Some Big Sustainability Issues

- Energy and Climate Change (John Fitzpatrick)
- Fresh Water Resources (Debbie Chapman)

Last time: Unsustainable societal construct

This week: Moving to a sustainable societal construct

Energy and Climate Change

Presentation Content – Last Time

Unsustainable societal construct

1. Current unsustainable energy situation

2. Global warming and climate change

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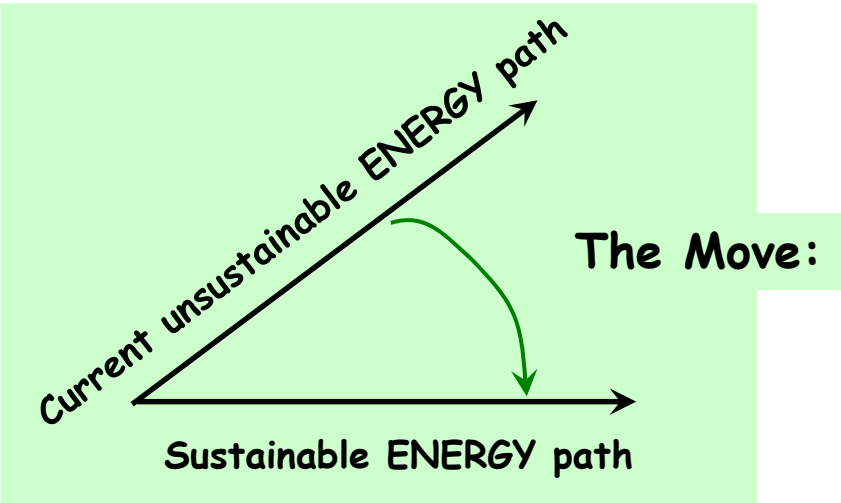
Energy and Climate Change

Presentation Content – This Week

Moving to a sustainable societal construct

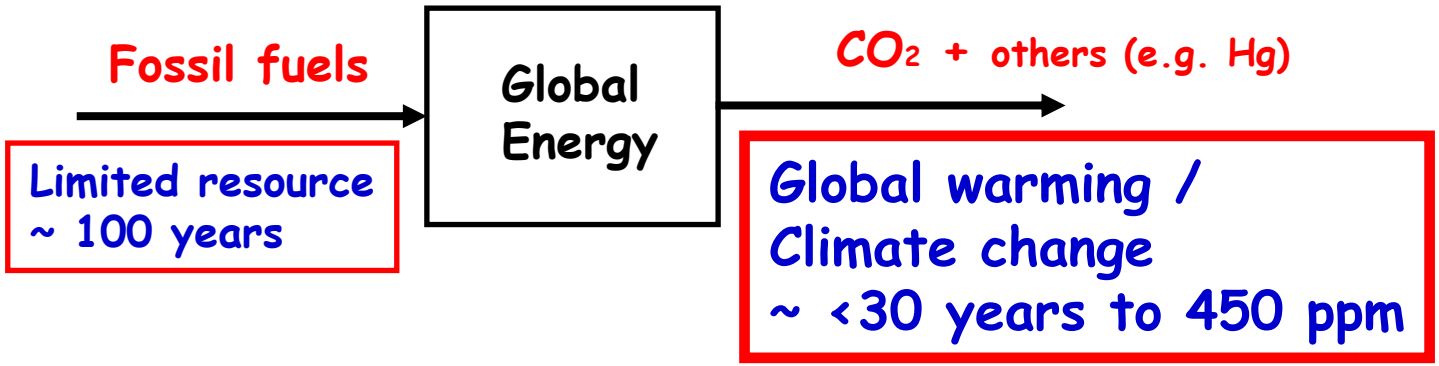
1. **The Move: A planned approach**
2. **The Move: Technological perspective**
3. **The Move: Economic & Social perspective**
4. **What will happen?**

