Democracy Study Center

Kiev, Ukraine

Climate change mitigation and adaptation

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Corresp. Member Pol. Acad. Sci., Member *Academia Europaea*

Introduction
Climate change mitigation
Climate policy
Climate change adaptation
Synergies and trade-offs
Concluding remarks

Introduction

Climate change mitigation

Climate policy

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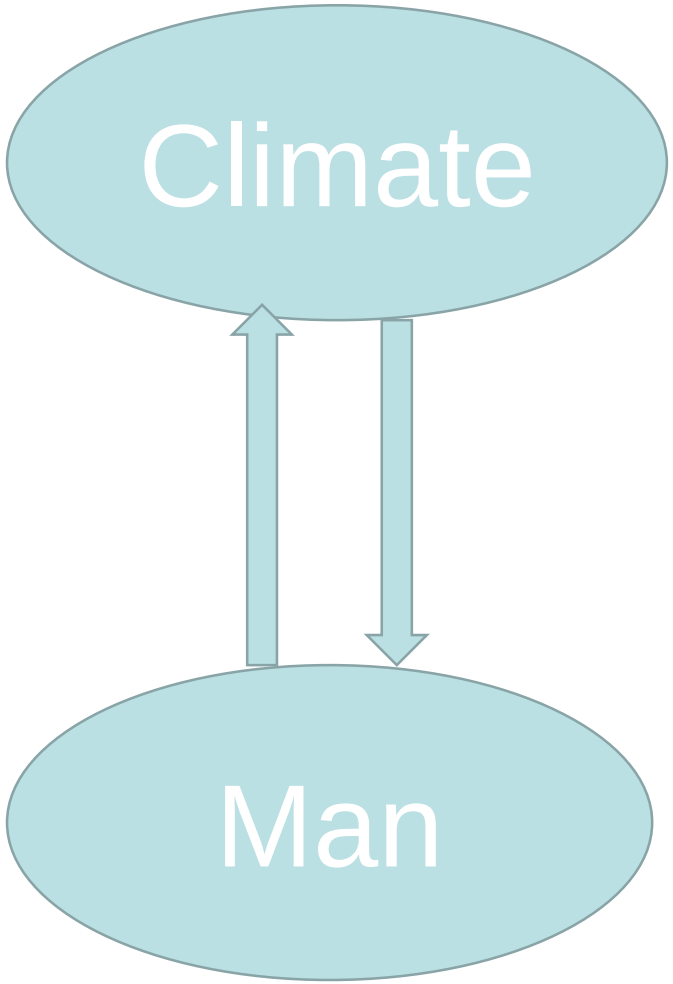
Mechanisms of climate change:

- Variations of solar radiation (solar activity),
- Change of parameters of Earth's movement (orbital forcing)
- Change of composition of Earth's atmosphere (greenhouse gases, dust, aerosols)
- Change of properties of Earth's surface (albedo, water storage).



Man:
- culprit
- victim
- beneficiary
of climate change

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A Report for the World Bank by the Potsdam Institute for Climate Impact Research and Climate Analytics

Turn Down the Heat

Why a 4°C Warmer World Must be Avoided

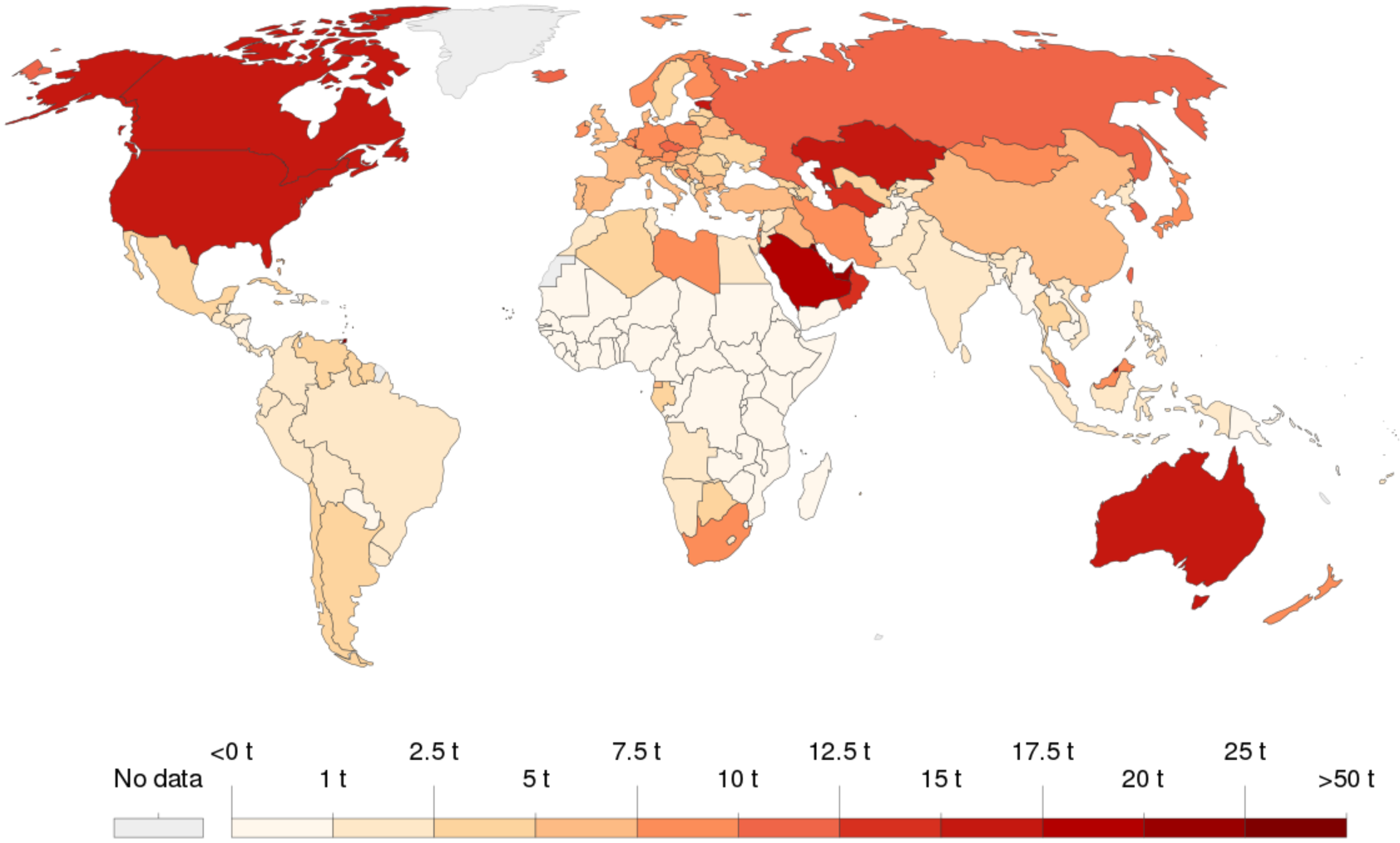
CO_2 emissions from fossil fuels in 2017 [Mt CO_2 / y]

