Duality in Climate Change: A tale of Parisian triumph & tragedy

twitter: @KevinClimate

web: kevinanderson.info

Kevin Anderson
Professor of Energy & Climate Change
Richard Feynman on climate change & Paris

For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled.

Richard P. Feynman.

*Shuttle Presidential Commission 1986*
My Pre-Paris provocation

In developing 2°C emission scenarios, we’ve applied questionable assumptions and fine-tuned our analysis to align with political & economic sensibilities.
Backdrop to **Paris** (& *latest IPCC reports*)

- The mitigation message has changed little in the last **twenty five** years

- Annual emissions **~60% higher** than at time of the first report in **1990**
Backdrop to **Paris** (& *latest IPCC reports*)

- in terms of temperature (2°C) rise by 2100,
- it’s **carbon budgets** that matter,
- **not** long-term (2050) targets

*i.e. the more we emit today— the less we can emit tomorrow*

... *this has fundamental political repercussions* ....
Thinking of this graphically...
The carbon budget (e.g. for 2°C) is the area under the curve.
If we delay stringent mitigation today

We emit additional CO$_2$

A

Carbon dioxide emissions

- If we delay stringent mitigation today, we emit additional CO$_2$. A
Carbon dioxide emissions (GtCO₂/yr), which must be compensated later (if possible!)
Carbon dioxide emissions (GtCO\textsubscript{2} / yr) with higher rates of mitigation.
Returning to the Paris Agreement
Conference of the Parties
Twenty-first session
Paris, 30 November to 11 December 2015

Agenda item 4(b)
Durban Platform for Enhanced Action (decision 1/CP.17)
Adoption of a protocol, another legal instrument, or an agreed outcome with legal force under the Convention applicable to all Parties

ADOPTION OF THE PARIS AGREEMENT

Proposal by the President

Draft decision -/CP.21

The Conference of the Parties,

Recalling decision 1/CP.17 on the establishment of the Ad Hoc Working Group on the Durban Platform for Enhanced Action,

Also recalling Articles 2, 3 and 4 of the Convention,

Further recalling relevant decisions of the Conference of the Parties, including decisions 1/CP.16, 2/CP.18, 1/CP.19 and 1/CP.20,
Paris Agreement – An important diplomatic triumph

local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity,

Also acknowledging the specific needs and concerns of developing country Parties arising from the impact of the implementation of response measures and, in this regard, decisions 5/CP.7, 1/CP.10, 1/CP.16 and 8/CP.17,

Emphasizing with serious concern the urgent need to address the significant gap between the aggregate effect of Parties’ mitigation pledges in terms of global annual emissions of greenhouse gases by 2020 and aggregate emission pathways consistent with holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.

Also emphasizing that enhanced pre-2020 ambition can lay a solid foundation for enhanced post-2020 ambition,

Stressing the urgency of accelerating the implementation of the Convention and its Kyoto Protocol in order to enhance pre-2020 ambition,

Recognizing the urgent need to enhance the provision of finance, technology and capacity-building support by developed country Parties, in a predictable manner, to enable enhanced pre-2020 action by developing country Parties,

Emphasizing the enduring benefits of ambitious and early action, including major reductions in the cost of future mitigation and adaptation efforts,

Acknowledging the need to promote universal access to sustainable energy in developing countries, in particular in Africa, through the enhanced deployment of renewable energy,

Agreeing to uphold and promote regional and international cooperation in order to mobilize stronger and more ambitious climate action by all Parties and non-Party stakeholders, including civil society, the private sector, financial institutions, cities and other subnational authorities, local communities and indigenous peoples.
… hold the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C.

…to undertake rapid reductions in accordance with best science.

…on the basis of equity, and efforts to eradicate poverty.
‘Issues’ with the Paris Agreement

- no reference to fossil fuels or decarbonisation
- aviation and shipping exempt from any action
- voluntary pledges (INDCs) equate to 3 to 4°C
- no major review of INDCs until ~2023; i.e. ~300 billion tonnes of CO₂ from now
- fundamental reliance on highly speculative negative emission technologies

- $100 billion p.a. finance to “help developing nations cope with climate change”

Cf. [1] UK 2015 GDP $2.8 trillion (~28x total funds for “developing nations”)
[2] IMF estimate direct & indirect subsidy to fossil fuels in 2015 ~$5.3 trillion (53x)
Before Paris ...

