

WELCOME!

These are the slides for Stratospheric Aerosol
Injection Inevitability

SLIDE

NOT a call to action

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Please feel free to print and disseminate these.

This is all about the idea.

Please keep in good faith with our goals.



sai-reality.com

Not a call to action , a statement of fact:

2° cap? INEVITABLE FAILURE

No blame here... 2 ° cap simply asks too much too soon.

Here's why...

#1: If we halted things at 1.5° warming... What would the United States have to do? (IEA Net Zero by 2050 Roadmap)

- Halt all new oil/gas leases immediately. (2026)
- Phase out Coal by 2040 worldwide. **China/USA/India/Poland** etc. don't even plan to achieve this. (IEA;Climate Action Tracker)
- Internal Combustion Sales STOP by 2035 (9 years)
 - Within 9 years we will tell Americans they can't buy the car they want and Americans will somehow be ok with that.
- STOP buying new gas stoves/furnaces/water heaters and oil furnaces IMMEDIATELY. (phase out)

#2: Economics: Immature Economies

Oil will remain profitable for major producers past 2050.

(IEA Net Zero by 2050 Roadmap, 2050 \$24/barrel; greater than prod. costs)

For petrostates their own people won't let them stop drilling until they modernize their economies.

Nigeria, Russia, Iraq, Venezuela, Iran, Mexico, Libya, Kazakhstan and a dozen others will not modernize their economies, as required to prevent >2 degrees warming, within the next 15 years.

Their economic transition isn't remotely possible.

~~Saudi Arabia? Maybe. UAE and Qatar? Yeah, but rich TINY populations~~

#3: Economics: Un-American

America will pay TRILLIONS extracting the emissions of OTHER countries.

(IPCC) 10B tons annually, (Belfer) \$400 current minimum per ton)

We must pay for those who CAN'T:

The entire developing world, 80% of humanity, can't afford ~ANY of it's green transition. (United Nations)

We must pay for those who WON'T:

See Economics: Immature Economies -> The USA will also have to pay to extract emissions from oil that other countries are PROFITING from..

USA taxes paying to mop up CO2 from the profits of Iran, Russia etc.

Why AMERICA would eventually use Stratospheric Aerosol Injection (S.A.I.) anyways

Unacceptable American Deaths: (source Nature 2025 study)

Even if we somehow achieve the 2.0 limit... EVERY SINGLE YEAR 60,000+ Americans will die from wildfires (smoke/pulmonary)

- Doesn't include annual heatwave deaths, storm deaths or casualties.
 - Our social programs are in financial distress. Just the money from warming damage will cost lives by defunding them.
-

Property Damage: Insurance (source Neptune Flood)

90% of flood insurance comes from the FEDERAL government.

They are >\$22 billion in debt...

They only cover 3.3% of Americans (NFIP)

so... who pays for all the storm damage?

FEMA.

Our taxes pay EITHER WAY.

Where are the ACTUAL lines for the rich world?

Developing world tipping points are at or below 1.5°. In 2024 we averaged 1.6!

(Copernicus Climate Change Service, confirmed by NASA, NOAA, WMO, Berkeley Earth, UK Met Office) Too late in MANY ways.

The rich world crosses that threshold between 2.0°C and 2.5°C warming, where multiple tipping points become likely simultaneously. (Armstrong McKay et al., Science 2022)

If the developing world doesn't use Stratospheric Aerosol Injection first...

The rich world does it later.

The most important # you never hear.

Spoiler alert:

2050: \$16+ Trillion annual Global Damage

(Current trajectory, Swiss Re study)

WELCOME

Hello, My Name is Kevin Galvin.

These ideas need to be in the daylight so thank you for your time.

I respect that time so let's make this real easy.

You do not have to trust me.

There's a safe PDF file here, Download it and DON'T read it.

Don't waste your time!

This idea is all human but AI is a quick judge. Take your favorite AI that is strong in Science, several are good at dissecting arguments.

Upload the PDF argument and ask that AI, "Strictly regarding likelihood, analyze the strength of this argument and give a synopsis"

How's that answer?