Globally	37077
China	10877
USA	5107
EU	3548
…	…
Poland	319

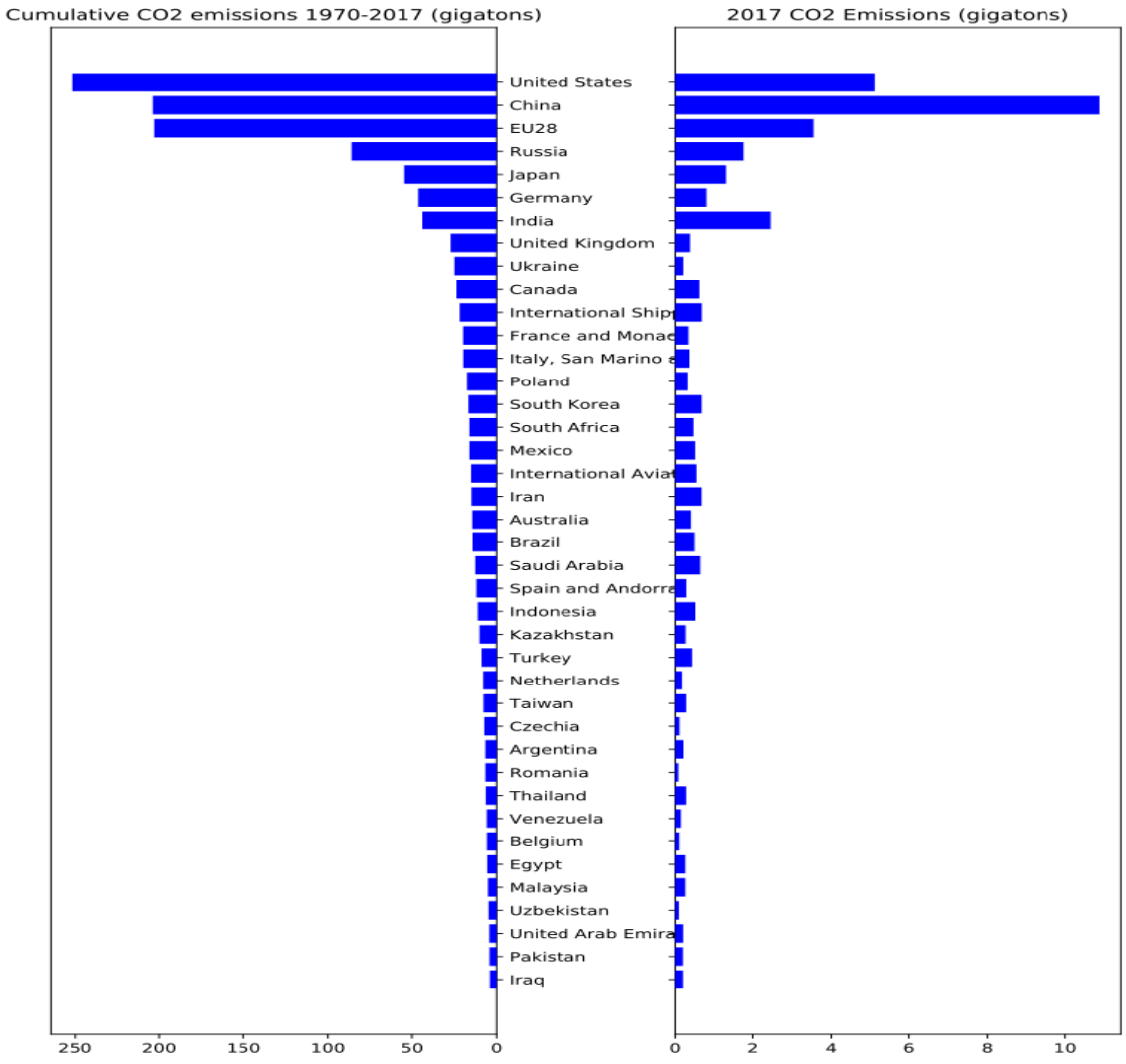
CO_2 emissions per capita, 2017

Average carbon dioxide (CO_2) emissions per capita measured in tonnes per year.

Our World in Data



Source: OWID based on CDIAC; Global Carbon Project; Gapminder & UN


Cumulative CO2 emissions 1970-2017 (gigatons)
2017 CO2 Emissions (gigatons)
United States
China
EU28
Russia
Japan
Germany
India
United Kingdom
Ukraine
Canada
International Ship
France and Monac
Italy, San Marino
Poland
South Korea
South Africa
Mexico
International Aviat
Iran
Australia
Brazil
Saudi Arabia
Spain and Andorra
Indonesia
Kazakhstan
Turkey
Netherlands
Taiwan
Czechia
Argentina
Romania
Thailand
Venezuela
Belgium
Egypt
Malaysia
Uzbekistan
United Arab Emira
Pakistan
Iraq
250
200
150
100
50
0
0
2
4
6
8
10

Ottmar Edenhofer (PIK):

Climate change is a market externality. Energy costs do not include impacts on a third party that is not involved in transaction.

Internalization of costs is essential for effective long-term reduction of greenhouse gas emissions. It can be done via:

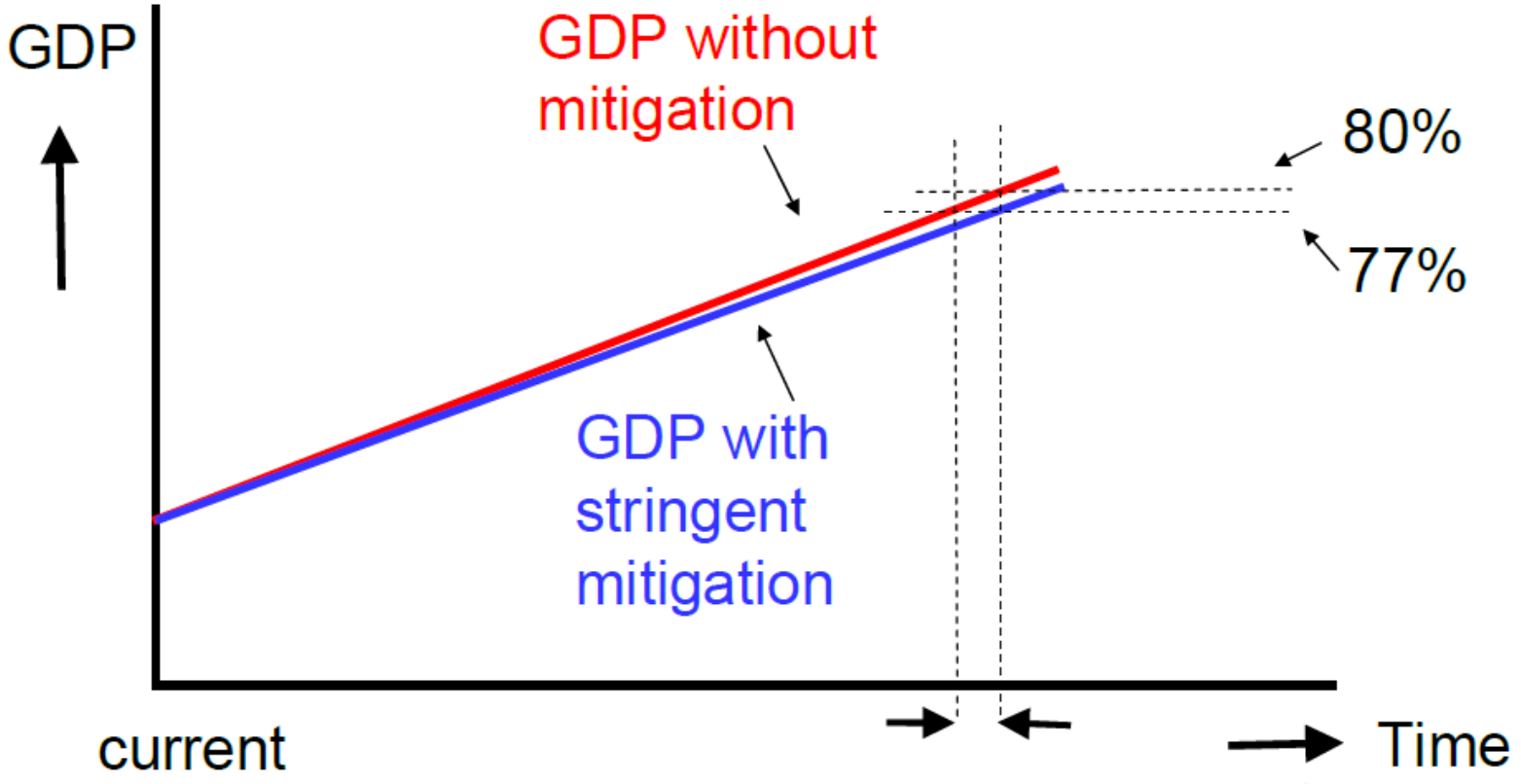
(1) pollution taxes (price signal) or (2) pollution permits (quantity signal)

Problem re (1): calculation of the marginal damage of pollution

Problem re (2): setting pollution permits (that will determine the price)

Illustrating the Cost of Mitigation

With stringent mitigation GDP growth is only delayed by approximately 1 year



Mitigation costs depend on the target level of greenhouse gas reduction (grow with inreasing reduction stringency) and on the timing of reduction (grow with delay).

Impact and adaptation costs grow with the greenhouse gas concentration.

