# futureth

research for global sustainability

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Science Officer Future Earth Global Secretariat



United Nations ational, Scientific and Cultural Organization



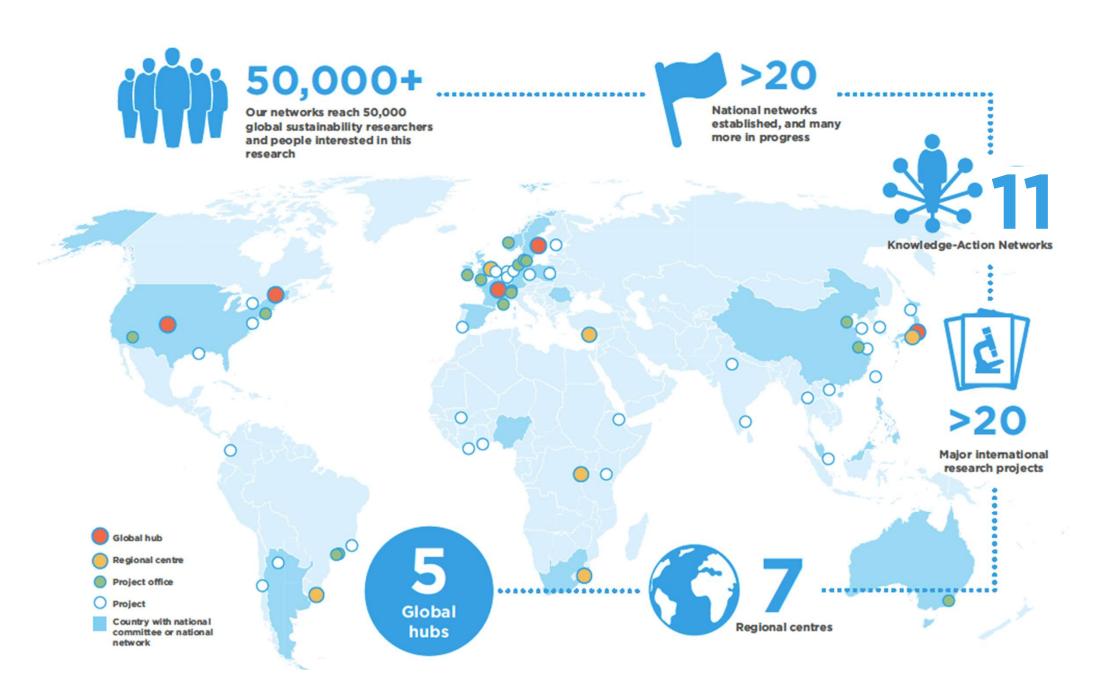


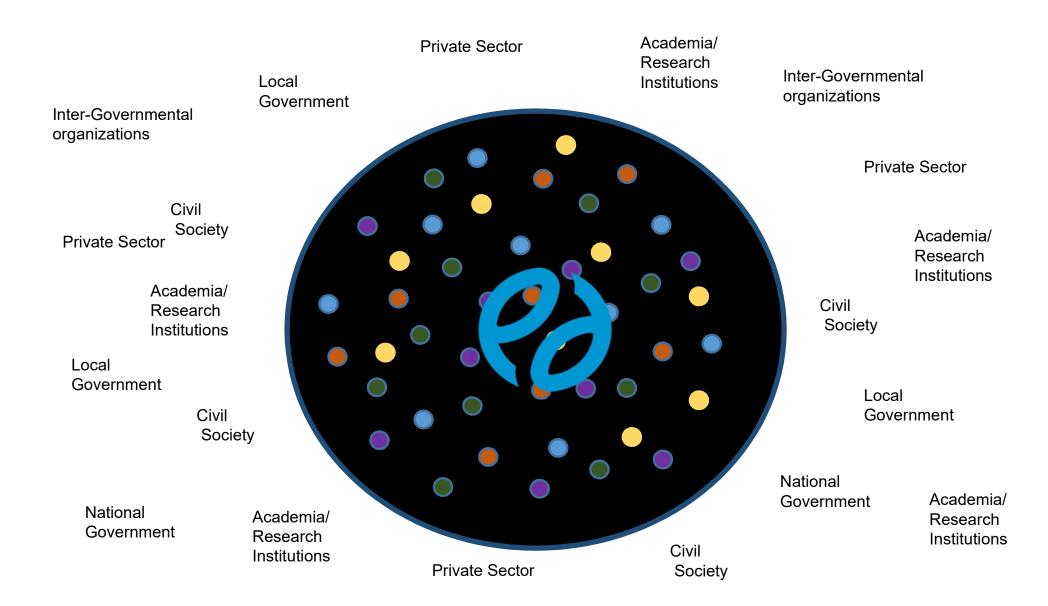