Need a little more to give this idea a try? I would.

Ask AI, "How conservative are the numbers and how generous are the timeline assumptions given to scenarios without S.A.I.?"

Passes the sniff test? OK, Let's get to business.

What does this argument want from us?

Talk about it. Really! That is all we need to do.

For once, awareness of an issue actually is enough.

So tell a nerdy friend about this site or don't mention this site at all. Just talk about our subject matter, Stratospheric Aerosol Injection, including, perhaps especially, your reservations about it. The day we see articles about any geoengineering projects as regular clickbait on news sites...

Our job is done. That noise will register where it needs to.



We WILL use a cooling geoengineering project.

Almost certainly it will be Stratospheric Aerosol Injection.

But... Inevitability doesn't mean permanence.

There's a path that avoids both warming damage AND *significantly* shortens our use of Stratospheric Aerosol Injection.

Everything is about money, and that's where this path leads.

But to start we must understand our financial circumstances.

Thank you again.

S.A.I. Main Argument

Inevitability

S.A.I.

Are they talking
about our kids?



Stratospheric Aerosol Injection

We should have started 30 years ago!



2040

2060



We should have started 10 years ago!

Stratospheric Aerosol Injection S.A.I.

A global geoengineering project that
cools the entire earth

The ~inevitability of S.A.I. is the new idea.

For 2050, then every year, \$16+ trillion damage (~16-29)
(Swiss Re study, 10-18% Global GDP; current trajectory)

Our 1.5 °C warming limit? We passed that, gone, in 2024

S.A.I. guaranteed unless we radically pivot NOW on our climate efforts.

We WON'T. So now let's learn about S.A.I..



MONEY



TIME



*The Swiss Re study our damage numbers are based
on isn't from academia or some political think tank.
It's an assessment by an **INSURANCE** company.
Actuaries have BOTH feet in reality.*

S.A.I.

Are they talking
about our kids?



For money the rich world will do this, but too late...
The developing world needs to discover
how to save itself ➡ by itself.

Stratospheric Aerosol Injection (S.A.I.): A Global Cooling Geoengineering project.

This project uses airplanes to deliver Sulfur Dioxide (or possible alternative aerosols) into the upper atmosphere (Stratosphere). It binds with water and reflects solar radiation back into space. S.A.I. has MAJOR RISKS and they are discussed at length in the appendix.



S.A.I. is like a low-dose maintenance chemotherapy. It doesn't cure but suppresses the cancer side effects (warming).

Two men have cancer. Both need this chemotherapy but one is still much healthier than the other. A healthier man will delay that chemo (S.A.I.) and a sicker man embraces it sooner. Imagine though if one of those men chose the time both of them started the chemotherapy? Each man would be angry if deprived of choice but only one man getting his way kills the other man.

*If the healthier man hasn't even
100% accepted his illness...
then the sicker man needs to be in
control of that choice.*



S.A.I. is necessary. We only need sea level rise to prove it. Too much sea level rise is "locked-in", even for America.

Future warming damage is also uneven across the globe. Even if some places aren't so bad it only takes a few places to feel the brunt of warming damage to trigger S.A.I. use.

At some point the rich world won't be able to gaslight the developing world. It's innocent as we're also gaslighting ourselves about the illness.



KEY POINT:

We are not comparing
Stratospheric Aerosol
Injection to the world now.

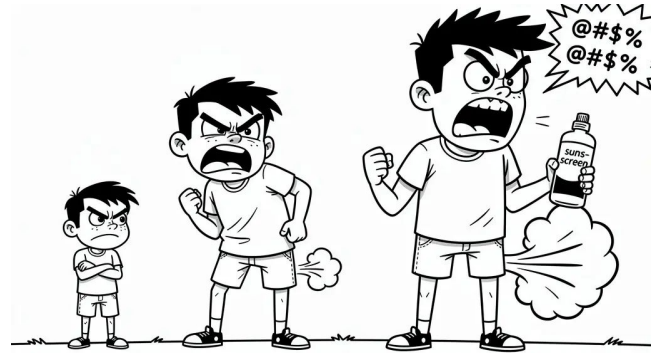
It's a comparative risk
between S.A.I. and un-offset
warming on a progressive
timeline.

