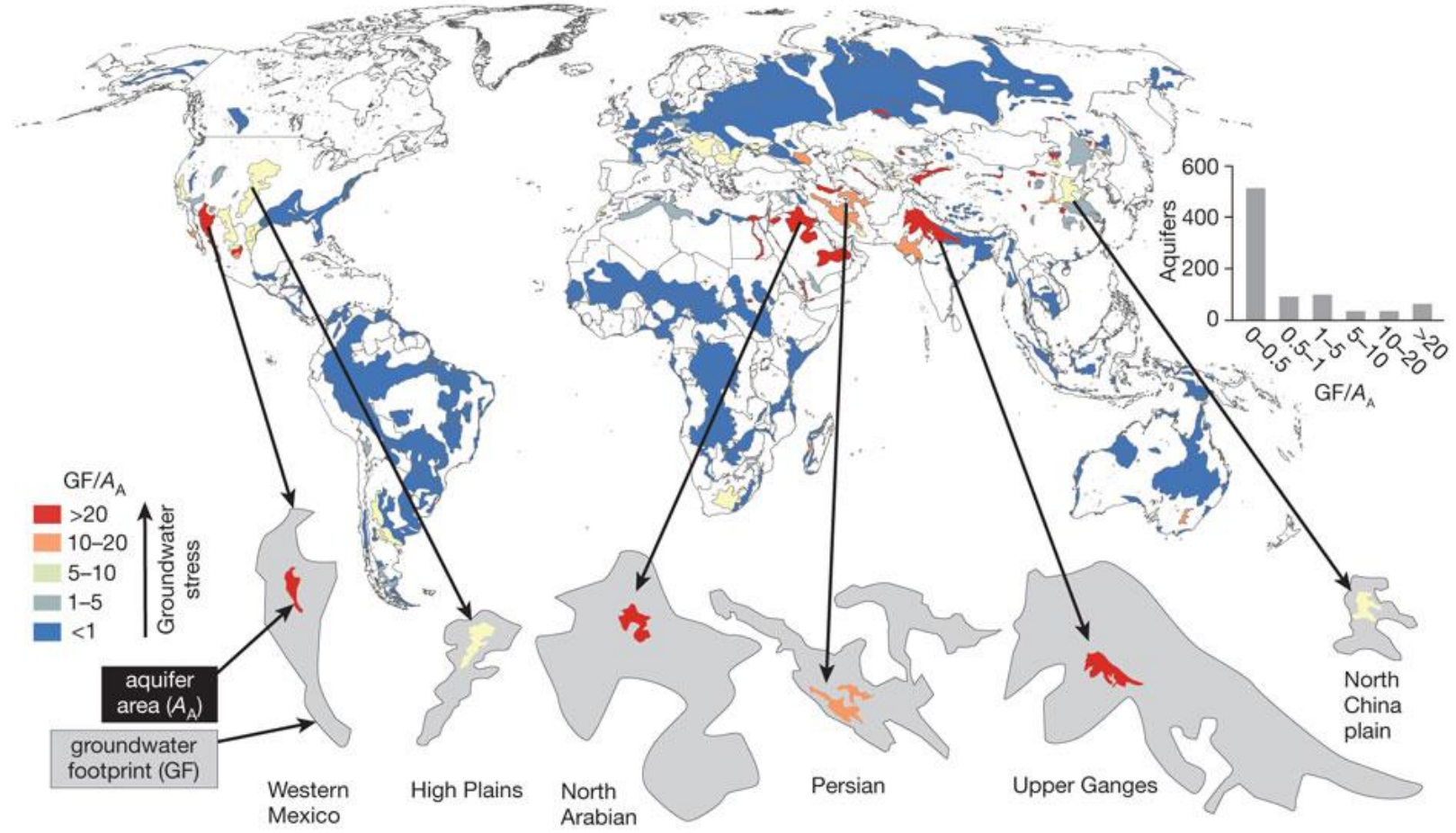
Integrated Climate and Access Policies



Source: Cameron et al., Nature Energy, 2016

