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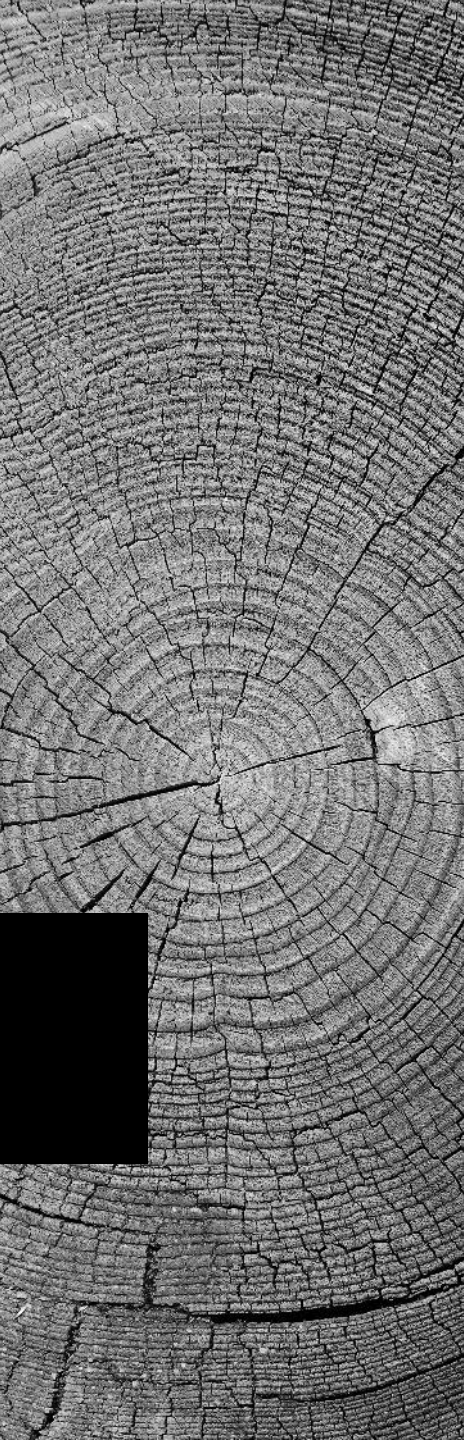
CLIMATE CHANGE AND SUSTAINABILITY

Development Policy

FSPPM



Extreme weather takes climate change models 'off the scale'

Scientists say shifting pattern of jet stream and global warming are key drivers

Extreme weather events across the world © AFP/Getty/Reuters/AP

Leslie Hook, **Christian Shepherd** and **Nastassia Astrasheuskaya** JULY 24 2021

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Fires, floods, heatwaves and droughts. The deadly weather that has unfolded in recent weeks has left climate scientists "shocked" and concerned that extreme events are arriving even faster than models predicted.

DID WE UNDERESTIMATE THE IMPACT OF CLIMATE CHANGE?

- Climate change models have accurately predicted temperature rise, but not extreme weather events
- Unpredictable consequences of warmer artic air
- Low pressure causes heavy rains and floods in places that are not prepared
- Warmer air holds more moisture
- But high-pressure systems also more stationary → drought and forest fires

SUSTAINABILITY

- World Commission on Environment and Development (1987)
- Sustainable development define as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”
- Per capita consumption should not decline over time.
- Intergenerational equality

SUSTAINABILITY AND THE HARTWICK RULE

- Three kinds of capital
  - Reproducible capital: Roads, irrigation systems, buildings, factories, etc.
  - Human capital: Knowledge and skills
  - Natural capital: Nonrenewable resources, ecosystems
- If these forms of capital are substitutes, then sustainability requires that:
  - Investment in reproducible and human capital is at least equal to the resource rents from the depletion of natural capital
  - $I^G \equiv I - D - R$ → Genuine investment is approximately equal to investmen less depreciation and the extraction of resource rents

SUBSTITUTABILITY

- Ecosystems provide unique services that cannot be replaced by reproducible and human capital, e.g. forests and climate change
- “Weak Sustainability”
  - Reproducible and human capital can substitute for all forms of natural capital
  - Hartwick Rule provides a rule of thumb
- “Strong Sustainability”
  - The Hartwick Rule must be modified to leave ecosystems intact
  - Uncertainty over how future generations will value irreplaceable ecosystems reduces our ability in the present to deplete them

THRESHOLD EFFECTS (NONLINEAR IMPACT) AND THREAT OF ECOLOGICAL COLLAPSE

- At some point ecological damage becomes irreversible: for example, overfishing to the point of extinction of species or destruction of the ozone layer
- At these tipping points environmental degradation becomes a threat to human survival
- “Planetary boundaries” necessary because uncertainty about the impact on future generations of exceeding these thresholds
- But many of these ecosystems are in developing countries: Who will pay to protect them?