Warming damage quickly
outpaces S.A.I. negatives. The
only reason we need to ↑
the amount of aerosol we send
up each year is the increase in
greenhouse gases to offset.

Global Mean Temperature?

S.A.I. decreases
Un-offset warming increases
(simple)

Stratospheric Aerosol Injection



TIMELINE



Un-offset Global Warming

Let's Go:

We assume here that climate science is 100% valid.
Our disagreement with climatologists isn't about
science, it's about what to do with what we know.



Ask your phone...

A: "How many people in the developing world will be displaced
by sea level rise by 2050?"

- >100 million
- The rich world won't take millions of refugees
 - Definitely not tens of millions.
- The developing world will quickly lose the ability to adapt.

REFUGEE CAMPS

Tens of millions of vulnerable women and children trapped in camps within their own fractured countries; No help coming.

Trafficking, Malnutrition, Disease, RAPE.

There are already 1.28 million Rohingya refugees in Bangladeshi camps who will never be properly resettled.

- Camps will be the only financial option for poor countries

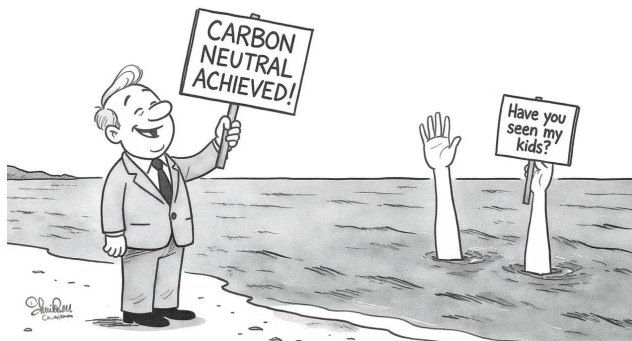
For comparison: By 2050 ~2 million Americans are displaced but we won't be in camps. America is ok in 2050.

.....

But hey! What happens if we succeed with 2050 Carbon Neutral?
That would help, right?

OK... let's go **CRAZY** and assume we achieve Carbon Neutral TODAY. That definitely has to help with sea level rise, right?

WRONG.



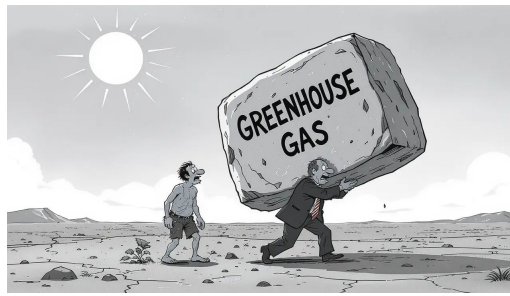
Ask your phone...

B: "If we achieve Carbon Neutral TODAY will it significantly slow sea level rise by 2050?" (just to make the strongest point)

- No. Period. (it will still *accelerate* due to warming lag)
 - A = Tens/hundreds of millions displaced by 2050 due to sea level rise.
 - B = Achieving carbon Neutral TODAY does not prevent any sea level rise before 2050.

A + B = The developing world will collapse regardless of if/when we tackle greenhouse gases. **BINGO!**

*Greenhouse gases and
ocean acidity?
The developing world couldn't
afford to help even if it wanted to.*



Ask your phone...

C: “What geoengineering method would cool the Earth quickly enough to slow sea level rise and be affordable enough for the developing world?”

- Google gives us one solution, the one it hates:
Stratospheric Aerosol Injection (S.A.I.)
 - It can slow sea level rise by decades allowing *organized* resettlement and saving the poor world from consuming itself.
 - Only one **AFFORDABLE** solution to save tens of millions of poor people and it's not being researched?
 - over \$2+ trillion is spent on Climate Change investment every year.
 - A few hundred million is spent on S.A.I. R&D (2025)
 - <1/5,000 of green investment
 - INSANE. 2024 wildfires: \$4.8 billion spent and 11 dead firefighters.
 - Greenhouse gases mean *nothing* in saving the developing world in the near-term or in preventing dead USA firefighters. Who is deciding our research priorities?