This Week



Our current unsustainable energy situation

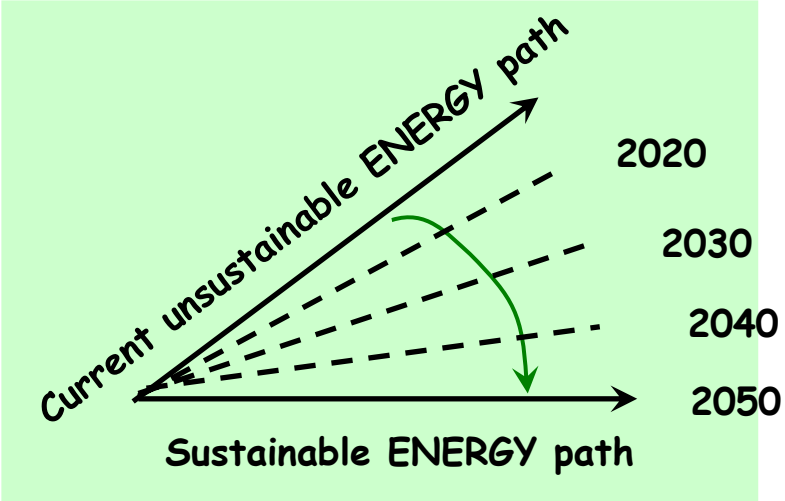
Our big current energy unsustainability
~ 81% fossil fuels



This means we have to move to an energy system with greatly reduced GHG emissions.

1. The MOVE – A Planned Approach

The Move: A Planned Approach



This is the Kyoto Approach

GHG in the atmosphere is a global issue and reduction in GHG emissions needs to be tackled from a global perspective.

Very difficult to get everyone to buy in, however if you can get the Big Emitters to buy in [China, USA & EU, which comprise over 60%], then you can make progress.

The Move: A Planned Approach

For example, reduce GHG emissions from energy production to zero gradually over time so that we don't go above 450 ppm.

To achieve this:

- What percentage yearly emissions reductions required?
- How long will it take?
- How much fossil fuel power replacement is required each year?
- What scale of infrastruture is required to do this?

Let's assume we start in a few years time at 400 ppm and
We want to reduce CO_2 emissions to zero
gradually over time so that we don't go above 450 ppm

To achieve target:

- Percentage yearly emissions reductions required? 2%
- Time it will take? 50 years

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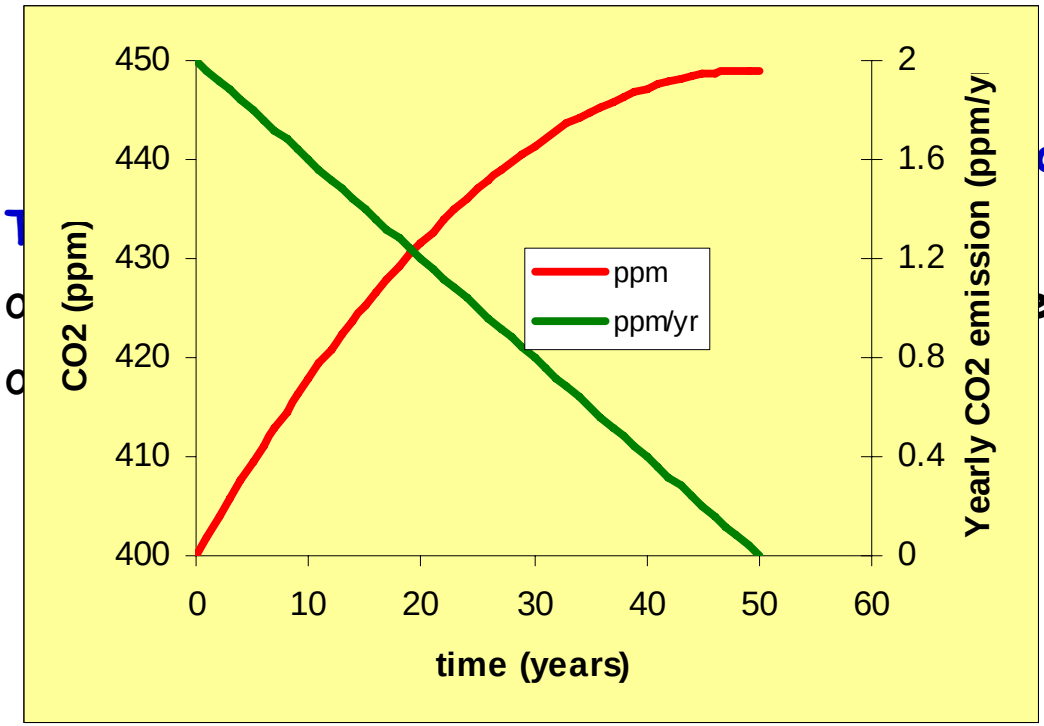

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Let's take global electricity production as an example
(This uses about 35-40% of all primary energy).