NINE "TIPPING POINTS" IN THE DEPLETION OF NATURAL CAPITAL

1. Climate change
2. Biodiversity loss
3. Overuse of chemical fertilizers (nitrogen and phosphorus)
4. Ozone depletion
5. Ocean acidification
6. Freshwater availability
7. Arable land availability
8. Chemical pollution
9. Atmospheric aerosol loading (particulate matter air pollution)

CLIMATE CHANGE

- To stabilize temperatures below 2º rise (2015 Paris Climate Accord) we will need to reduce emissions of GHG by 20% from business as usual over the next two decades
- Need to achieve net-zero emissions (sources of GHG equal to sinks) in the second half of the century
- A 3-5º rise would lead to profound changes to human and physical geography due to floods, droughts, sea level rise

GLOBAL CLIMATE RISK 1999-2018

Rank	Country	Deaths	Deaths per 1,000	Losses % GDP	Events
1	Puerto Rico	149,900	4.09	3.8%	25
2	Myanmar	7,052,400	14.29	0.8%	55
3	Haiti	274150	2.81	2.4%	78
4	Philippines	869800	0.96	0.6%	317
5	Pakistan	499450	0.30	0.5%	152
6	Vietnam	285800	0.33	0.5%	226
7	Bangladesh	577450	0.39	0.4%	191
8	Thailand	140000	0.21	0.9%	147

Source: Germanwatch.org

- Four Southeast Asian countries in top 8 worldwide for climate risk
- Storms, floods, droughts, heat, saline water intrusion
- Typhoons decreasing in frequency but increasing in intensity

COASTAL ZONES AT RISK TO CLIMATE CHANGE

- 270 million people living in rural low elevation coastal zones, 84% in Asia
- Poverty-environment traps: over-reliance on marginal lands and resources → saline intrusion, floods, sea level rise
- One meter rise in seas levels would inundate 74,000 km2 in Asia, including 10% of Vietnamese population (Mekong Delta)
- Development of alternative incomes including migration, but managed to prevent costs of migration falling only on the poor

CLIMATE CHANGE MITIGATION

- For the 2º scenario countries must reduce their 2030 emissions to 2000 levels
- Renewable energy was 18% of final consumption in 2017 and 26% of electricity production in 2018 (solar, wind, hydro, marine, geothermal, biomass and biofuels)
- Fuel switching (coal to gas) and increasing efficiency
- Carbon capture: Afforestation (especially in the tropics) and bioenergy carbon capture and storage
- Southeast Asian countries have agreed to slowing down growth of GHG emissions by 2030

TOTAL GREEN HOUSE GAS EMISSIONS (MTCO2E) 2016

Country	Power	Industry	Agric	Deforest-ation	Trans-port	Building	Waste	Total
China	4,023	7,732	1,689	4	970	628	1,017	16,064
India	1,060	1,327	1,912	34	288	141	758	5,520
Indonesia	181	742	456	1,115	147	26	237	2,904
Malaysia	106	199	24	52	73	5	46	635
Philippines	54	77	176	1	38	6	81	435
Thailand	93	220	186	15	92	7	59	803
Vietnam	78	193	193	3	42	12	60	597

