

# Transition

I feel the need, the need for speed. — Pete ‘Maverick’  
Mitchell.

Ivo Welch

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# Recap

- ▶ Climate change is coming.
  - ▶ Expected Warming:  $\approx 2-3^{\circ}\text{C}$ .
  - ▶ More catastrophic scenarios possible.
- ▶ Fighting CC is expensive and can only be done collectively and at huge scale.
  - ▶ Expected Effect:  $\approx 0.5^{\circ}\text{C}$ .
- ▶ CC will be bad for billions of people.
- ▶ Fossil fuels' PM 2.5 kills mlns every year.
- ▶ ***But the world will not end.***

# Today's Environmentalism

- ▶ Whine and lament:
  - ▶ *The planet is in grave danger.*
  - ▶ *Humanity is barreling towards extinction.*
  - ▶ The world is stupid, greedy, and suicidal.
- ▶ Ergo
  - ▶ work on your carbon footprint,
  - ▶ demonstrate at UN COP Conf,
  - ▶ meditate and medicate.
- ▶ Repeat next year.

# Empowering Status Quo

- ▶ What are you for?
  - ▶ radioactive nuclear power?
  - ▶ fish-killing hydroelectric dams?
  - ▶ plant-killing lithium mining?
  - ▶ bird-killing windmills?
  - ▶ desert-ecosystem killing solar cells?
  - ▶ geothermal plants (in the desert)?
  - ▶ view-killing new transmission lines?
  - ▶ eco-destroying tree felling?
  - ▶ industrial agriculture and manufacturing?

# Public Support

- ▶ Is your proposal just a minority view or can it become the majority view?
  - ▶ Locally, nationally and/or internationally?
  - ▶ → ***If minority only, it will likely die.***
- ▶ World will need to sustain 10 bn people.
  - ▶ Fight population growth?
  - ▶ How? Ideas welcome.

# Realism

- ▶ Lots of red pills ☐ in this chapter.
- ▶ Live with human nature.
  - ▶ Humans are too materialistic — yes!
  - ▶ **So are you!**
  - ▶ **So am I!**

- ▶ The problem is addressing the many, not the few.
- ▶ You will not change 8-10 billion people,
  - ▶ especially the poorer 6 billion,
  - ▶ whether you like it or not.

# Chapter 7: Realistic Solutions

1. Must work around the world.
  - ▶ Not all places are identical.
2. Must work over decades and generations.
3. Must not be too much against self-interest.
  - ▶ A little could be ok.
4. Must be able to sustain majority support.
5. Needs to work for 6-7 billion people in China, India, and Africa.



# Viabile Solutions

- ▶ Must be widely supportable,
  - ▶ ideally, super-majority,
  - ▶ locally, nationally, globally,
  - ▶ even in tough times.
- ▶ Must be economically not too harmful,
  - ▶ modest sacrifices may be possible.
- ▶ Ideally should be catalytic changes,
  - ▶ one-time one-way, then hard to reverse.

# Real Actions

- ▶ Build trucks to get humanity to the goal
  - ▶ *Research NOW*
  - ▶ *Develop SOON*
  - ▶ Get ready for deployment asap.
  - ▶ *Deploy FOAK early.*
- ▶ Will innovation work?
  - ▶ Most likely yes, but not certain.
  - ▶ This is the nature of RDD.
  - ▶ Some will fail.

# Start Today

- ▶ Plans for 30-50 years are important, too,
- ▶ Long-term plans are not my 'schtick'.
  - ▶ Mine is: what can we do *this* decade?
  - ▶ 30-50 years from now seems less important to me than today,
    - ▶ if only because I will be dead. ;-)
  - ▶ I leave distant future to *bigger minds*.

# Can A Country Go It Alone?

- ▶ Old-fashioned CO<sub>2</sub> curbing solutions.
  - ▶ Deploying locally, not in cheapest location, would be way more expensive (LDR).
  - ▶ Frankly, not a realistic approach for effective world CO<sub>2</sub> reduction.
  - ▶ It's not happening.
    - ▶ Why will this change?
    - ▶ Really? Are you sure?

▶ ***No country or bloc can fight CC alone.***

▶ Alone, countries can only adapt, not fight.



*Opinion: by the time OECD (or 2\*US) could be (painfully) decarbonized the old-fashioned way, the rest of the world will already emit far more. Sisyphean?*

# Face Economic Tradeoffs

- ▶ *Look them in the eye!*
- ▶ I did not design the world. It is what it is.
- ▶ Denial is never a great strategy!
  - ▶ This is not just for climate-change denial.
  - ▶ It also applies to climate-change fighting realities.
- ▶ What will the public support?



# Us / Oecd Tradeoffs

*Reminder: Warming slowdown from CO<sub>2</sub> **curbs** will not be 2.5°C, but only 0.5°C; and beneficial effects will not be felt greatly for decades. These facts are not my fault.*

- ▶ 35 years zero carbon → 0.1°C:
  - ▶ Make college free or lower temp by 0.1°C ?
  - ▶ Double all teacher salaries or 0.1°C ?
- ▶ Realistically
  - ▶ What will the US commit to?
  - ▶ What will the OECD commit to?



# World Tradeoffs (Worse)

- ▶ What can environmentalists sustain public support for, and for many decades?
- ▶ Many countries have little to lose.
  - ▶ Russia and Canada may even gain.
  - ▶ Most inland countries will likely be ok.
  - ▶ Most countries face more urgent problems.
- ▶ Will China, India, Africa commit?
  - ▶ If so, will they spend resources on GHG curbs for the world, or on local adaptation?