- Power replacement requirement each year? 40 GW average
- What scale of infrastructure is required to do this? Next Slide

It is a Humungous Move

Insight into Scale of the Move

What scale of infrastruture is required to do this? 40 GW

To provide an insight into this, consider the following:

Ireland's electricity capacity ~ 6 GW => 7 Irelands every year, 50 years

Moneypoint ~ 1 GW => Replace 40 Moneypoints every year, 50 years

Nuclear plant ~ 1 GW => Build 40 nuclear plants every year, for 50 years = 2000 Nuclear plants

2.5 MW giant wind turbines => Install 40,000 new wind turbines every year for 50 years = 2 million of these turbines.

And this is just replacing current fossil fuelled electricity.
Also, not considering peak load issues which will increase the numbers.

2. The MOVE – A Technological Perspective

The Move: Technological Perspective [quick tour]

Nuclear

Fission – Commercial technology.
However, fuel is non-renewable, so will run out.
There is also the waste issue.

Fusion – A potential energy silver bullet.
Still not commercialised.
Always appears to be 30- 50 years away.
We just can't wait that long.
However, should continue to invest in heavily!!

The Move: Technological Perspective [quick tour]

The renewables – hydro, wind, solar, wave & tidal

Many of the technologies are reasonably well developed and commercialised, but only hydro has a significant energy impact right now

General technical problems / issues

- **Diffuse form of energy**, thus need huge infrastructure
  e.g. 1 GW coal power plant vs 1000 giant wind mills

- **Intermittency,** can't turn the wind or sun on when needed,
  thus always need total back up.
  This affects infrastructure & efficiency of the rest of system.
  This is a huge negative issue!
  Badly, need major breakthrough in large-scale electricity storage

The Move: Technological Perspective [overall]

It is a technically gigantic task moving away from the current dominant CO_2 emitting energy technologies.

Current alternative clean technologies cannot do it right now.

However, there is enough technology currently available to make a good start,
and massive financial investment could spawn the huge innovation required to solve problems that will make significant impact.

It is kind of like "we really have not tried on the scale required".

The Move: What is currently happening?

Our big current energy unsustainability

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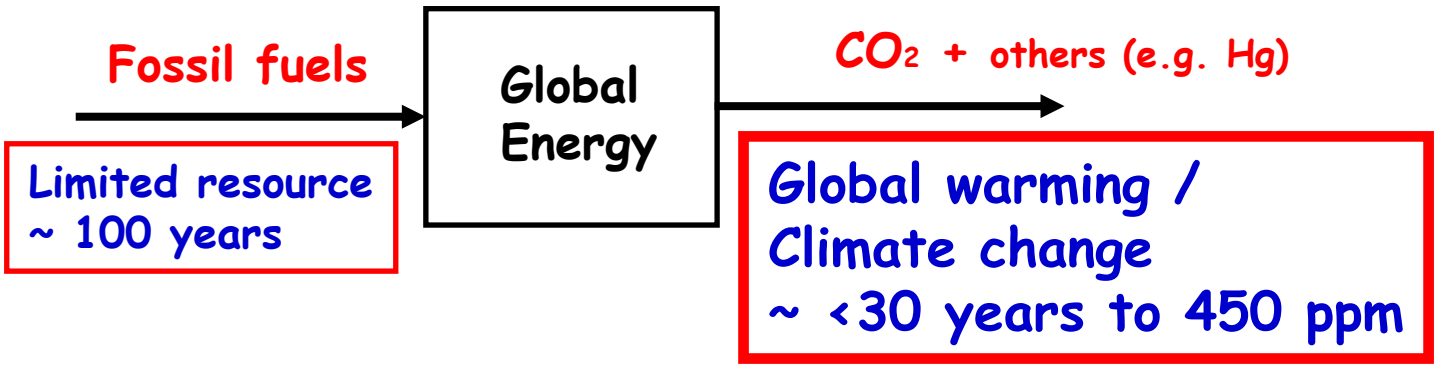


This means we have to move to an energy system with **greatly reduced** GHG emissions.

Currently,

- There is NO significant movement.
- In fact, emissions are even worsening
- Furthermore, there appears to be NO significant move in the near to medium future.

Why no significant move?

The Move: Why No Significant Move?

The MOVE is very, very, very big, and all the effort inputted so far is only having a small impact, because the MOVE is so big.

OK, there are major technological barriers / challenges in the MOVE, however there is enough technology available today to make a good start towards a sustainable energy paradigm.