A + B + C= Even if S.A.I. is crazy dangerous (it's not), desperate people will try ANYTHING. S.A.I. is it.

The poor will try a risky unresearched technology if they have to;
S.A.I. is the only AFFORDABLE project that helps global sea levels and it can be implemented within a decade.

Reactionary developing world politicians will save millions



Domestic pressure **ALWAYS** outweighs international pressure.

If uninformed terrified people scream for any hope then Brazilian, Bangladeshi, Nigerian and Indonesian politicians will offer S.A.I. to win elections. People in these camps are VOTERS. Once started the benefits of S.A.I. would be almost immediate. After that there is no going back politically in that country. It only takes a few developing world countries to afford S.A.I.

**Optimists think
a parent would be patient/rational
as their children go into camps.**

With **EXTREME** Action the west could stop the poor world:

- Shoot down the airplanes used for the geoengineering project.
- Threaten/Destabilize developing world governments
- We are the healthy man refusing to start treatment.

So, for a fair argument we must admit it's *technically possible* the west could stop the developing world and doom their vulnerable children to camps.

The only way to truly guarantee Stratospheric Aerosol Injection is used is if the rich world would eventually use it for themselves.

They will.

Ask your phone...

“When we achieve carbon neutral when will the earth cool down?”

When we achieve carbon neutral (we will) the Earth will not cool for CENTURIES. Annual sea level rise will stop accelerating with Carbon Neutral but that just means a plateau. Every year the seas will still rise at a high baseline rate for centuries.

- There's also a warming lag as the ocean still absorbs excess heat for 10-20 years. So whenever we achieve carbon neutral + lag years, that hot world is our permanent reality.
- As bad as the storms and floods then are, they will remain.
- 2050 AMERICAN wildfire deaths? **~60,000** (Nature 2025 study). (Only the wildfire #!) (smoke/pulmonary) (even with dramatic emission cuts!)
 - Even in America the death/damage will be too much
 - Just... FYI, 2060 being max heat (after lag) will require the United States to ban the manufacture of internal combustion engines <9 years. (IPCC special report)
 - The fleet has to age out... oh and no more oil leases can be given out for ~-5 years. Yes, negative. 2060 max heat is impossible.

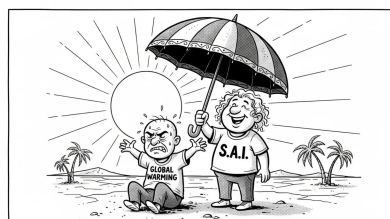
Who in America breaks first?

The Farmers? Ranchers? Insurance Companies? Fishermen? Thirsty cities? Firefighters?

Utilities? Military (global instability)?

Americans will demand something be done... FAST.

Sea level rise (w/out S.A.I.) guarantees economic disaster and massive loss of life; that's true for the rich world post 2050. Money funds our military and social programs. S.A.I. prevents TAXATION.



The Honest Truth: What are we trying to achieve?

Widespread discussion, merely awareness, of cooling geoengineering projects impacts those projects AND the green transition in two ways that dovetail.

#1: The threat of a geoengineering project sharpens minds on the green transition. Avoiding S.A.I. is a motivator. Best case scenario.

- Paris Agreement goals are unlikely. Is that a stretch? But the closer the better. S.A.I. needs less aerosol the closer we get. We push S.A.I. in order to lower our need for it. Engaging a harsh future helps lessen its harshness.
- The rich world is under less financial stress by being farther along the green transition and more able to help particularly vulnerable countries (Indonesia, Bangladesh, etc.)

#2: We fail to meet green transition goals but S.A.I. is at least ready.