Employment

Economy

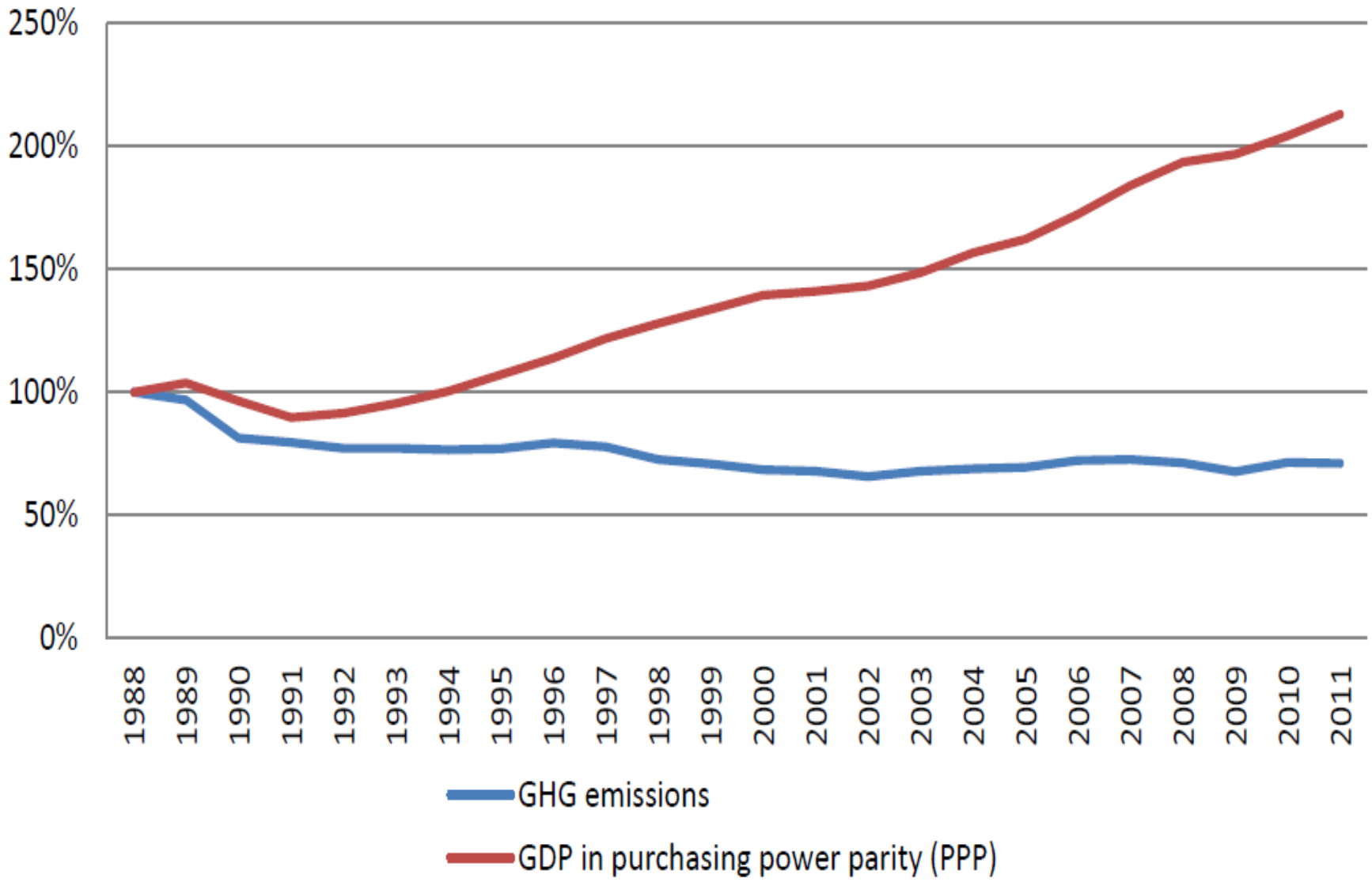
Health

Climate

Energy

Environment

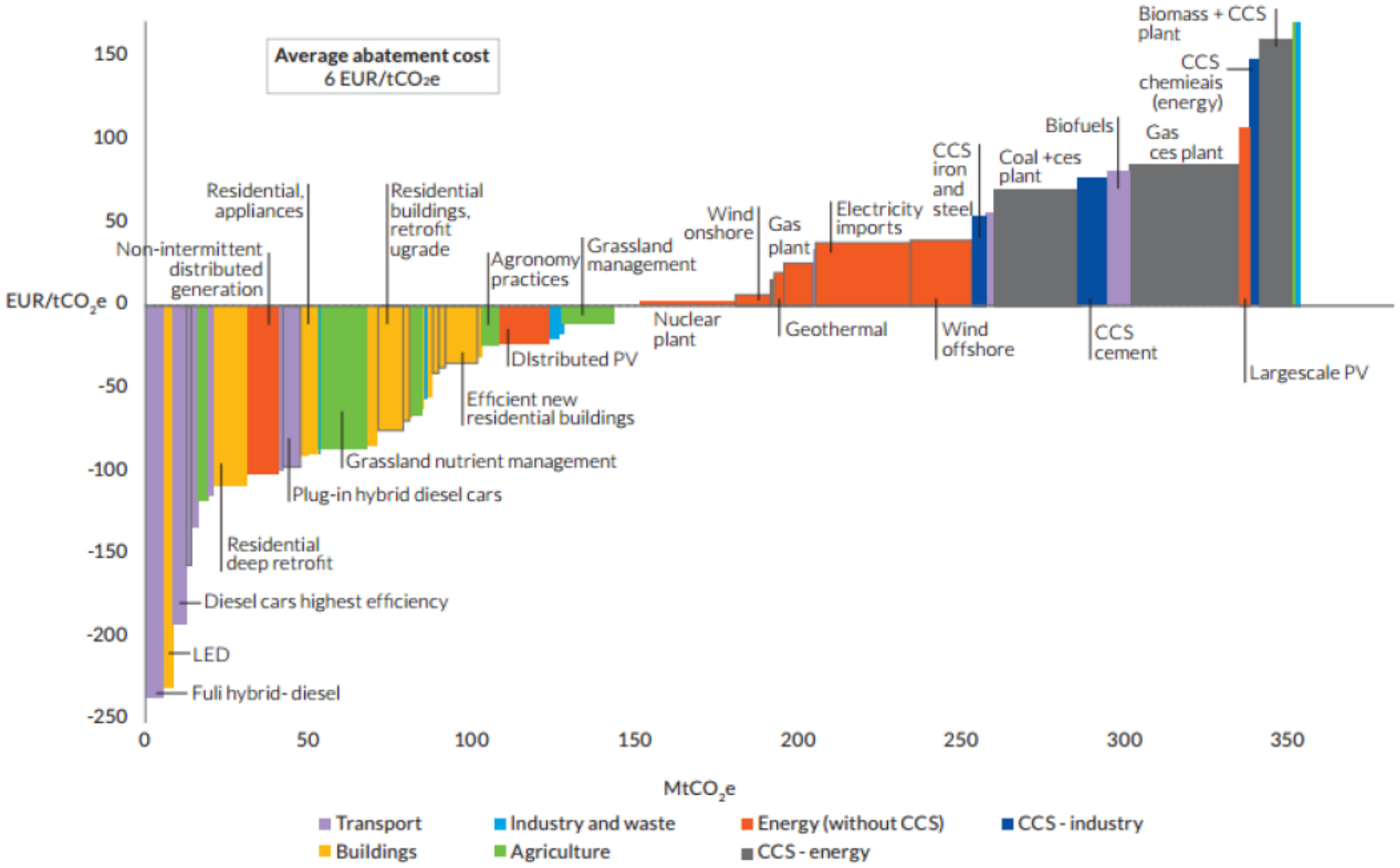
Decoupling of economic growth and GHG emission – Poland. Source: KOBIZE



Negawatts (negative Watts of saved energy), rather than Megawatts

It is always good to save energy – for financial reasons, for sustainable development, for curbing global warming.

Marginal abatement cost curve of GHG emissions in Poland, 2050. Source: KOBIZE




Solar batteries in Poddębice (PL)