4°C to 6°C
Carbon dioxide from fossil fuel & cement (GtCO₂ yr⁻¹)

Pledges (INDCs) ~3°C to 4°C
Carbon dioxide from fossil fuel & cement (GtCO₂yr⁻¹)

Year:
- 1980
- 1990
- 2000
- 2010
- 2020
- 2030
- 2040
- 2050

Pledges (INDCs) ~3°C to 4°C

2°C
What does this mean for our energy system?
Carbon dioxide from fossil fuel & cement (GtCO2yr⁻¹)

YEAR

GCP new data

Pledges (INDCs) ~3°C to 4°C

Deep Cuts in Energy Demand

2°C

Supply & demand

“well below 2°C” & “pursue 1.5°C” on the basis of equity
In 3 to 13 years we’ll use all the 1.5°C energy-CO$_2$ budget

Pledges not reviewed in depth till 2023

... from a budget perspective

it is now too late for 1.5°C
... and for $2^\circ\text{C}$?

- **66%** chance of $2^\circ\text{C}$ is lost

- **50%** demands a *war-like* footing on mitigation - now

- **33%** demands mitigation beyond anything discussed in Paris
What’s this mean for poorer & richer nations?
Poorer/industrialising nations:

1. Collectively peak their emissions by 2025

2. Then rapidly increase mitigation to ~10% p.a. by 2035

3. Fully decarbonise their energy systems by ~2050
... then, for 2°C, **wealthy** nations require:

At least **10% reduction** in emissions year on year from **now**, i.e:

- 50% reduction by ~2020 (c.f. 1990)
- 75% ~2025
- 90% ~2030

*Zero carbon energy by ~2035*

*Cf. EU’s submission to Paris 40% by 2030*
So, for energy & an outside chance of 2°C:

- Poorer & less-industrialised nations: \textit{zero CO}_2 \textit{by } \sim \textbf{2050}

- Wealthy industrialised nations: \textit{zero CO}_2 \textit{by } \sim \textbf{2035}
How can this fit with the Paris euphoria?

The good news is that [2°C] reductions ... are possible without sacrificing the benefits of economic growth and rising prosperity

UK Committee on Climate Change
How can this fit with the Paris euphoria?

... mitigation costs would be so low that

“global economic growth would not be strongly affected”

Chair of WG III
... by pulling a rabbit from the magician’s hat
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Negative emissions technologies (NETs)

i.e. suck CO$_2$ directly from the atmosphere by 2030 & beyond
... by pulling a rabbit from the magician’s hat

Negative emissions technologies (NETs)

**BECCS** – *biomass energy with carbon capture & storage:*

Grow trees/plants

*they absorb CO$_2$ through photosynthesis*

burn trees in powerstations

*capture the CO$_2$ from the chimney*

~liquefy the CO$_2$ & pump it underground

store for many 1000s of years
... by pulling a rabbit from the magician’s hat

Negative emissions technologies (NETs)

BECCS – biomass energy with carbon capture & storage:

Never worked at scale

huge technical & economic unknowns

major efficiency penalty

limited biomass availability (fuel or food?)
... by pulling a rabbit from the magician’s hat

**BECCS** – *level of inclusion in government means:*

- planting 1 to 3x the area of India
- year after year; decade after decade
- store 100s of billions of tonnes of CO₂
- securely underground for 1000s of years
… absorbs ½ of anthropogenic annual CO$_2$
  *i.e. oceans & plants absorbs ~20GtCO$_2$/yr.*

BECCS is set to absorb 10 to 20GtCO$_2$/yr
  *i.e. up to another planet’s worth of biospere*

... or the equivalent of adding another biosphere!
So Paris, some Academics & Politicians …

- rather than focus on urgent & deep mitigation now
  … *with challenging political & economic repercussions*

- prefer to rely on non-existent negative emission technologies
  … *to suck huge quantities of CO$_2$ from the air in the future*
A litany of scams

- Offsetting
- Clean development mechanism (CDM) ... state sanctioned offsetting
- Emissions trading (EUETS)
- BECCS & NETs

... when are we going to try actual mitigation?
We’ve ignored Feynman’s warning

For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled.