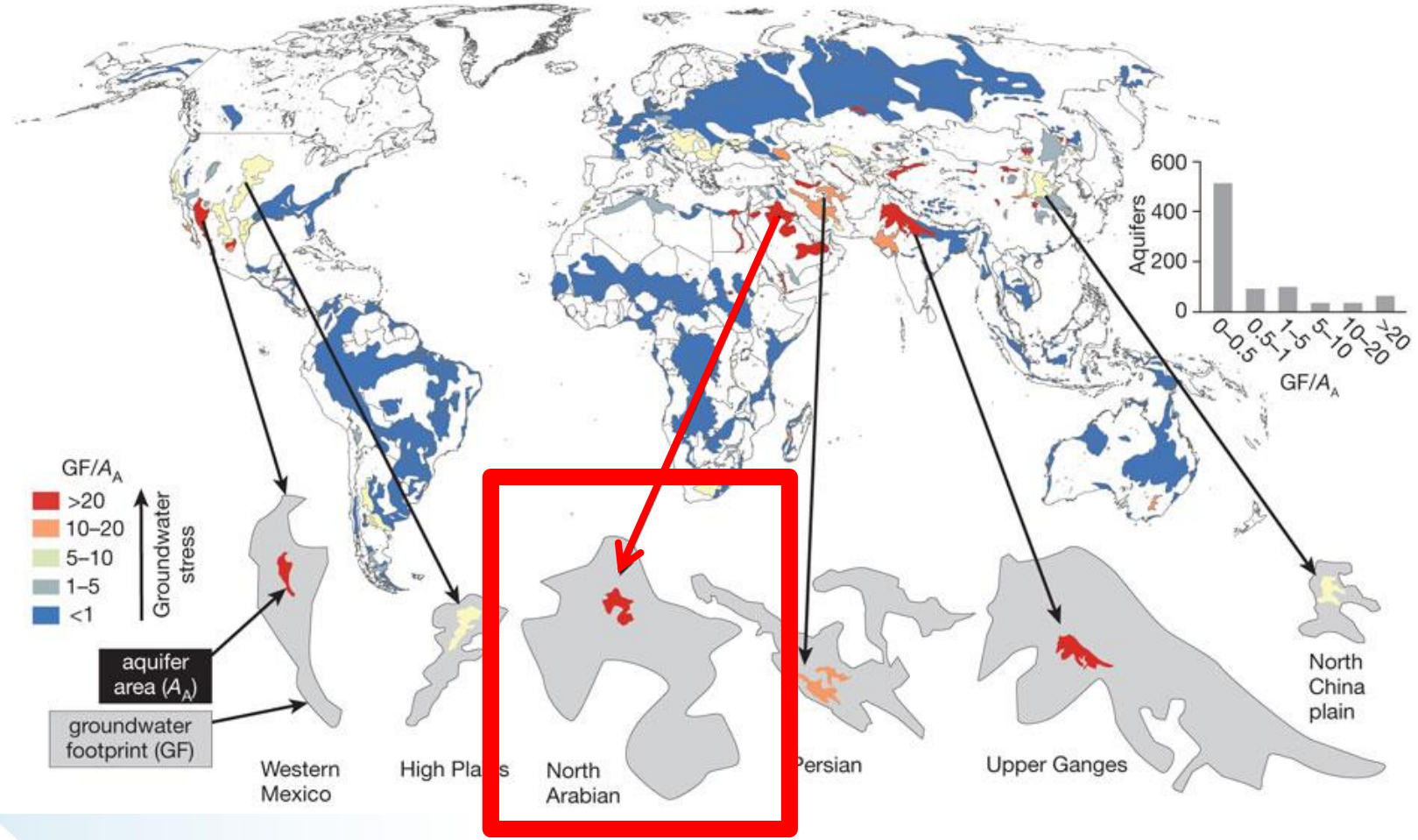
Water

Groundwater sustainability



T Gleeson *et al*. *Nature* **488**, 197-200 (2012)