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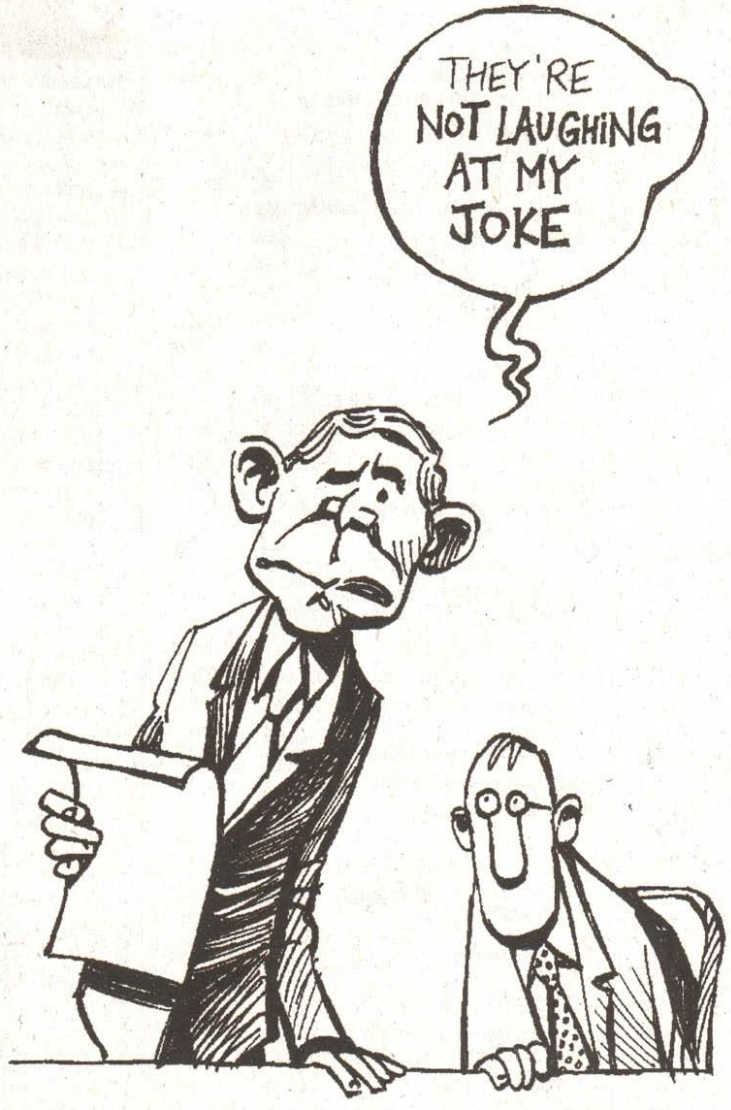
UN Framework Convention on Climate Change
www.unfccc.int

Convention adopted at the Earth's Summit in Rio in 1992 requests countries listed in Annex I (developed countries and countries in transition) to curb their GHG emissions.

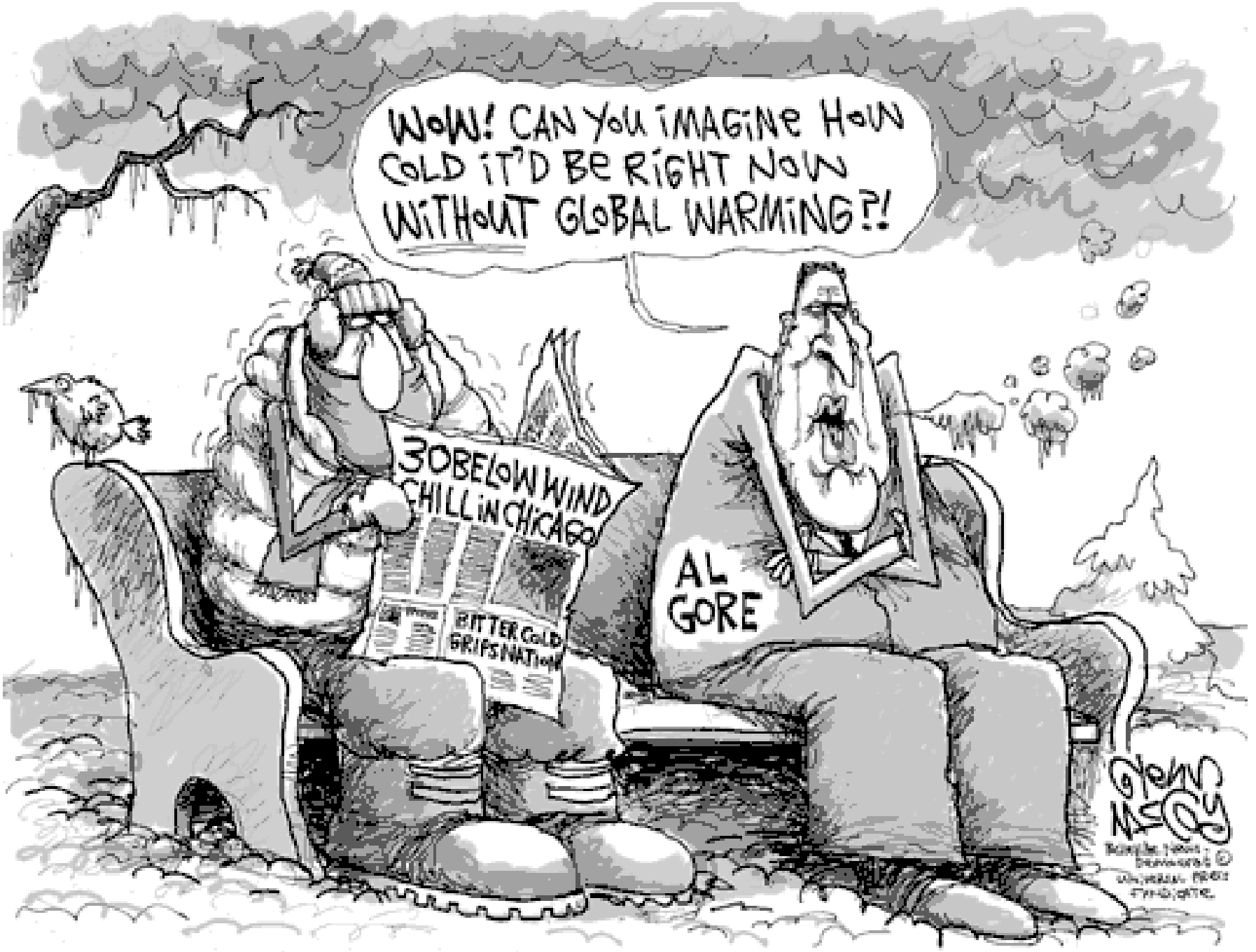
Kyoto Protocol (1997) – In 2008-2012, countries of Anex B should reduce their emissions by at least 5% with reference to the 1990 level.

Joint Implementation; Clean Development Mechanism



CHAPPATTE
Int'l Herald Tribune


IN OUR CONTINUING EFFORT TO COUNTERACT GLOBAL WARMING.
- WE HAVE DECIDED TO BRING BACK THE COLD WAR!
G 8 summit
THE PRESIDENT OF THE UNITED STATES
BUSH
THE PRESIDENT OF THE RUSSIAN REPUBLIC
PUTIN
Pootie-Poot
6/5 2007
PARKER
COLUMBIA DAILY TRIBUNE
CAGLECARTOONS.COM


WOW! CAN YOU IMAGINE HOW COLD IT'D BE RIGHT NOW WITHOUT GLOBAL WARMING?!
30 BELOW WIND CHILL IN CHICAGO
BITTER COLD GRIPS NATION
AL GORE