# Typical Survey Answers

Even in richest countries:

- ▶ Widely supported sacrifices on half of CC seems to be  $\approx$  \$100/year.
- ▶ Actual needs are  $\approx$  \$5,000/year.
  - ▶ This assumes old-fashioned CO<sub>2</sub> curbs and taxes.
  - ▶ It does not assume technological investment.

*If you can manage to convince for more, great. I just doubt it.*

# The World Apocalypse?

- ▶ The world will not end.

*Reminder: Warming slowdown from CO<sub>2</sub> **curbs** will not be 2.5°C, but only 0.5°C; and beneficial effects will not be felt greatly for decades. These facts are not my fault.*

- ▶ It sucks that the sun goes down at night, but there is nothing we can do about it.



*PS: We can try to find shelter for the night.*

*Actually, there are some things we can do about CC.*

# What Can We Do?

- ▶ Many things, but they won't be perfect.
- ▶ Measures must be efficient and effective.
- ▶ Not *wellness* measures.
- ▶ Don't blame me. I did not design the world.

# 1. Increase Innovation

- ▶ RDD: Research, Development, and Deployment.
- ▶ ‘Finesse’ knowledge sharing.
- ▶ Public-Private Collaboration
- ▶ Accept risk and failure in R&D.
- ▶ Offer X-Prizes?
- ▶ Deploy FOAK.
- ▶ Educate engineers, *entrepreneurs*, and public.

## 2. Tax Local Pollution

- ▶ Local fossil-fuel taxes are globally not first-best solutions.
  - ▶ They are too low, but could go a long way.
  - ▶ They could speed up clean technology and the demise of coal.

### 3. Forestation

- ▶ Obvious cheap choice.
- ▶ Bipartisan in many countries.
- ▶ Invest in forestation research, too.

## ▶ World Goal?

- ▶ Not a plan but a dream.
- ▶ Increase forestation and lumber harvesting for capture of 2 GtCO<sub>2</sub> per year?
- ▶ Cover looming human emission increases?!
- ▶ Not perfect, but a lot better than now nada.

## 4. Price Electricity By Time Of Day

- ▶ Free electricity from 10am to 5pm.
  - ▶ Or during daytime?
  - ▶ Or when wind blows and sun shines?
  - ▶ Or with internet broadcast of prices?
  - ▶ Customers will adjust e-demand.
- ▶ → will greatly reduce e-storage needs.
- ▶ → will solve much of e-storage tech problem.



## 5. Uproot Bad Habits

- ▶ Change habits:
  - ▶ Change e-usage patterns.
  - ▶ Address efficiency paradox (washer).
  - ▶ Some coercive mandates (e.g., LED) for initial economies of scale.
  - ▶ Sunstein-Thaler **nudges**.
  - ▶ Use product marketing tools:
    - ▶ advertising, guarantees, introductory pricing.

## 6. Reverse Technological Lockins

- ▶ Worked great for LED bulbs.
- ▶ Working great for cars.
- ▶ What's next?

## 7. Coordinate Transitions

- ▶ ***Expensive Electric Grid Overhaul !!!***
- ▶ Bidirectional information signaling.
  - ▶ Internet and line can give current and signal near future info on demand, supply, and prices.
- ▶ Lots of devil in details:
  - ▶ Incentives, exact protocol, cyber security.
- ▶ Make clean-plant hookups easier.
  - ▶ Make it free?

## 8. Reduce Green Red Tape

- ▶ Needs good system balance.
  - ▶ Smart decisions within 1-2 not 10-20 years.
  - ▶ Cut both regulatory and legal hurdles.
- ▶ Concierge Service:
  - ▶ Costs money,
  - ▶ will be fought by incumbents,
  - ▶ easy to bedevil.

## 9. Free Federal Land Leases

Auction Federal 30-year land leases:

- ▶ Forestry with harvesting,
- ▶ Solar farms,
- ▶ Wind turbine farms.

If need be, price could be zero.

*Revocable with penalty upon non-performance.*

*Warning: process could be badly subverted.*

# 10. Kill Worst Emitters

- ▶ Should be worldwide.
- ▶ Reasonably internationally agreeable,
  - ▶ with some international cross-subsidies?

# Many Other Ignored Issues

- ▶ Adaptation will be important part,
- ▶ but this is *not* a solution to CC.
  
- ▶ Many crises beyond climate:
  - ▶ Species and Habitat Extinction.
  - ▶ Culture Wars (not just within US).
  - ▶ Weapons Technology.

# Individual Contributions

- ▶ Change your carbon footprint and behavior?
  - ▶ See unrealistic lists from Chapter 7.
- ▶ *Wellness* sells eyeballs to rich people
  - ▶ Will not reduce CO<sub>2</sub> in atmosphere.
- ▶ Carbon-shaming?
  - ▶ Don't be stupid.

*If anything, stop offending people you want to bring on board; deescalate outrage, and detribalize.*



# You

- ▶ Build a career in relevant science, technology, entrepreneurship, and business.
  - ▶ Better than in law and finance,
  - ▶ but both law and finance can be used for the good, too.

*Be realistic and don't feel guilty. Most graduates need to pay off student loans rather than pursue ulterior motives. Maybe in some distant future?*

# You

1. Research better technology.
2. Invent better mousetraps.
  - ▶ Especially improve energy storage and agriculture.
3. Deploy better technology.
  - ▶ Become filthy rich (or fail miserably).

*#3 is the most difficult.*

*Musk is not a scientist, inventor, or engineer. He is a businessman.*

# You

- ▶ Educate others what's real and what's not.
- ▶ Lead others, even as politician, if you can stomach it.
- ▶ Write an honest book and teach a class.
  - ▶ Now you know what I know, so
  - ▶ do something useful in your life with it.