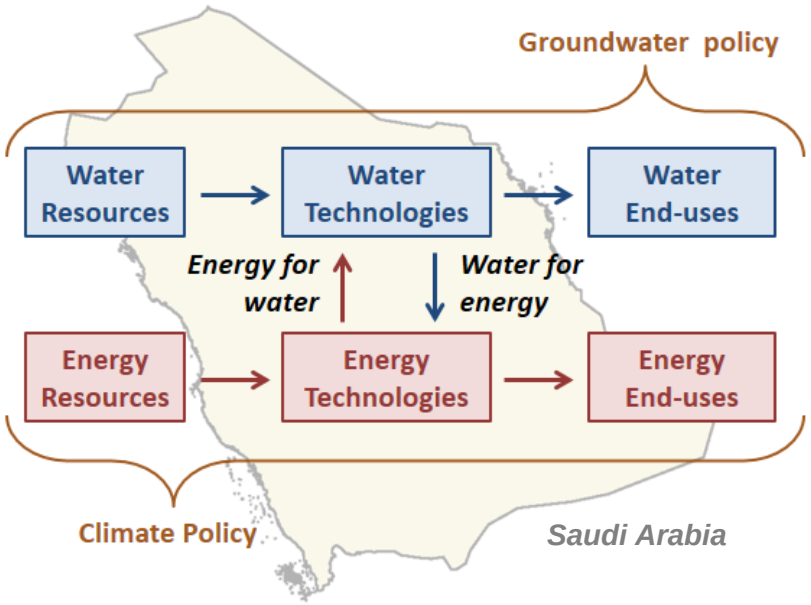
Groundwater sustainability

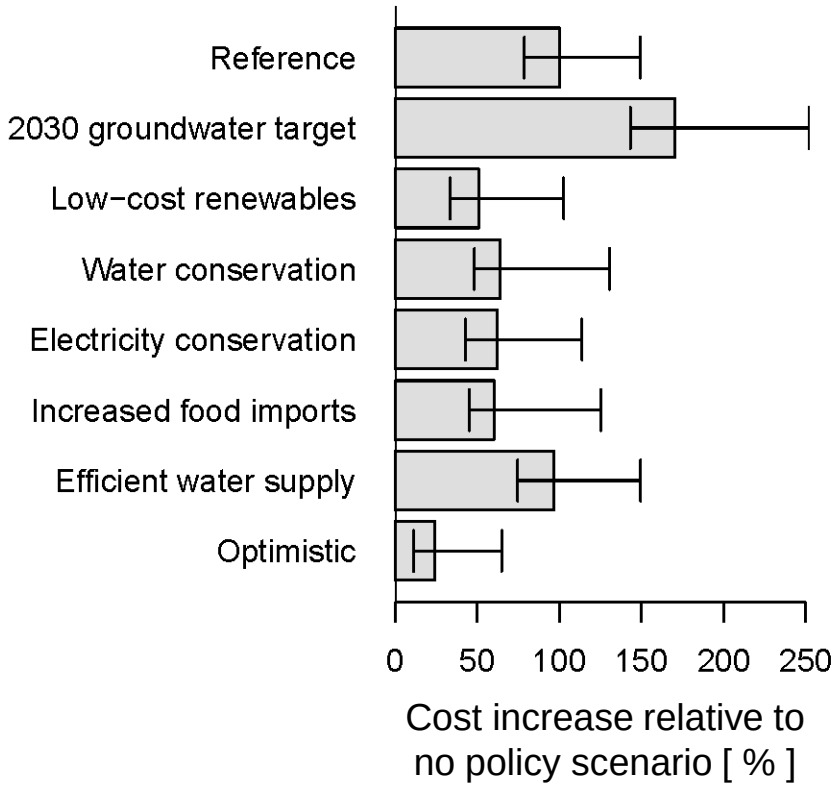


Saudi Arabia annual withdrawal more than **17X** the renewable recharge

T Gleeson *et al. Nature* **488**, 197-200 (2012)

Water constrained low-carbon energy pathways





- Integrated long-term development scenarios
- Implications for costs of different policy scenarios

S.C. Parkinson et al. (2016), *Environmental Science & Technology*

Simultaneous Assessment of Multiple Objectives

Interactions!

Planbureau voor de Leefomgeving

	Eridicate hunger	Access to water	Access to energy	Clean energy	Climate mitigation	Conserve biodiversity
Eridicate hunger		ns	ns	ns	More GHG emissions from increased production (fertilisers; land expansion, tractors)1)	More impact of agriculture on ecosystems
Access to water	Access to safe drinking water helps to prepare safe food Competition as well as synergy between water for residential use and in agriculture		ns	ns	ns	ns
Access to energy	Allows making use of income opportunities when less time is spent on collecting fuels, and health improved through less indoor air pollution	Water required for power generation Modern energy helps to improve access to safe water (e.g. pumps)		Less pollution from traditional energy sources (charcoal, firewood)	Less deforestation vs more fossil-fuel use, but modern energy more efficient than traditional energy systems	Less disturbance of natural ecosystems from wood collection for fuel or charcoal
Clean energy	Less impact of air pollution on crop yields and quality Less risk of disruption of vital ecosystem services	Less contamination from the deposition of airborne Effects of climate change on precipitation patterns and potential evapo-transpiration	ns Higher energy price	Less pollution thanks to a reduced use of fossil fuels, particularly oil and coal	Depends on the choice of air pollutants to be	Lower deposition of atmospheric pollutants on Less impact of climate change on biodiversity
Climate mitigation	Bio-energy competes with food and feed and may spur scrambles for land; but also opportunities for poor in rural areas					Effects of GHGs and climate change on crop yields Additional land required for bio-energy crops
Halting Biodiversity Loss	Less land used for food production Preservation of ecosystem services helps safeguard long-term sustainable food supply	A more gradual / uniform flow and cleaner water to rivers and aquifers Increased water use by permanent vegetation	ns	More intact ecosystems contribute to air quality	Fewer CO_2 emissions from land conversion and agriculture Restoration of degraded land creates new CO_2 sinks	