-AND WE MIGHT WANT TO HAVE A LOOK AT THIS 'GLOBAL WARMING' THING BEFORE THE NEXT ELECTION...
January 2007
NEASE '07

The United Nations Framework Convention on Climate Change

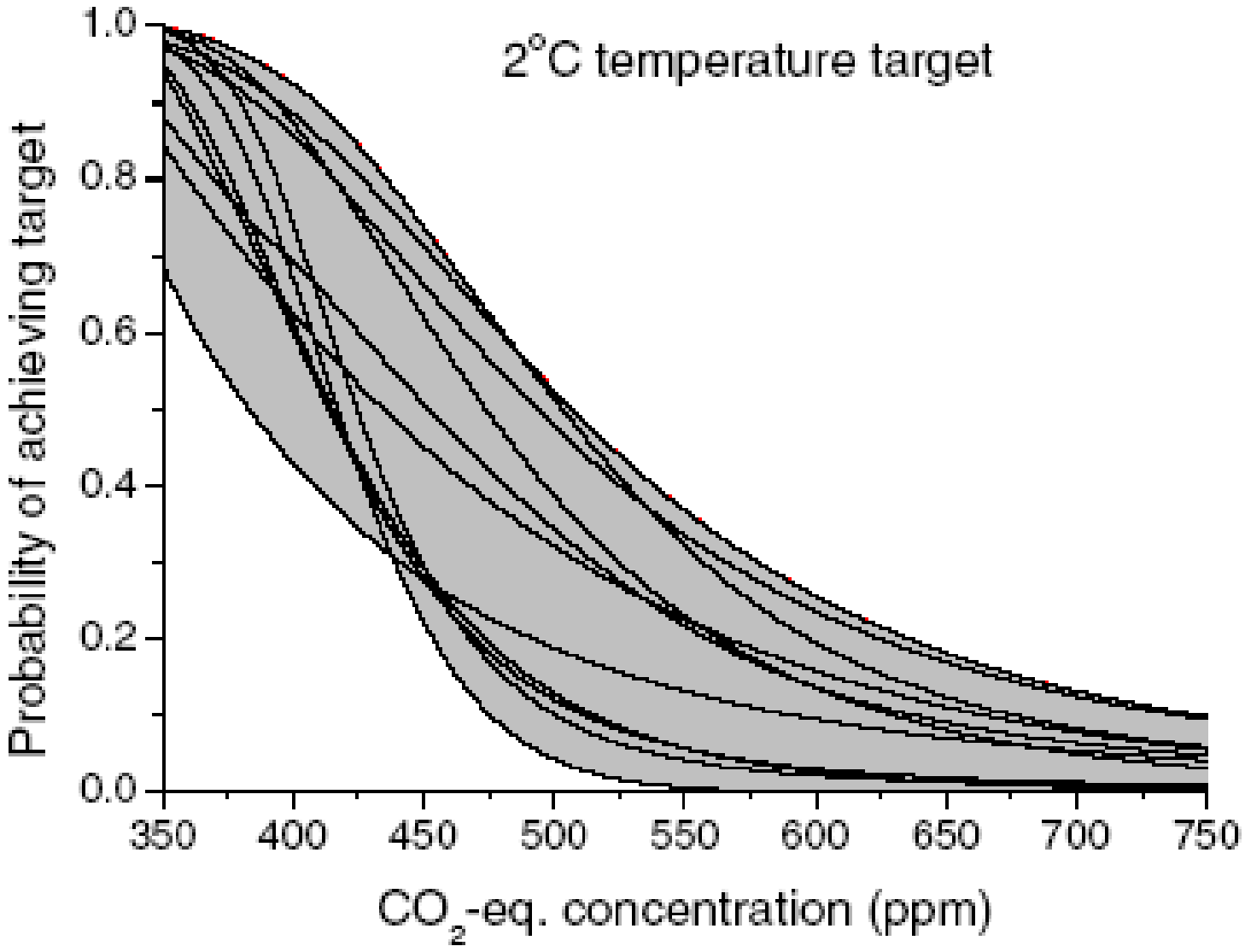
Article 2 OBJECTIVE

The ultimate objective … is to achieve … **stabilization of greenhouse gas concentrations** in the atmosphere at a level that would **prevent dangerous anthropogenic interference** with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) proposes to hold the increase in global mean temperature to well below 2°C above pre-industrial level, and to pursue efforts to limit the warming to 1.5°C.

1.5°C: global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range).

Below 2°C: CO2 emissions are projected to decline by about 20% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2075 (2065–2080 interquartile range).


2°C temperature target
Probability of achieving target
1.0
0.8
0.6
0.4
0.2
0.0
350
400
450
500
550
600
650
700
750
CO2-eq. concentration (ppm)

The New York Times

Friday, June 2, 2017 | Today's Paper | Video | 70°F | FTSE 100 +0.30% ↑

Trump Pulls U.S. Out of Climate Accord, Saying It's a Threat to U.S. Economy

Environment Will Suffer as Result, Allies and Rivals Say

By MICHAEL D. SHEAR

- In choosing to leave the pact, President Trump sided with G.O.P conservatives: "I was elected to represent the citizens of Pittsburgh, not Paris."
- The decision was a rebuke to heads of state, climate activists, corporate executives and even some members of the president's own staff.

4454 Comments

- **International Call to Action**
  5:23 AM ET


Video by THE ASSOCIATED PRESS. Photo by Doug Mills/The New York Times

NEWS ANALYSIS

A 'Draconian' Pact? The Facts Say Otherwise

By MARK LANDLER, BRAD PLUMER and LINDA QIU

The president seemed to base his decision more in his belief in its potential to save jobs than in any disbelief in climate science. But he also justified his action with distorted reports.

Cities, States and Businesses Circumvent the President

By HIROKO TABUCHI and HENRY FOUNTAIN

Michael Bloomberg, the former New York City mayor, is coordinating the effort. "We're going to do everything America would have done if it had stayed committed," he said.

- **How Cities and States Reacted**
- **Corporations Push Back: 'Not Good for America'**

NEWS ANALYSIS

Looking to 2018 (and Beyond), Trump Bets on His Base

DIPLOMATIC MEMO

Void in Leadership Opens Door to Global Upheaval

By DAVID E. SANGER and JANE PERLEZ

The decision is perhaps the greatest strategic gift to the Chinese, who are eager to expand their diplomatic reach

The Opinion Pages

EDITORIAL

Our Disgraceful Exit

Here's what Mr. Trump's decision on the climate change pact says to the world: America cares little about science, its allies and competitiveness.

Trump's Stupid and Reckless Climate Decision

By BILL McKIBBEN

Quitting the climate accord undercuts the planet's best hope.

- **Brooks: Trump Poisons the World**
- **Krugman: Trump Gratuitously Rejects the Paris Accord**
- **The Womb Is No Protection From Toxic Chemicals**

THE SIX-DAY WAR AT 50

The Past 50 Years of Israeli Occupation. And the Next.

By NATHAN THRALL

Israel enjoys perpetual control of the Palestinian land it captured in 1967 thanks to myth and military power.

- **On Campus: When the Left Turns on Its Own**
- **The Scope of Hate in 2017**

TIMES INSIDER »

Inside 'The Daily' With Michael Barbaro

THE CROSSWORD »

Play Today's Puzzle

3m

The EU's objective:

The **2020 climate and energy package** is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020. Three key targets:

- 20**%** cut in **greenhouse gas** emissions (from 1990 levels)
- 20% of EU energy from **renewables**
- 20% improvement in **energy efficiency**

The **2030 climate and energy framework** includes EU-wide targets and policy objectives for 2021-2030. Three key targets:

- At least 40% cuts in **greenhouse gas emissions** (from 1990 levels)
- At least 32% share for **renewable energy**
- At least 32.5% improvement in **energy efficiency**

ENCYCLICAL LETTER

LAUDATO SI'

OF THE HOLY FATHER

FRANCIS

ON CARE FOR OUR COMMON HOME

The Holy See

26. Many of those who possess more resources and economic or political power seem mostly to be concerned with masking the problems or concealing their symptoms, simply making efforts to reduce some of the negative impacts of climate change. However, many of these symptoms indicate that such effects will continue to worsen if we continue with current models of production and consumption. There is an urgent need to develop policies so that, in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced, for example, substituting for fossil fuels and developing sources of renewable energy. Worldwide there is minimal access to clean and renewable energy…. Some countries have made considerable progress, although it is far from constituting a significant proportion. Investments have also been made in means of production and transportation which consume less energy and require fewer raw materials, as well as in methods of construction and renovating buildings which improve their energy efficiency. But these good practices are still far from widespread.

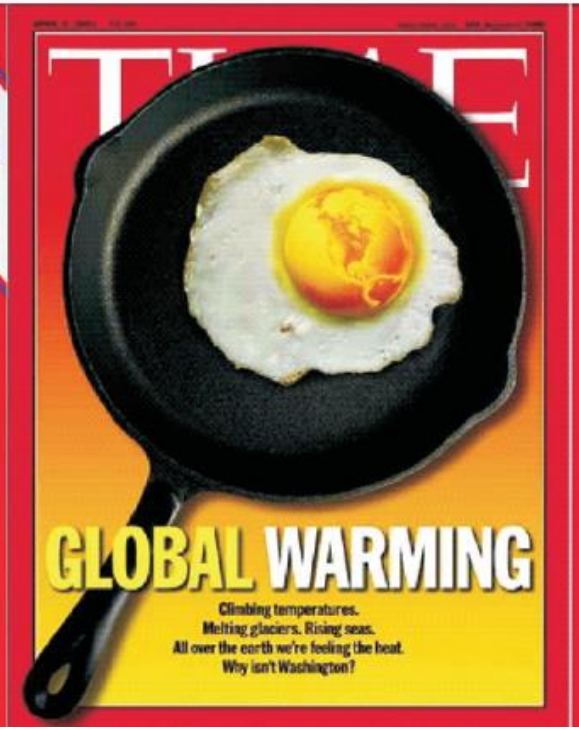
“There is an urgent need to develop policies so that, in the next few years, the emission of carbon dioxide and other highly polluting gases can be drastically reduced, for example, substituting for fossil fuels and developing sources of renewable energy.”

11 December 2019 Brussels

The European Green Deal sets out how to make Europe the first climate-neutral continent by 2050, boosting the economy, improving people's health and quality of life, caring for nature, and leaving no one behind

https://ec.europa.eu/commission/presscorner/detail/e%20n/ip_19_6691


TIME
Inside The Inauguration in Color
The Big Freeze


GLOBAL WARMING
Climbing temperatures.
Melting glaciers. Rising seas.
All over the earth we're feeling the heat.
Why isn't Washington?