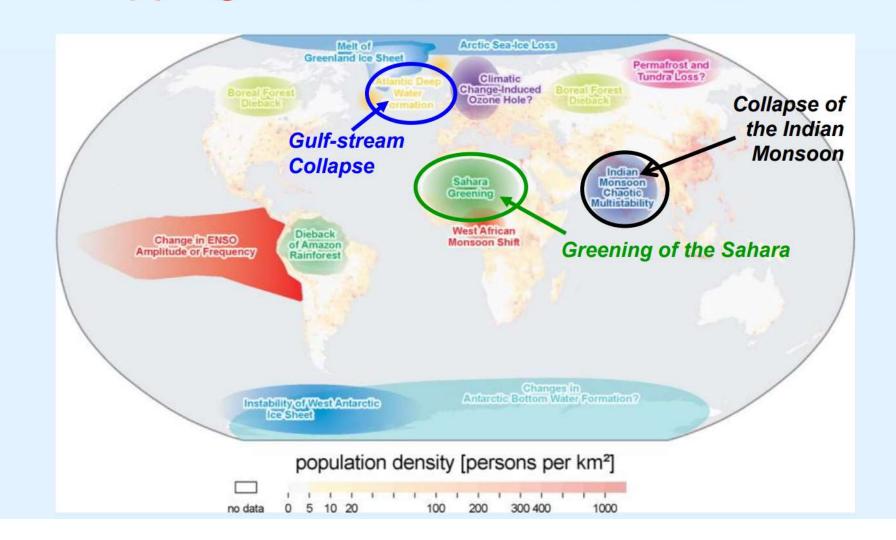




# **Knowledge-Action Networks**



#### Tipping Points (Lenton et al., 2008)

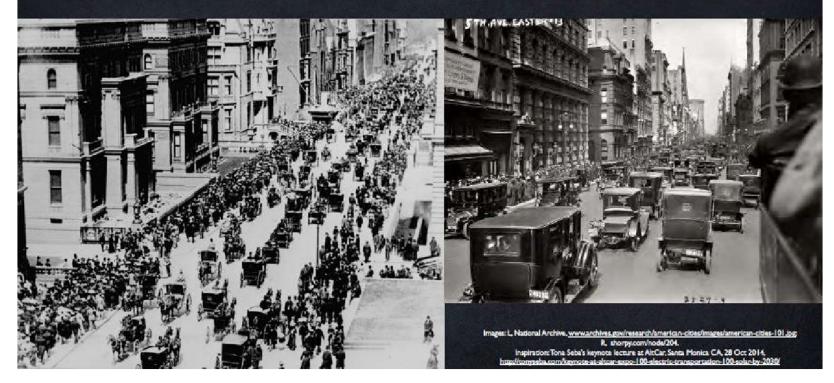


## **Disruptive Change**

#### Easter Parade on Fifth Avenue, New York, 13 years apart

1900: where's the car?