- Fear of unilateral deployment motivates research. S.A.I. on the lips of Indonesian politicians engages the rich world.
 - Better that it be deployed ASAP and not just for the developing world. S.A.I. is dangerous. We'll need the money it saves us to build its own replacement (a plausible mirror that just takes time). S.A.I. is a bridge to a destination we want to reach sooner.
- IF S.A.I. is extremely dangerous we can stop and the aerosols dissipate in months. That brief (few years) kind of test will*

not do any serious harm (no serious termination shock). Scientists even admit that. But most people haven't even HEARD of Stratospheric Aerosol Injection.

~~Climatologists act like a controlling priest class~~

You and me and S.A.I.?

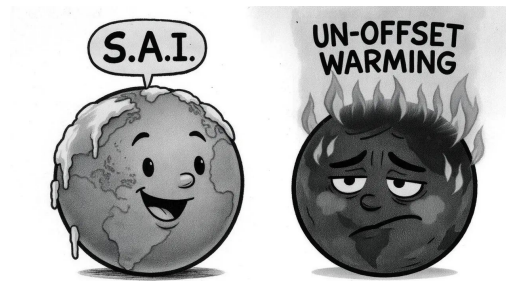
We're not heretics denying climate science.

Climatologists fear us more.

We are apostates who wield the same science with different priorities (money/children)

COOLING PROJECTS

Appendix: Geoengineering Cooling Projects



None of us wants to use **any** geoengineering project.
When you mess with one thing in a complex system...
a lot can go wrong.

But we've shown that eventually a cooling project will be needed
even by the rich world. (see Carbon Neutral appendix)

Look around us. Things look pretty normal.

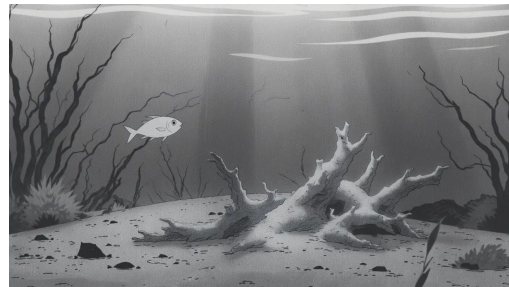
So Global Warming and geoengineering projects
both seem like nightmares.

Both are nightmares. But that's where the true similarities end.

Projects are managed risk, we have some levers of control.

Un-Offset warming is chaos.

It's cascading collapses.



Example: Coral death

Coral death isn't even the

worst warming threshold event and that is a bit scary.

Yes, cooling projects are uneven and could kill coral reefs in a
specific area but un-offset warming threatens worldwide coral
collapse

- Coral tourism is \$36 billion annually but forget tourism.
- The true value of coral is:
 - 25% of ALL marine species depend on coral reefs.
(coral is <1% of ocean floor)
 - 500 million - 1 billion people require them for food.
 - They absorb 97% of wave energy. That spares our shorelines.
 - They are in the shallows for light so cooling surface ocean temps helps coral a LOT. (S.A.I.)

Mass coral extinction, like most threshold events, is tied to
GLOBAL temperatures.

It's **BLACK** and **WHITE**:

**Cooling projects lower/maintain global temperature;
un-offset warming raises global temperature.**

Geoengineering projects are *locally* hit or miss but overall global
surface temperatures are the big game.

It's the sea level game!

- ☒ Implementation
- ☒ Affordability
- ☒ Effectiveness

Our cooling project requirements:

Implementation: Can we deploy this project <10 years?

Affordability: Could a few developing world countries afford this?

Effectiveness: Does it effectively and quickly slow sea level rise?

#1: **Marine Cloud Brightening (MCB)** is spraying ocean water
to make low level clouds that reflect sunlight.

MCB has dangers but it's easy to shut down and affordable
enough for a few cooperating developing countries to implement.
None of that matters because it's all about sea level rise and MCB
doesn't have enough global effect even at scale.

We need serious global sea level impact well before 2050.