TIME
HOLIDAY BLIZZARD:
More signs of GLOBAL WARMING


SPECIAL REPORT GLOBAL WARMING
TIME
BE WORRIED. BE VERY WORRIED.
Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well
EARTH AT THE TIPPING POINT
HOW IT THREATENS YOUR HEALTH
HOW CHINA & INDIA CAN HELP SAVE THE WORLD—OR DESTROY IT
THE CLIMATE CRUSADERS


Obama's Working-Class Woes
Why More Women Are Choosing C-Sections
Can Richard Branson Save the Airline Industry?
TIME
SPECIAL ENVIRONMENT ISSUE
How to Win The War On Global Warming
BY BRYAN WALSH

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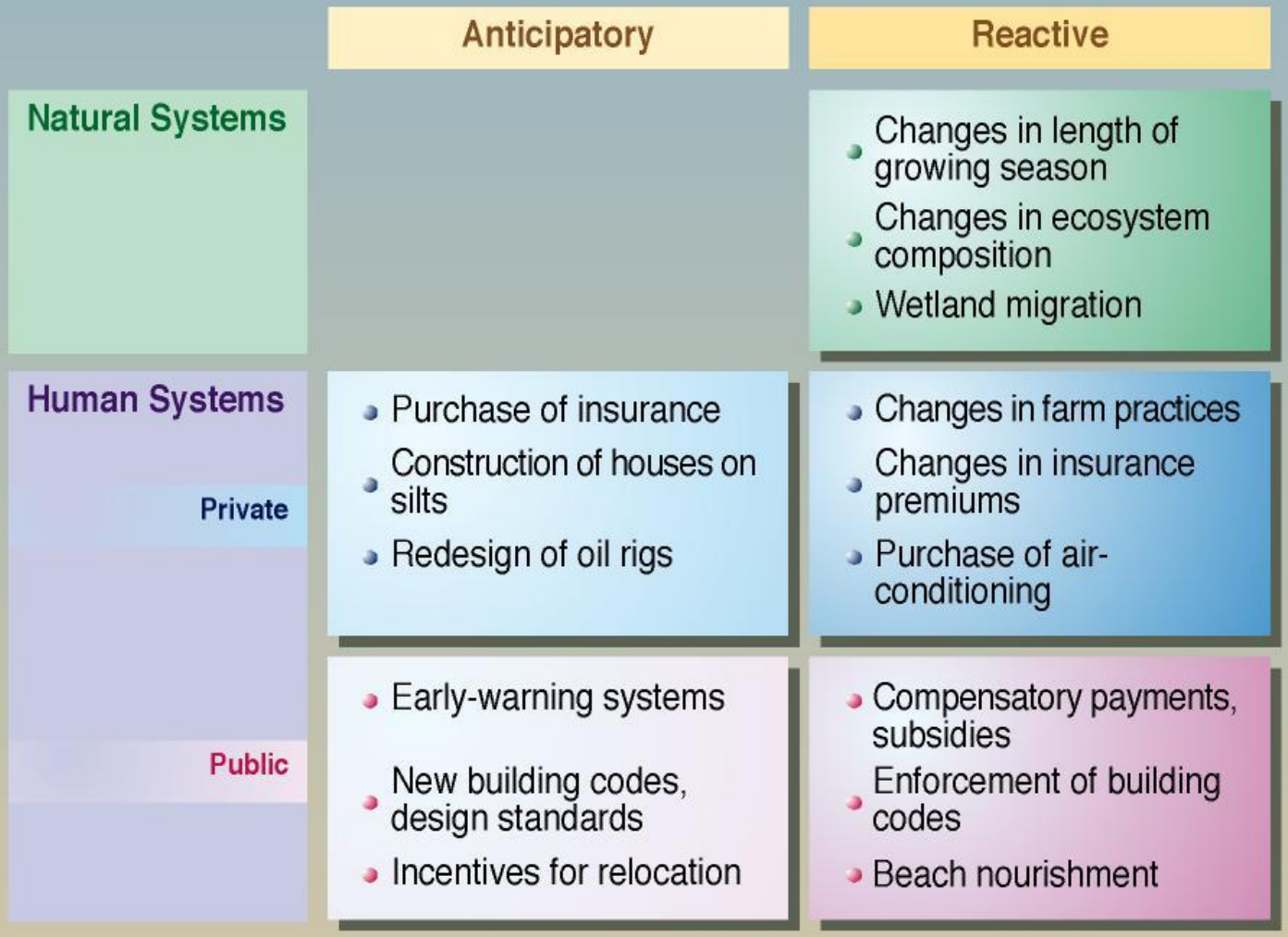
Even with efficient climate mitigation policy, climate change will continue for many decades, so that **adaptation** to its impacts will be **increasingly necessary**.

Types of adaptation to climate change



WG2 - FIGURE TS-9

EEA (2007):

Prevent the effects: structural and technological (e.g. hard engineering solutions and implementation of improved design standards)

Prevent the effects: legislative, regulatory and institutional (integrated management; revision of guidance notes for planners and design standards)

Avoid or exploit changes in risk (change location or other avoidance strategy, improve forecasting systems, contingency and disaster plans)

Share loss (insurance-type strategies)

Bear loss (where losses cannot be avoided: montane and arctic fauna and flora, coastal areas)

Research, education, awareness raising

Adaptive capacity highly uneven (Adger)

- Sections of all societies have insufficient capacity to adapt:
- *'In all regions there are certain areas, sectors and communities which are particularly vulnerable, for example the poor, young children and the elderly'.*
- Multiple stresses such as HIV/AIDS, violent conflict and land degradation adversely affect the capacity to adapt

Benefits of adaptation usually outweigh costs

- Multiple benefits of making development sustainable in:
  - Coastal planning
  - Agriculture
  - Energy demand for heating and cooling
- Analysis of water management (S Africa) and flood management (Netherlands) show benefits > costs

Broad range of uncertainties: e.g. model-dependent projections of precipitation

Robust findings on some variables and regions, but less so, elsewhere

Planning horizons – up to many decades (dams, forests). Information expected to change during the planning horizon.

Opportunity cost of faillure to act early vs value of delay (narrower range of uncertainty)

Good adaptation to existing climate and its variability augurs better for adaptation to the future, changed climate.

Current water management practices are very likely to be inadequate to reduce adverse impacts of climate change.

Adaptation to what? Uncertainty ranges

Adaptation to changing conditions has always been the core of water management, which traditionally focussed on **meeting the increasing demand**.

Water resources - **distributed unevenly** in space and time.
Flow regulation in time - storage reservoirs (capturing water when abundant and using it when it is scarce), **in space** - via water transfer.

Climate change causes changes in **supply** and **demand** and challenges the existing water infrastructure and management practices by **adding uncertainties**. Climate change poses novel risks often **outside the range of experience** .

Adaptation options for water supply and demand

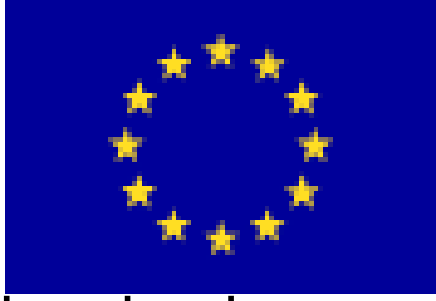
Supply side	**Demand side**
Increasing supply by enhancing storage (building reservoirs and dams, rainwater harvesting and storage, aquifer recharge), conjunctive use of surface water and groundwater, water transfer, deep well pumping, desalination of sea water Save water: improve efficiency of water use (Factor 4, „more crop per drop”), recycling, re-use (e.g. after treatment of waste water), leak reduction.	Reduction in water demand by policy instruments: legislative and regulatory, financial and market-based, education and information Examples: water pricing, promoting water saving technologies; metering; re-allocation of water to high-value uses; awareness raising.

Many potential current adaptations are consistent with sustainable development; that is, they can protect against both climate variability now and future climate change („no-regret" strategies – do things that make sense anyway. It is always good to save energy and water).

Adaptation measures can be „no-regret" but may also entail significant costs. Comprehensive estimates of costs of adaptation are limited and speculative. Even less is known about the benefits of adaptation, in terms of damages avoided.

Early adaptation is effective for avoiding damage, provided that projections of future climate change are sufficiently accurate. Delayed adaptation may lead to greater subsequent costs.

European Union Floods Directive



• Preliminary flood risk assessment (a map of the river basin; description of past floods; description of flooding processes and their sensitivity to change; description of development plans; assessment of the likelihood of future floods based on hydrological data, types of floods and the projected impact of climate change and land use trends; forecast of estimated consequences of future floods).