Richard P. Feynman.

Shuttle Presidential Commission 1986
Returning to 2°C

... is it still a viable goal?
Hypothesis: yes  ... just

- Technology
  - Demand: near term options
  - Supply: decadal timeframe

- Equity: immediate & near-term
Technology:

`saviour of the status quo?`
Technology: the saviour of the status quo?

Supply: delivering low/zero carbon energy

Demand: using less energy to deliver the same services
SUPPLY: low-CO$_2$ electricity

- Tidal
- Wave
- Biomass

(CCS ?)
SUPPLY: low-CO₂ energy

But, electricity is typically 20% of final energy demand.

What options for decarbonising the other 80%?

- Massive electrification (heating, transport, industry etc.)
- ‘Sustainable’ biomass/biofuel
- Hydrogen (electrolysis or thermal decomposition)
- Other (e.g. wind for ships)?
SUPPLY: headline message for fossil fuels

To meet the Paris commitments:

Over 80% of existing reserves must remain in the ground

Timeframe for 2°C means this changes little even with CCS

Unconventionals (shale gas/oil, tar sands, etc.) have little/no role to play
SUPPLY: too little too late for 2°C

- Decarbonising energy supply will take several decades
- In 2016 we don’t have the luxury of such timescales

Zero-Carbon supply is essential but insufficient
DEMAND: opportunities for near-term mitigation

The example of private cars:

- EU & US ~12-15% of emissions
- ~270 petrol/diesel models <100gCO2/km... at no price premium
- 2/3 of car travel is by vehicles 8yrs old or younger
DEMAND: opportunities for near-term mitigation

Set a stringent $CO_2$ Standard

... then even existing models of petrol/diesel cars

- With no additional capital cost
- Reduced operating cost
- Identical infrastructure
- Same employment & companies

could deliver 50% to 70% reduction in ~10yrs

NB: walking, cycling, public transport, electrification & less travel are all essential
DEMAND: opportunities for near-term mitigation

More generally

- Establish stringent efficiency standards
- Tighten year on year
- Providing long-term & dynamic market signal
- & most cost-effective improvement in energy-service security

**Industrialised/wealthy nations:** - *power-down energy demand by 40 to 70% in around 10 years*

*(NB: accompanying policies to address issues of rebound are essential)*
Beyond technology

Put simply:

Technology (supply & demand) alone cannot deliver on the Paris budgets

Rapid & deep changes in *what we do, how we do it & how often we do* is now critical
Equity:

$CO_2$ asymmetry & mitigation
EQUITY: extreme emission asymmetry

~50% of global CO$_2$ comes from ~10% of the population

Top 1% of US emitters (~3.4 million people) ... have CO$_2$ footprints

2500x higher than bottom 1% globally (~70 million)
... if the top 10% of global emitters were to reduce their carbon footprint to the level of a typical EU citizen

*Global CO$_2$ emissions would be cut ~33%*
So, who is in this key 10% group?
So, who is in this key 10% group?
So, who is in this key 10% group?
EQUITY: frames a new agenda for mitigation

- Most of the 7 billion have little scope to reduce emissions
- There is huge asymmetry in responsibility
- Rapid & near-term reduction in CO$_2$ from top 10% of emitters
- Real opportunity for leading by example
- And thereby catalysing system-change
Climate Change demands System Change

Interpreting Paris through the scientific logic of carbon budgets begs fundamental questions of our norms & paradigms
A Radical Plan for 2°C – two phases

1. Deep reductions in energy demand from now to ~2030
   
   ... by the high emitters

2. Marshall-style build programme of zero carbon energy supply

   ... with 100% penetration by 2050
Climate Change *is* System Change

But which ‘System’ will we choose?

- continue with our insincere platitudes on mitigation – ignore the poor & climatically vulnerable, and bequeath our own children a rapidly changing climate

- Or demonstrate integrity and begin an *immediate* and *radical* programme of decarbonisation shaping a new and prosperous post-carbon society
Thank you

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