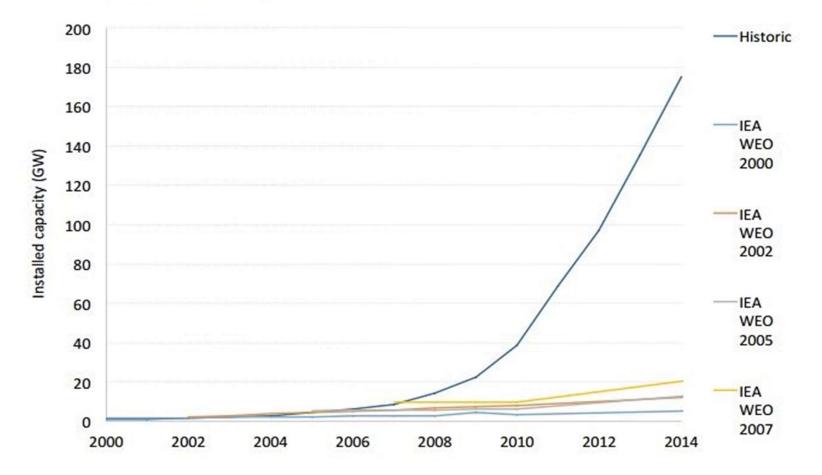
1913: where's the horse?



Source: Campanale, Carbontracker

#### Energy forecasts and exponential change

Figure A: IEA solar PV capacity forecasts against actual



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unionment whith the majoranty in the last de-cude (see the figure, part C). All sectors (e.g., cule (see the figure, part C). All sectors (e.g., applications), finance, manufac-norm, manying and empayable transfor-metion pathways. In addition, data sain at of viable alcinatives, the world mark in a middly gaining up C4 pract 0.5 (ROC) /year by modely sealing up C4 pract 0.5 (ROC) /year by 1940, 25 by 2040, and 5 by 2050. CO, univmeans from zero to at least 0.5 GNCD /year by 5080, 25 by 3040, and 5 by 2050. Co\_ cons-sions from land-use must decrease along an linear trajectory from + GRCD, year in 2010, to 3 by 2020. Least of the optical comto 2 by 2030,1 by 2040, and 0 by 2050 (see to 2 by 2020, 1 by 2040, and 0 by 2050 (see the figure, part Cr. The endgame B for emut-lative (3) emissions since 3097 to be brought lative (3) emissions since 3097 to be blow 2000 back from anound 700 (RCO, to below 2000 CrCO, but the end of the constructions of the figure crCO. back from around 700 (steel, to nerve 200 GIO<sub>2</sub> by the end of the century (see the fis-pre, part A) and atmospheric CO<sub>2</sub> concentrations to return to 380 ppm by 2100 (currently

Roadmans are plauning instruments, link-Koomage are planning inserments, mak-ing skorter-term turgets to longer-term gala. The budyaking actions and comparisoning to the site of the states of the state of the states of the problem states of the states of the states of the problem states of the states of th unnugus to meet a conexice chanenge. An explicit carbon roadmap for halving anthro-Emissions inevitably approach zero with a "carbon law" pose framing the decarbonization challenge pose framing the decarbonization challenge in torus of a global docatal roadausp based on a simple neuralist—a "carbon taw—of halving groue anthroppenie orbention-ide (FO) transcissor carbo docate. Canada International a accordination world. The muces towards a accordination world. The explore and a cargon has well be a dust Arat-er that public measures and a dust rate discontinuation of the second and the discontinuation for solutions of the simulation of the market. Thus, the transformation from by interfa imposed by next selections unifolds at a page specific imposed by recondent within the important imposed by recondent behandingties (see the figure, part 16). halving gross anthroposenic carbandios ide (CO<sub>2</sub>) emissions every decade. Comple-nicated by immediately instigated, scalable nicined by innernaciy insusaes, someore and and remain and entries to ramp conver-land-use CO<sub>2</sub> emissions, this can lead to telland use CO, emissions, tius can lead to tech acto emissions around mid-century, a path necessary to limit warming to well below 2000 recessing to more warming to very perior 270. The Paris goal translates into a finite planramer man by mertia migrate or mer technologies (see the figure, part 8). The Paris goal translates into a finite plan-clary carbon budget: a 30% chance of limit-ing warming to 15% by 2000 and a >08% probability of meeting the 2°C target imply that abade Co-emissione useds to later than probability or meeting the 4 C target rought has global CO, emissions posk to later than 2000, and more meetings during from . At