• Preparation of flood maps and indicative flood damage maps, for the river basins, sub-basins and stretches of coastline, covering the geographical areas which could be flooded with a high probability (likely return period, on average once in every 10 years); with a medium probability (likely return period, once in every 100 years), and with a low probability (extreme events).

• Preparation and implementation of flood risk management plans, aimed at achieving the required levels of protection.

Water managers in a few countries have begun to consider the implications of climate change explicitly in flood management.

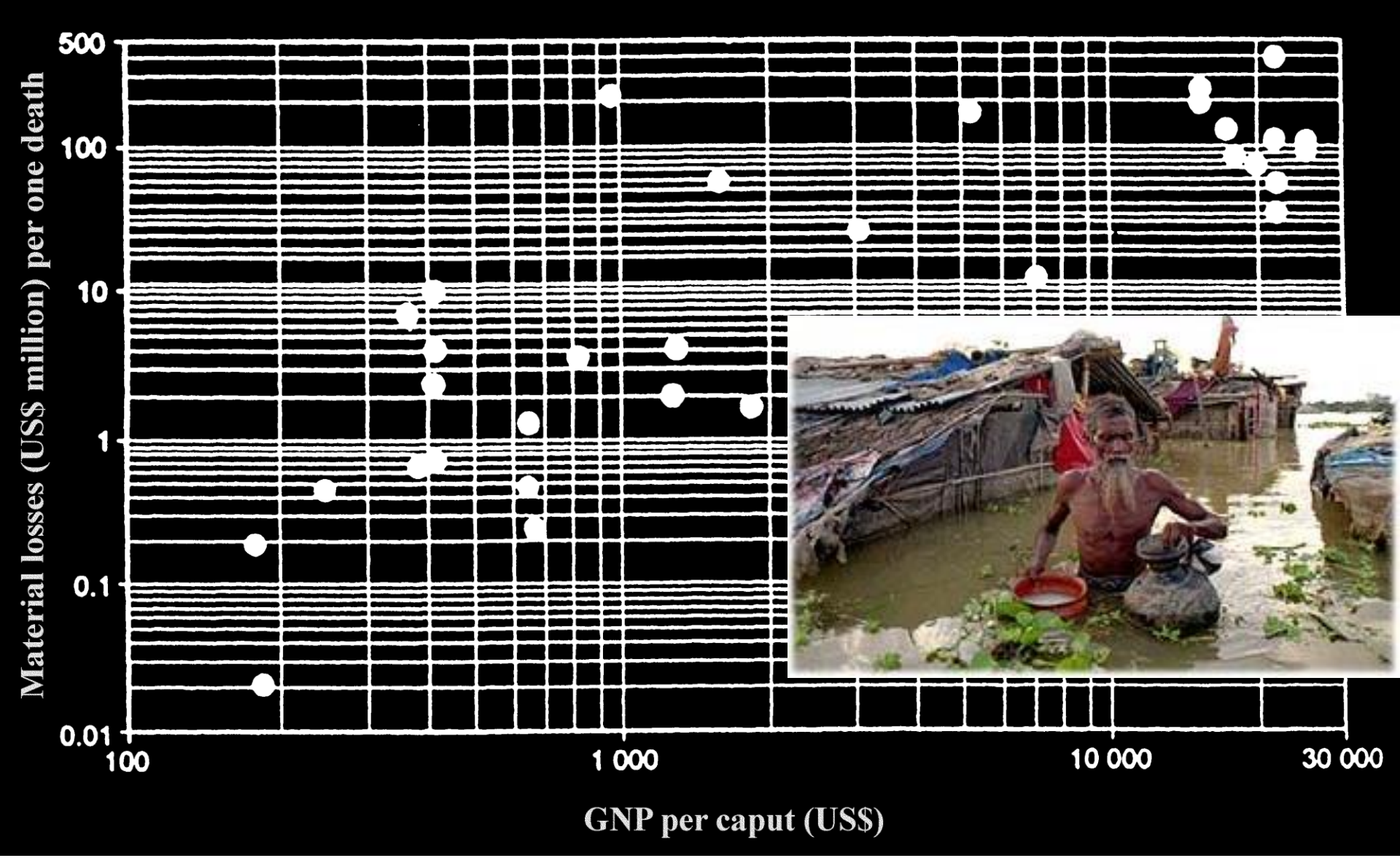
In the UK and in Bavaria design flood magnitudes have been increased by 20% and 15%, respectively, to reflect the possible effects of climate change.

Measures to cope with the increase of the design discharge for the Rhine in the Netherlands from 15 000 to 16 000 m^3/s must be implemented by 2015 and it is planned to increase the design discharge to 18 000 m^3/s in the longer term due to climate change.


ROAD SUBJECT TO
FLOODING
INDICATORS SHOW DEP


Occasional
Flooding
OORSTROMINGS
VAN TYD TOT TYD


EMERGENCY
AND ROAD
INFO
TUNE TO 1470 AM
IN CASE OF
FLOOD CLIMB
TO SAFETY
ESTES
PARK 20



Flood protection depends on wealth ***[Kundzewicz & Takeuchi, 1999]***

Combating desertification in China

Is migration a failure of adaptation? Source: Adger

Micronesia and Happisburgh, Norfolk

- Ongoing emigration from small island states – potential loss of sovereignty
- Cultures and places at risk

Limits to adaptation (after Arnell & Delaney, 2006, modified):

- **physical** (it may not be possible to prevent adverse effects, e.g. when rivers dry up completely, becoming ephemeral);
- **economic** (whilst it may be physically feasible to adapt, there may be economic constraints to what is affordable);
- **political and social** (relocation, constructing reservoirs may not be acceptable due to the detrimental effects to the environment; reduced reliability or standard of service unpalatable);
- **institutional** (e.g. capacity of water management agencies).

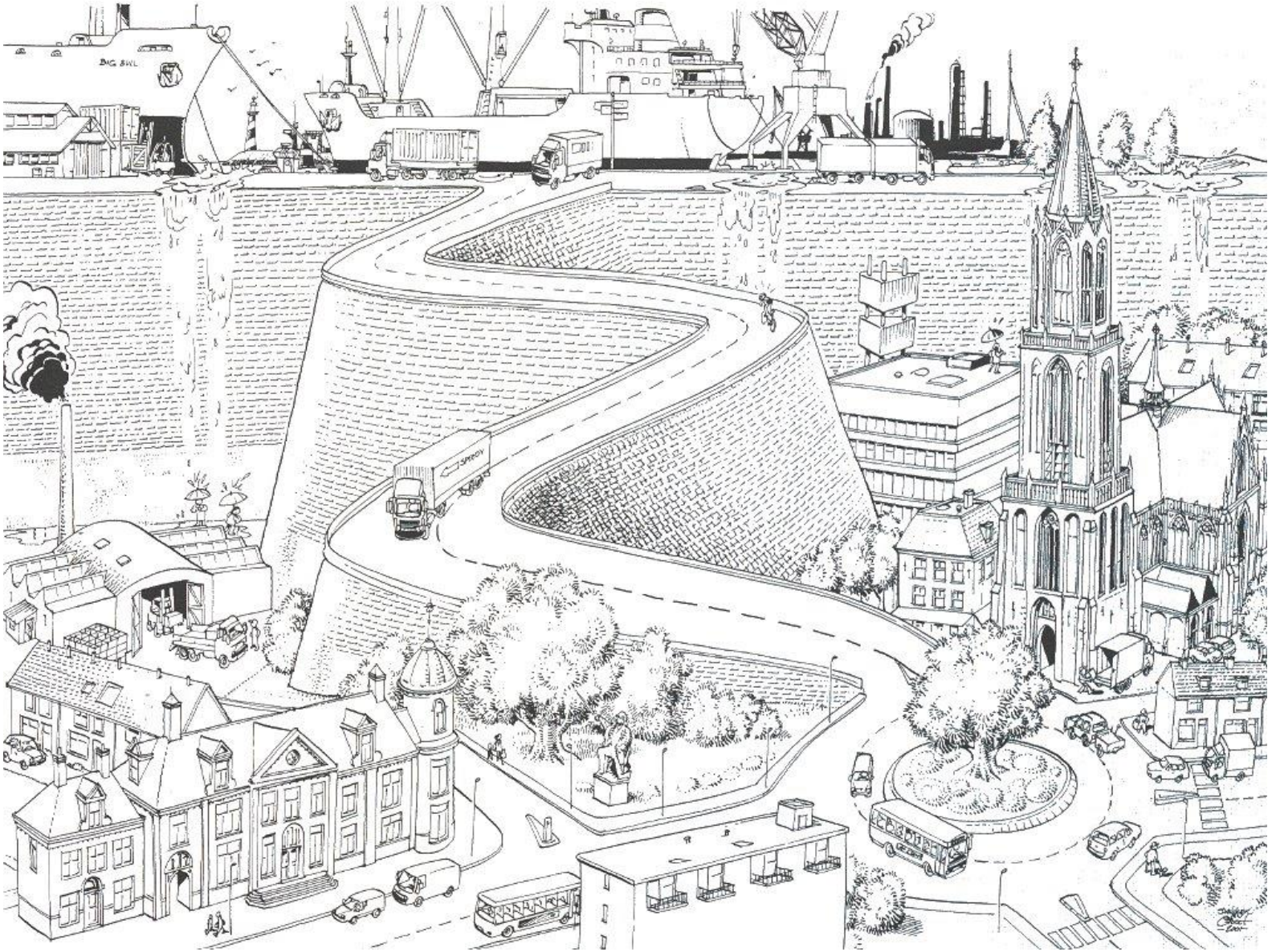
Barriers to adaptation to floods via relocation can be **external**, e. g. lack of land for relocation, or **internal**, such as unwillingness of people to relocate.