I suggest that the **biggest barriers** to the MOVE exist in the **economic, political, social domain**.

So, let's explore this!

3. The MOVE –
An Economic & Social Perspective

The Move: Economic, Political, Social Perspective

To implement the MOVE requires:

- Huge clean energy infrastructure and
- Loads of people (for infrastructure and **innovation**)

All this requires massive investment

- **Trillions of Euro**

This scale of investment is not forthcoming !

Why not?

Really can't compete with fossil fuel energy now or in medium term.
Fossil fuel energy is:

- Cheap
- Well developed technology
- Huge infrastructure already in place.

Really doesn't make economic sense to take a multi-trillion euro bet right now

The Move: Economic, Political, Social Perspective

What will make the market move and make that multi-trillion euro investment?

Usually **Money, Price, a Price Signal**
Also, **Regulations and Standards**

Looking at price: Fossil fuel energy is miles too cheap

Its price needs to **greatly increase** to facilitate the MOVE by allowing clean energy technologies to compete.

Approaches to do this include:

- Carbon taxes
- Fossil fuel floor (minimum) prices
- Cap and Trade schemes
- Etc.

The Move: Economic, Political, Social Perspective

Will these economic measures happen any time soon?

Don't think so! Why NOT?

- **Global economic recession** in the short to medium term (decades),
  Increased energy prices => global recession
  => increased unemployment => social instability

- **Fossil fuel corporations** + allies will lobby strongly against this.
  - Cause global recession / unemployment / social instability
  - It affects their profits / return on investments

  Very Powerful Lobby

- **Governments won't implement** necessary economic / regulatory measures because:
  - Fossil fuel corporate lobby
  - Recession / unemployment / social instability
  - Revenue decrease
  - Currently, no major bottom-up push form general public

The Move: Economic, Political, Social Perspective

Will these economic measures happen any time soon?

Don't think so! Why NOT?

- **General population will revolt** against decrease in incomes.

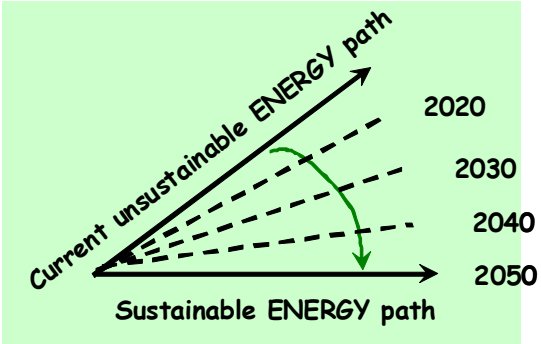
Our current lifestyle is fuelled by cheap energy supplied by fossil fuels.

- **General Lack of understanding** of the seriousness of the problem amongst the public => little bottom-up push.

OK, aware of climate change as something that may be out there, somewhere!
But, still not really feeling its effect physically or financially.

The MOVE: What needs to happen ?

- **Develop the plan**



- **Need governments to implement**, globally, [or even China, USA, EU to gradually use economic & regulatory instruments to:
  1. Price CO_2 emitting energy gradually out of existence.
  2. Allow or unleash the market to develop / deploy the clean energy revolution.

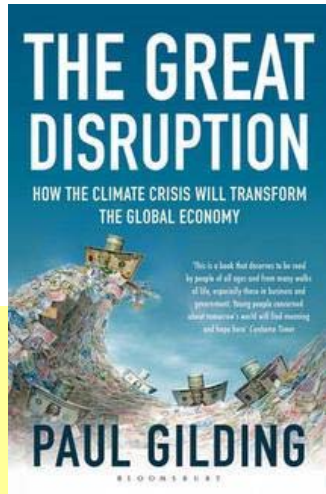
- **Convince the general public** of the seriousness of the problem so as to generate a bottom-up push politically, technologically & culturally.

Convince them that any short/mid-term **sacrifice** is worth it to them and their kids and grand-kids.

4. What Will Happen?

What will happen?

Who knows for certain!