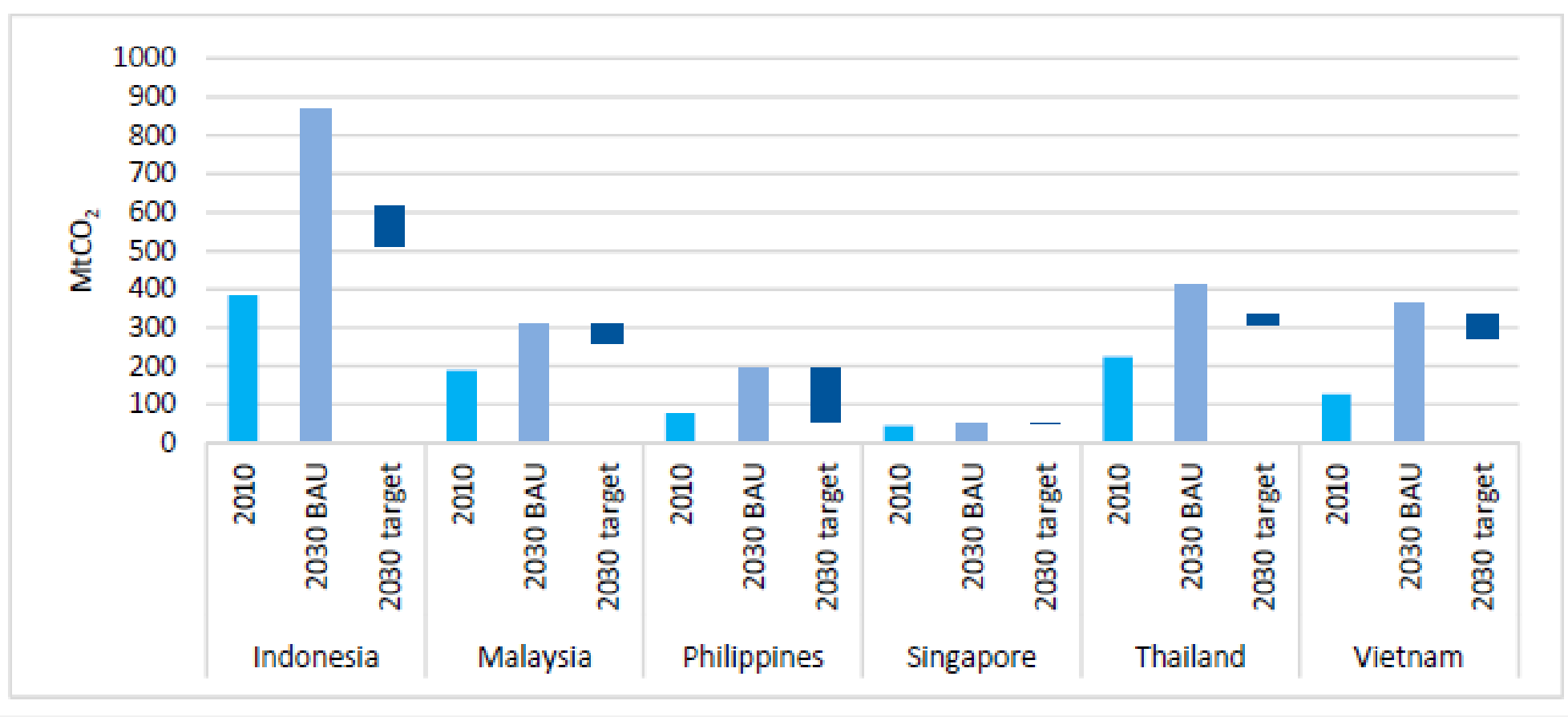
Source: IPPC

NATIONALLY DETERMINED CONTRIBUTIONS (NDC)

Country	Energy related emissions 2010	Target	Target definition
Indonesia	20%	29%	Unconditional GHG below 2030 BAU
Malaysia	58%	45%	Unconditional GHG below 2005 level
Philippines	51%	75%	Conditional GHG below 2030 BAU
Singapore	77%	36%	Unconditional GHG intensity per unit GDP relative to 2005
Thailand	53%	20%	Unconditional all climate pollutants below 2030 BAU
Vietnam	41%	9%	Unconditional GHG below 2030 BAU