- Right now MCB would help *mostly* with local (not global)
surface temperatures but as the oceans warm Marine
Cloud Brightening's mechanics work less and less.
 - Rising ocean surface temperatures means that
before 2050 MCB will have diminished returns and
could start to HEAT more than cool.
- It's usefulness is too limited to waste money on now..
 - MCB could be deployed in the arctic as part of a
mixed bag of future cooling projects.
 - (colder water/better MCB mechanics)

#2: Albedo cooling is painting our roofs and roads **white** and in general has to do with material reflectivity.

This has minor risks but those also don't matter as **Albedo** is ineffective at scale for significantly slowing sea level rise.

Even if it did work albedo involves painting an additional 1-2% of the entire Earth white. That is not cost effective for the developing world (\$Trillions) and likely involves painting entire deserts white.



The decline of reflective white ice at both poles and the diminishment of glaciers compounds the problem. We'll have to do a lot of Albedo just to offset those reflective losses. However, sea level rise aside, albedo is extremely useful for local heating, especially in urban "heat islands".

Albedo is one of the few cooling methods normal people can help with. Individuals/towns/states could implement albedo for roofs and use lighter colors for roads.

For the USA let's keep the federal government out of it.

Albedo + Marine Cloud Brightening

Our best Albedo sources are the ones we already have.

Arctic/Antarctic/Greenland ice sheets are highly reflective.

Albedo and Marine Cloud Brightening have an interesting dynamic in this regard.

Marine Cloud Brightening works well with cold water. We could implement MCB in the arctic circle and **INCREASE**

the size of the ice cap. This would be a significant help. Ice cap restoration isn't annoyingly in our face like local albedo projects. Capitalism is our friend but special interests want northern shipping lanes to open via ice cap reduction. In this limited way we need to push back on industry.



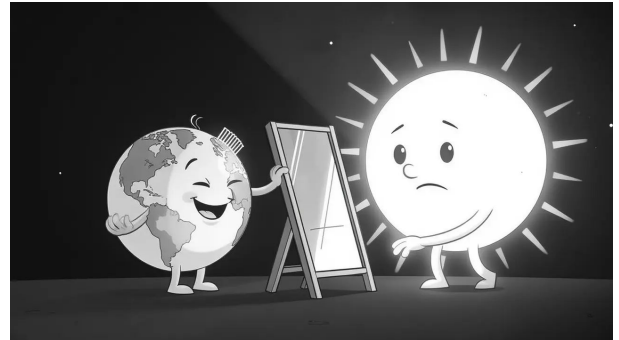
#3: The Space Mirror: *This truly works for global sea level rise.*

We love the space mirror!

The Space Mirror would (will eventually) reflect a small percentage (1-2%) of sunlight away from earth. The mirror is **VERY** safe for the planet. It will be four times farther away than the moon so not visible to us. **FAR** less complicated than even a tiny Mars colony. A dream come true!

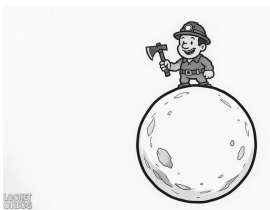
The space mirror will cost \$5 - 10+ trillion dollars. Pricey but doable, but even if we decided to build this today, even if it was **FREE**,

The mirror will just take too long. The mirror fails in both implementation time and developing world affordability.



The mirror involves sending tens/hundreds of millions of tons of material into space (International Space Station = 450 tons). It will take many years just for that shipping and most scenarios involve mining asteroids or the moon.

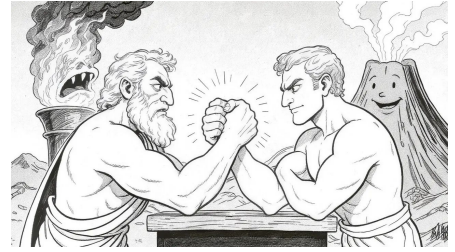
- **So... mining the moon is the *PRACTICAL* option?**
 - Let's imagine the moon with established large scale mining operations within the next 15 years... also a giant space factory that itself would take many years to build. A lot of robots will help build it. Just the robots will take years to build. Remember, we're assuming all of this is **FREE**. We're assuming we don't hit any unexpected delays. **Mining, design, construction and deployment, even if we had the money we just don't have the time.**
 - All of us want the space mirror to be the option... but it isn't. Even the rich world will get desperate before this is logistically feasible.