I kind of agree with Paul Gilding
& "The Great Disruption"

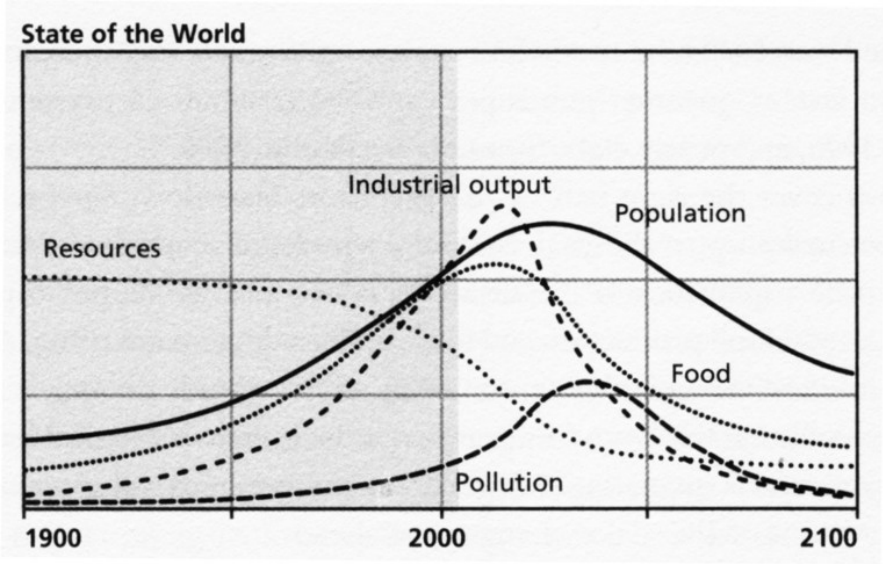
The MOVE will not occur until the Environment hits the Economy and causes major economic recessions,
i.e. when it is clear to most people that the "Economic Hurt" is being caused by:

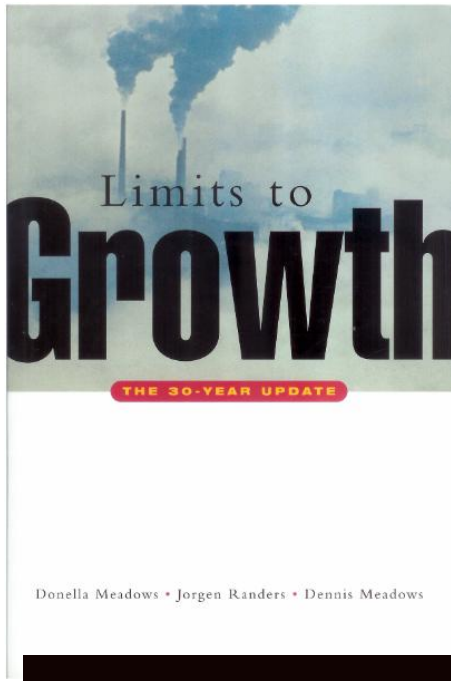
- Environmental resource scarcity, and / or
- Environmental change / degradation e.g. climate change

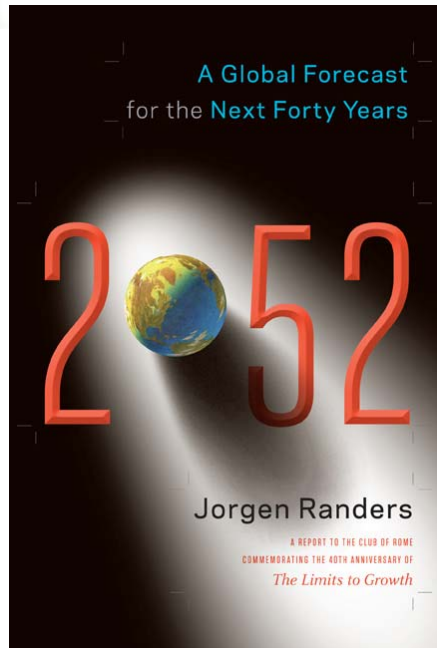
This has not really happened yet ! ~2018 - 2030

Jorgen Randers – Limits to Growth [MIT]

Scenario 1:
Business-as-usual







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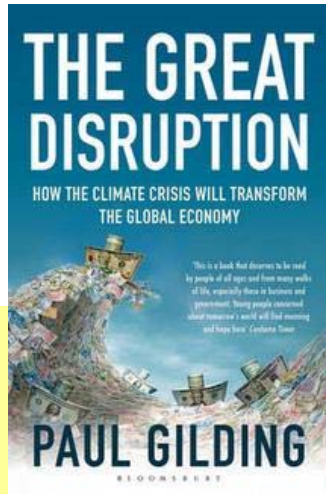

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At that stage, humanity has 2 options:

- Continue with business as usual on the road to collapse
- Change and embrace the MOVE

Humanity will change but it will be much more difficult then, than if the MOVE started now.