unat Europa CO, emissionis peak nu later than 2020, and gross emissions decline from ~40 systems (metric) of carbon dinside (RACO.) Systemas (merric) of carbon mostne (rac0.). year in 2020, to -24 by 2030, -14 by 2010, year in 2020, in -21 by 2050, -14 by 2010, and ~5 by 2050 (3) (see the figure, part A). Risks could be further reduced by moderately increasing ambition to halve emissions every Increasing ambition to halve emissions every decade (see the figure, part C). Following such a global environ hav means at least himit-ing and the total CO, emissions from 3077 and the end of the centure to -2000 GrO ing cumulative total CO, emissions from 2077 utili lac cust of the century to -700 GROs, which allows for a small not essential contun-which allows for a small not essential contun-lor of the content of the rentweev in the focure. gency (-125 GtG), less comparet with total CO, emissions in the pathway in the figure, part A) for risks of blosphere carbon feedpart, A) for fishes of onospinare carbon (ced-backs (ii) or delay in ramping up CO<sub>2</sub>-removal

a carbon law applies to all sectors and A ceruon any appares to an secon and countries at all scales and encourages hold technologies. countries at all scales and encourages bold action in the short term, it means, for ex-anable, coubling of acro-caluon shares in the encreasy system every 5 to 7 years. A rate

explicit cartern roanmap for having antitro-pogenic emissions every decade, codesigned by and for all industry scetors, could help provy nou or an moustly sectors, como neip pro-mole disruptive, nonlinear technological advance one opener, nonmener wermonoppen and and the lowerds a zero-canissions world. The

technologies (see the figure, part I). We skeled) out a busad decadal docat-bolization paratice in jour dimensions-involvement at convide schewerd fossibilitie nnovacion, institutions, intrastructures, inti investiment-to provide evidence of feasibility investment—to provide evidence of recommiss to and depth of transformation for economies to and depth of transformation for economics to env on a carbon-law trajectory: The numeric purifies no guarantees but identifies crucial stops grounded in published securities out-hirds with enser interment. Heat new has slops, grounded in published scenarios com-blied with expert judgment. Each step has byo parts: actions for rapid near-term emissions reductions, and actions for systemic sions reductions, and actions for systemic and long-term impact, creating the basis for the next steps. Such a narrative, specifically the next steps, once a narrow, spectrosy designed with decadal largels and incentives, ousioned with necausi targets and incentives, could provide key elements for national and could provide new extraction for international climate strategies.

2017-2020: NO-BRAINERS Annual emissions from fossil fuels must start failing by 2020, Well-proven (and ide-start failing by 2020, Well-proven (and ideally incomedicated policy instruments ally income-neutran poincy maximization and state and st 31 NARCH 2017 - VOL 311 ISSUE 6551 1269

# A "CARBON LAW"

Meeting the Paris Agreement translates to HALVING EMISSIONS **EVERY DECADE** to 2050



Leonardo DiCaprio 🥥 @LeoDiCaprio

Follow

Leading scientists propose a new approach to tackle #climatechange called the #CarbonLaw. Learn more:



Science (24 March 2017) Rockström et al

POLICY FORUM

A roadmap for rapid

ie," Hans Joachim

th the Paris Agreement's goals (1) ough the rans Agreements your (7) aligned with science (2) and can, in reple, be bechnically and economic

achieved (3), alarming inconsisremain herween science-based remain nerween science-oasea and national commitments.

ogress during the 2016 Marrakeeh

progress during lite 2010 Marrakeen negotiations, long-term goals can hed by political short-termism. Kol-

strategies, with more due soon.