Synergy

Mixed

Trade-off

Source: van Vuuren et al. 2012

Potential co-benefits and adverse side-effect of energy transitions

	Sectoral mitigation measures	Economic			Social			Environmental			Other objectives
		Energy security	Sectoral productivity	Local/sectoral employment	Reduced health impact	Thermal comfort, work conditions	Safety/ disaster resilience	Reduced ecosystem impact	Reduced water use/pollution	Reduced land use	
Low-carbon energy supply (replacing coal)	Nuclear	↑[a]		↑	↑ ↓		↓	↑↓			Proliferation, nuclear waste
	Non-combustion renewable	↑		↑	↑			↑↓	↑↓		(Off-grid) energy access Increased resource mining
	CO_2 capture & storage (CCS)			↑↓	↓		↓	↓	↓		Long-term monitoring of CO_2
	Bioenergy with CCS; (excl. co-effects of bioenergy)				↓		↓	↓	↓		Long-term monitoring of CO_2
	Bioenergy[b]	↑		↑↓	↑↓			↓[c]	↓	↓	Food security and equity in land tenure
Transport	Fuel switching	↑			↑[d]		↑	↑ ↓			Technical spill-overs to Developing Countries
	Technical energy efficiency	↑			↑		↑	↑			
	Urban form/modal shift[e]	↑	↑	↑ ↓	↑		↑	↑		↑	Equitable mobility access
	Energy demand reduction	↑	↑		↑			↑↓		↑	Reduced urban congestion
Buildings	Fuel switching	↑		↑	↑			↑			Reduced fuel poverty
	Technical energy efficiency[f]	↑	↑	↑	↑↓	↑	↑	↑	↑		Reduced fuel poverty
	Energy demand reduction[g]	↑			↑			↑			
Industry	Fuel switching (incl. CCS)		↑		↑	↑		↑	↑		Increased competitiveness
	Technical energy efficiency	↑	↑	↑	↑	↑	↑	↑	↑		Technological spillovers
	Material efficiency			↑	↑		↑	↑			Reduced resource mining

↑ co-benefit

↓ adv. side effect

Source: von Stechow et al., 2015

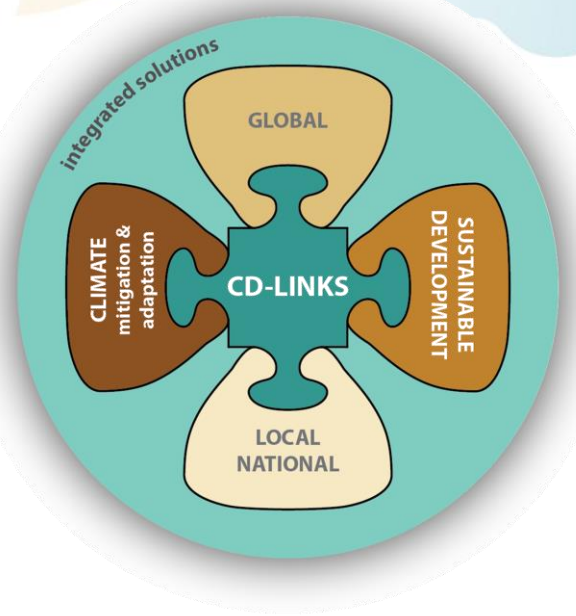
CD-LINKS Project

Integrated Approach:

- Climate AND Sustainable Development
- National AND Global

Multiple Objectives:

- Economic development
- Energy poverty and inequality
- Air quality and health
- Water
- Food security
- Biodiversity
- Adaptation, resilience and reduced risks
- Energy security



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Thank You!

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