- High adaptive capacity does not necessarily translate into action
- Can we afford to wait for ‘events’?
- Ecosystems unlikely to adapt beyond (unknown) thresholds
- Evidence of behavioural and social constraints

Source: Anisimov & Lavrov, 2004

Town	Percent of affected buildings
Dikson	35%
Dudinka	55%
Pevek, Amderma	50%
Chita	60%
Vorkuta	80%

Recent and future climatic extremes: consequences for the Netherlands




GLOBAL WARMING WARS HEAT UP! • HOUDINI'S SÉANCE • THERE BE DRAGONS
SKEPTIC
SPECIAL ISSUE: Global Warming Skepticism and the Problem with Predictions • Hydrogen Fuel Cell Skepticism
How We Know Global Warming Is Real • How to Save the Planet
Last Chance to Win Randi's Millions; Houdini Conducts a Seance;
King Kong & Loch Ness—a Surprise Connection; Anthropologists
Not Skeptical Enough; What's Wrong with Broadcast Journalism;
REVIEWS: What's so Great About Dinesh D'Souza; The Best Damn
Evolution Book Period; Paul Davies' Cosmic Jackpot;
Science Wars II: Norman Levitt v. Steve Fuller

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Mitigation and adaptation

* Mitigation acts on a **global** level over longer time scales due to the inertia of the climate system, slowing the rate of climate change and thus delaying the date of impact and its magnitude.
* Adaptation strategies can reduce vulnerability to changes in climate at the **local and regional** level and over short time scales, thus reducing the impact.
* Most of the benefits of mitigation will not be realised until after decades, requiring adaptation to address near-future impacts.
* Without mitigation, eventually the increasing magnitude of climate change would significantly diminish the effectiveness of adaptation.

Air conditioning:

Good for climate change **adaptation**

A+

Bad for climate change **mitigation** (unless electricity is not produced of fossil fuels)

M -

There are complex linkages between **mitigation of climate change** and **adaptation to climate change**. **Mitigation** is often about **energy**. **Adaptation** is often about **water**.

In general, mitigation policies reduce the impacts and need for adaptation to climate change but some mitigation measures may constrain adaptation options. **Biofuel production competes for water and land with food production.** First-generation biofuels may have higher water and carbon footprint per unit of energy produced compared to fossil fuels. Corn grown in the US for energy purposes may require more calories of input than it eventually produces. On the other hand, some water management adaptation measures (e.g, **desalination, pumping of deep groundwater, or water treatment**) are very energy-intensive and their implementation would increase greenhouse gas emissions.

Mitigation of climate change and adaptation to climate change and its impacts are sometimes in conflict.

Desalination: **A+ M-**
Afforestation: **A- M+**
Enhancing water storage: **A+ M+ E?**

Multi-purpose water storage:

Enhancing multi-purpose water storage is a remedy for both classes of hydrological extremes: floods and droughts (in addition: there are positive effects for water supply; hydropower, recreation, navigation, fishery, aesthetics, ecosystems).

Enhancing water storage can be advantageous for both adaptation and mitigation but adverse effects are possible (disruption of ecosystems – fish cannot migrate; resettlement; inundation of fertile land, including vegetation – GHG emissions)

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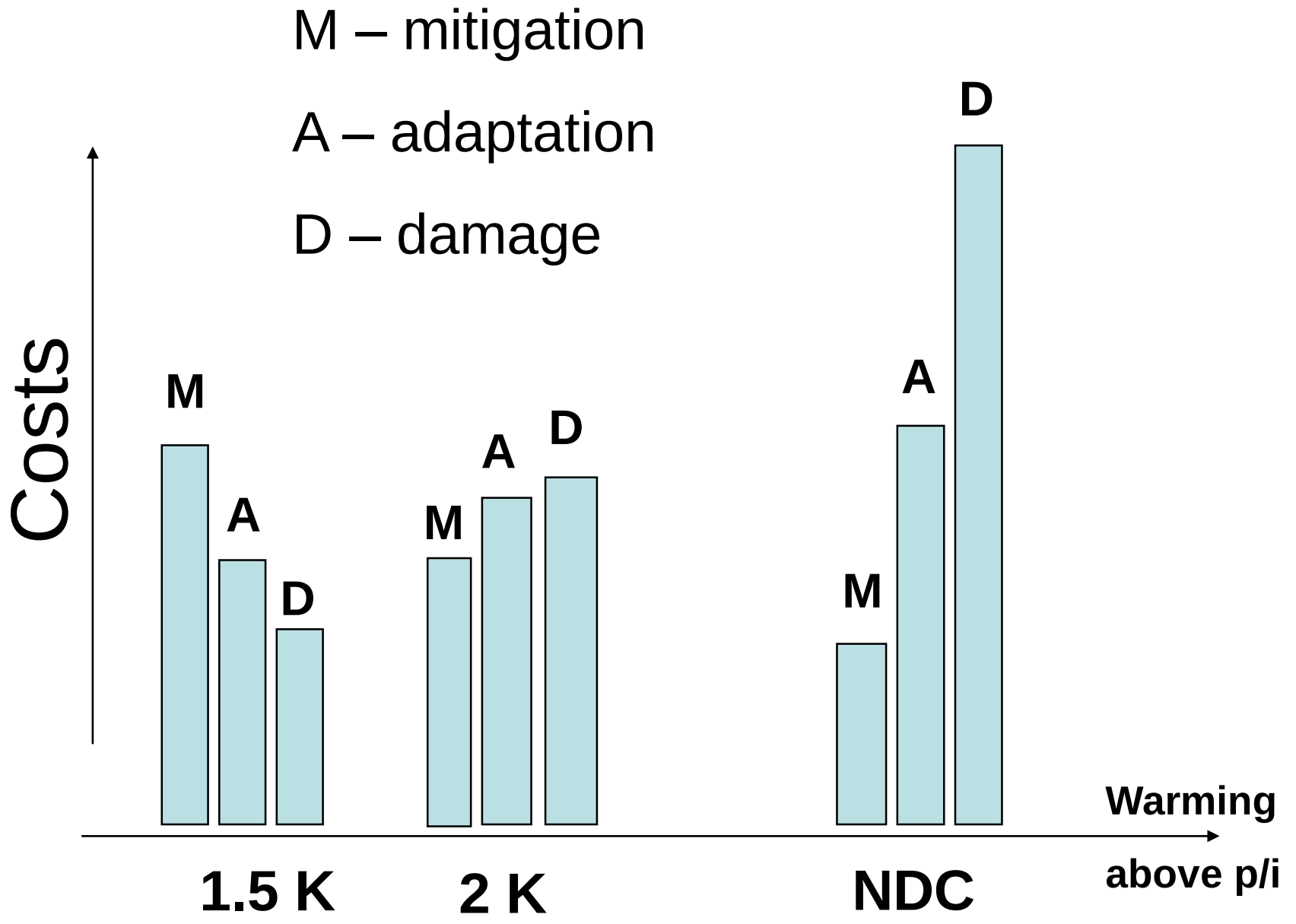
What can be done?

mitigate

adapt

suffer


M – mitigation
A – adaptation
D – damage
Costs
M
A
D
M
A
D
M
A
D
Warming
above p/i
1.5 K
2 K
NDC

We have to avoid the unmanageable and to manage the unavoidable

Thank you

Source: andzia.obiezyswiat.org

kundzewicz@yahoo.com