Source: www.climatewatch.org

SOUTHEAST ASIAN MITIGATION EFFORT IS SLOWDOWN OF GHG EMISSIONS FROM ENERGY

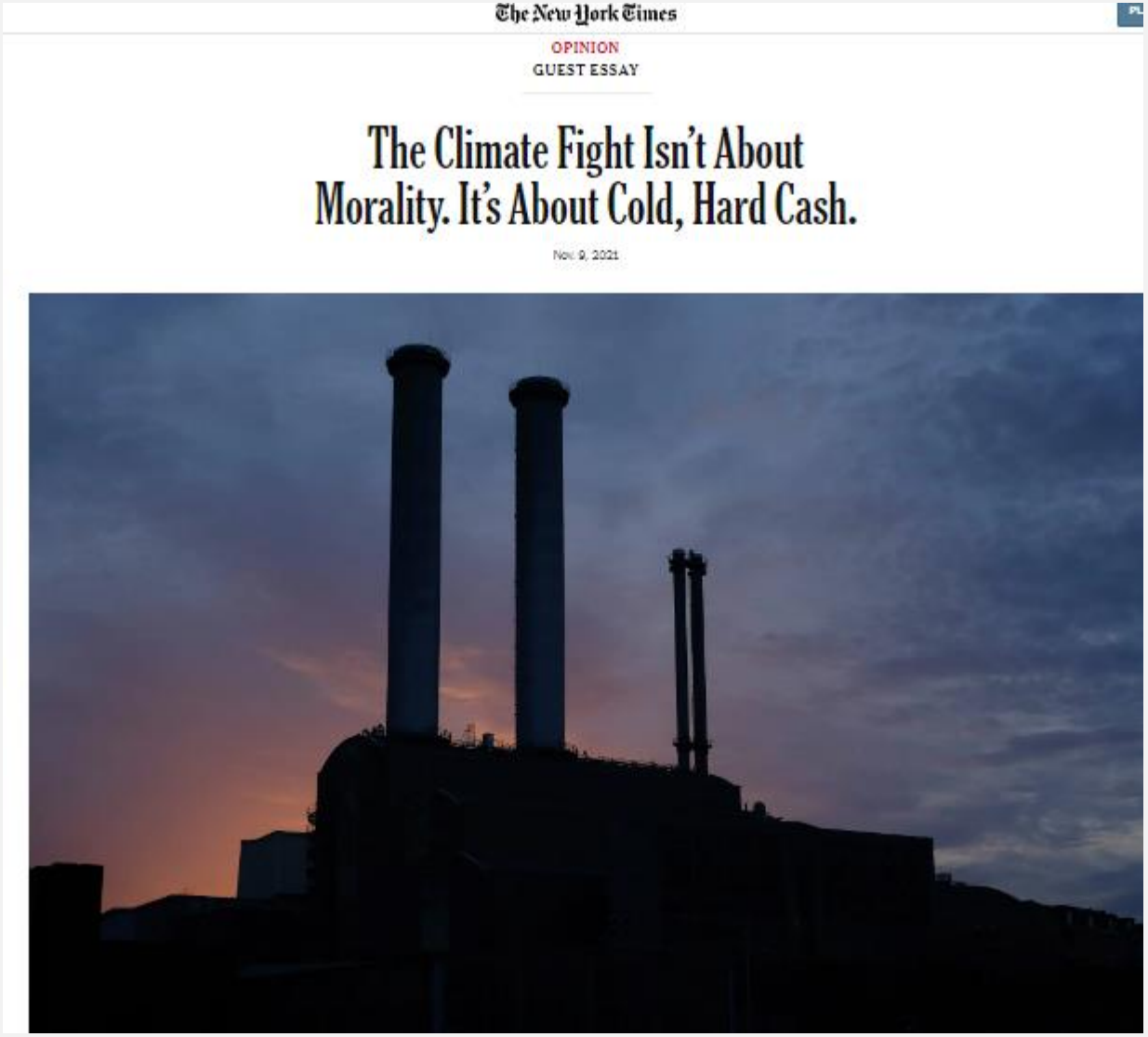


Source: Fulton et al, 2017

SOUTHEAST ASIA: COAL-FIRED POWER PLANTS AND DEFORESTATION

- 90% of power emissions in Asia are from coal (vs 70% globally)
- Southeast Asia energy demand will increase 66% by 2040 and 40% of the increase will come from coal-fired plants
  - Indonesia is second largest net exporter of coal
  - Vietnam ranks third in planned construction of coal-fired plants after China and India
- Asia emits 80% of global CO2 emissions in steel and cement industries
- 40% of deforestation in Indonesia due to clearing land for palm oil plantations
  - Draining peat swamps 6% of global CO2 emissions
  - Emissions from Indonesia forest fires greater than entire EU emissions in 2015

CLIMATE FINANCE HAS EMERGED AS A KEY BATTLEGROUND



- Half of new power generation in developing countries 2018-2020 is coal-fired, mostly financed by Japan, China and Korea
- Annual investment in clean energy projects has to rise to $4 trillion by 2030, more than triple current spending

ADAPTATION: RANGE OF POLICIES AND PROGRAMS

- Infrastructure: Flood prevention, mass transit, irrigation, water and sanitation
- Agriculture: Land use planning, development of crop varieties to manage water stress and salinization, farmer training to raise new crops as land/water conditions change
- Reforestation: To prevent flooding and landslides
- Storm-resistant housing: Protecting people from more intense typhoons
- Relocation: Managed migration to safe areas and occupations

POLICY IMPLICATIONS: CLIMATE CHANGE AS A GLOBAL EXTERNALITY

- Externality: a cost (or benefit) resulting from production that is incurred by (received by) the producer.
- Domestic pollution is an externality “internalized” by local or national laws: Producers are taxes or fined.
- Global externalities require treaties and enforcement mechanisms that countries agree to because the costs of doing so outweigh the benefits
  - Free-riding: Countries have an incentive to let other countries carry the economic burden of reducing GHG
  - The current generation has n incentive to free-ride and allow future generations to bear the costs of climate change
  - Need to tie benefits (access to markets, finance) to increase cost of GHG

DISCUSSION QUESTIONS

- Why is Vietnam still building coal fired power plants?
- Define sustainability and discuss the implications of your definition for development policy