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towing us ASCOLLER, which occurs much bational low carlier than expected, several contries published mid-century decur-

tonization strategies, with more due soon. Model-based decarbonization assessments (4) and scenarios often stratight to capture

one senaras oren srugge to cajure austremative change and the dynamics as

vonsectuative change and the communication and socialed with it: disruption, innovation, and

Nonlinear change in numan benavior. For ex-ample, in just 2 years, China's eval use swurge from 3/7% growth in 2013 to a decline of 3/7%

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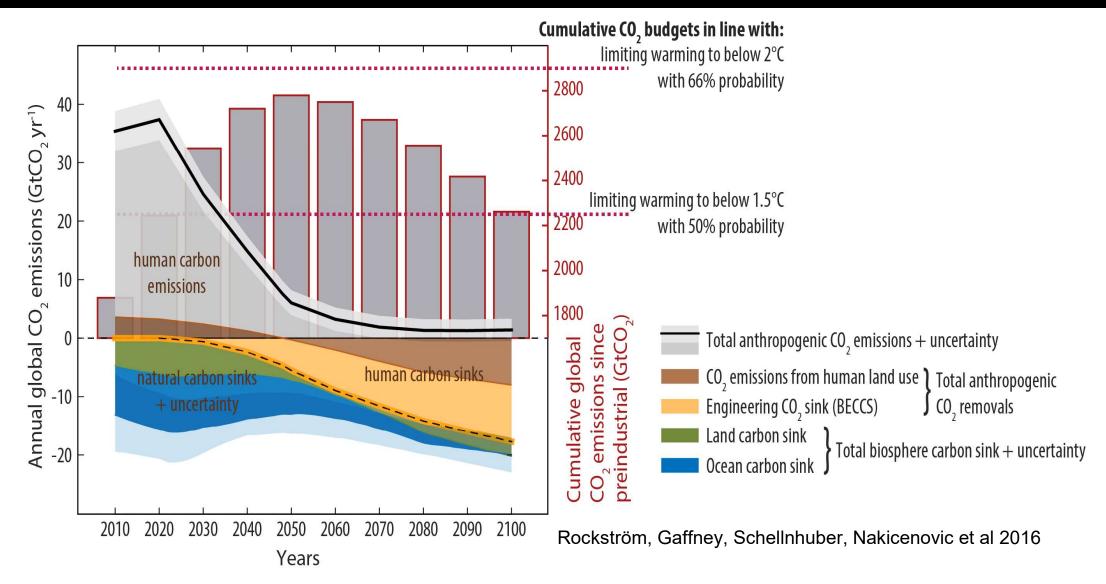
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un 3/7% grown in 2015 to a ceane of mar 2015 (5). To harness these dynamics and calibrate for short-term realpolitik, we pro-

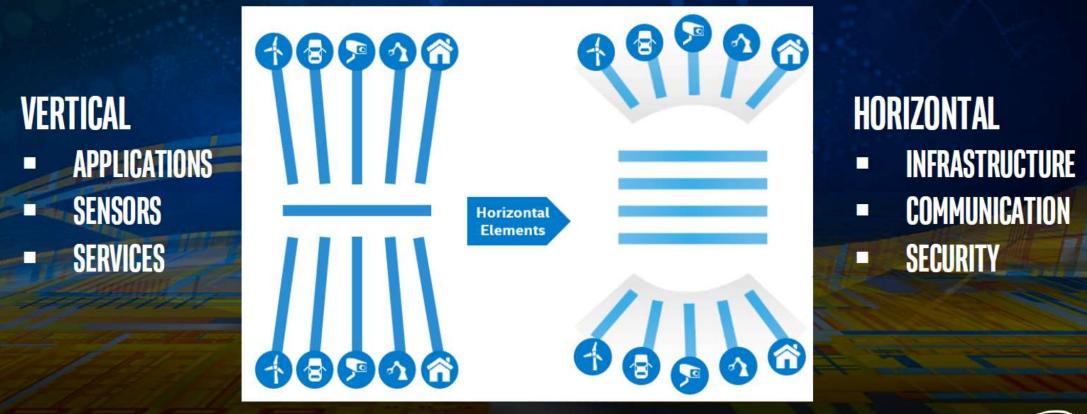
decarbonization

kström,' Owen Ga oeri Rogeli,<sup>54</sup> Malte Meinshausen

#### A global transformation – to a safe climate future



# FROM VERTICAL TO HORIZONTAL ECOSYSTEM ENABLES COST REDUCTION AND CONTINOUS INNOVATION

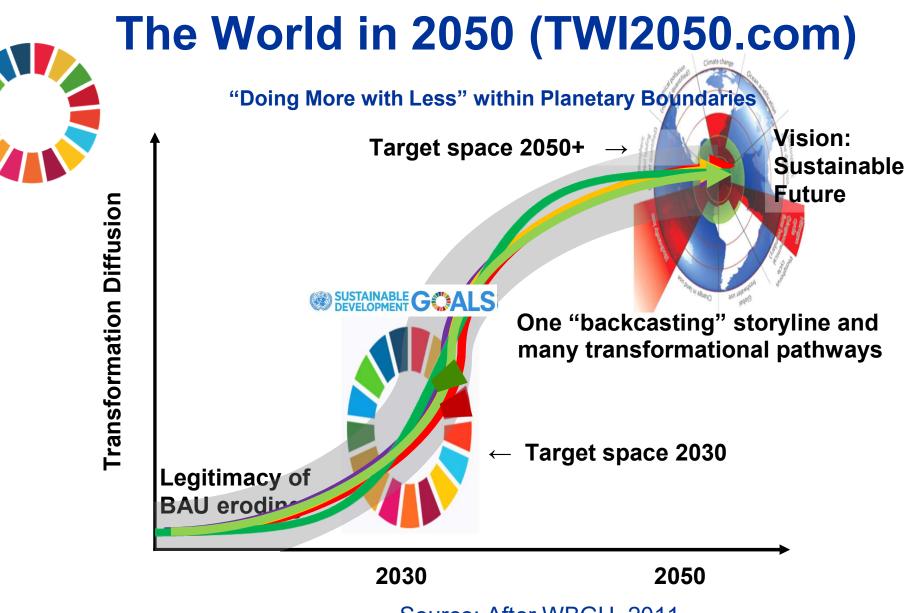






## Transformations

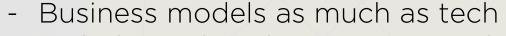
- Challenge: To understand and inform how societies can make transitions toward sustainability
- Working in tandem with the ISSC Transformations project
- Partnering on the major Transformations 2017 conference (Dundee, UK, 2017)
- Setting up a Global SDG Transformations Forum



Source: After WBGU, 2011

### How drive low-carbon disruptions?

HZ



- A dedicated push, consistent policy
- Meeting user needs

Alfie Kirk, Tyndall Centre

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- Fair access to markets
- Addressing social resistance ma

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#### WHAT IS THE D.COM MARY

- Are distributed patterns impacting?
- Differences between countries?
- How deal with incumbents?
- Are current modeling tools sufficient?

WHAT KINDS of MNONTION LEAD TO TEANS ADEMATIN?



technology lunnavation

H3

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**UK Science** & Innovation futurearth research for global sustainability

HOW DO WE DEFINE

destruction ?

LENKYBURAL

Tyndall<sup>°</sup>Centre<sup>®</sup> for Climate Change Research

#### Tipping Cities to Decarbonisation Pathways through ICT Tokyo 2018 | Stockholm 2018



#### Key 2018 conference on cities and climate change



Deadline for abstracts and session proposals: 16th Oct

# Take aways:

- Magic will happen in the **intersection** between different academic disciplines, stakeholders, policymakers...
- Research should include understanding for possible sudden system-level changes, tipping points
- How stimulate and direct exponential change towards sustainability?

Thanks for listening!

To collaborate, start here ---- erik.pihl 🔗 futureearth.org