S.A.I. (A bridge) ➡ Mirror

Stratospheric Aerosol Injection (S.A.I.):

*Prometheus gave us industry,
Hephaestus saves us from it.*



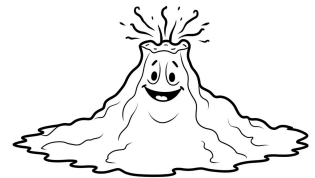
The new idea here is that S.A.I. is inevitable.

IF Stratospheric Aerosol Injection is ~guaranteed then it's risks (hopefully researched) are simply problems we need to work.

Let's explain S.A.I. mechanics and then discuss dangers in a worst case scenario.

Stratospheric Aerosol Injection is not a new idea. It was developed as a geoengineering concept in the 1970's from studying volcanoes. Volcanoes shoot Sulfur Dioxide, an aerosol, (and ash etc.) into the upper atmosphere (stratosphere). When in the stratosphere Sulfur Dioxide (SO₂) combines with water and is excellent at reflecting sunlight back into space.

In 1991 Mt Pinatubo erupted and cooled the entire earth by ~.5 Celsius for a few years.



- That is 30% of today's entire global warming.
- Do any of us remember the great Mt. Pinatubo scare of the the early 90's?
 - No, the eruption was a non-issue to anyone but scientists and the local population.
 - This does not mean 3 yearly Pinatubos don't have severe global risks.
 - S.A.I. DOES have severe global risks



Remember the two cancer patients?
Suppressive chemo (S.A.I) has risks.
The healthier man will reject any
risks/negatives

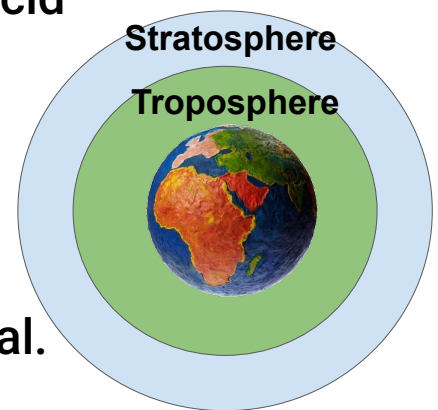
Stratospheric Aerosol Injection uses invisible Sulfur Dioxide (not ash or the other crap) shot very high above our weather (into the stratosphere).



The $\text{SO}_2 \leftrightarrow \text{CO}_2$ offset ratios are **AMAZING** for humanity:
One kilogram (2.2 pounds) of SO_2 offsets hundreds of thousands of kilograms of Carbon Dioxide (CO_2).

Some less studied alternatives to Sulfur Dioxide have even better ratios:
Calcite or Alumina
(cheaper too!)

We're a bit **hypocritical** in our fears of Sulfur Dioxide (SO_2). It does create some acid rain. However, today human industry puts >50 million metric tons of Sulfur Dioxide into the *lower* atmosphere (troposphere) every year. In the *troposphere* SO_2 is all bad and no benefit. SO_2 in the troposphere creates a LOT more acid rain and pulmonary related deaths (per kg of SO_2) than SO_2 in the *stratosphere*. In the troposphere it hardly cools at all (1-2% of stratospheric). We could list acid rain as an S.A.I. negative but we gladly and willfully create a lot more every year by ourselves than would S.A.I.. Given that general SO_2 irresponsibility our fears, at least pertaining to acid rain, are hypocritical. How much SO_2 does S.A.I. put up?



Less than 30% of what we put up already.

>50 million tons of SO_2 for Industrial profit? OK!

<20 million tons to save millions of people? Hell No!

An Honest Representation of Dangers:

There are life-threatening risks with SO₂ that are specific to its use *in the stratosphere*.

These include some minor annoyances and three MAJOR risks.

Two of these major risks, while valid,
are wildly misrepresented by climatologists.

A: These are the minor annoyances of S.A.I.

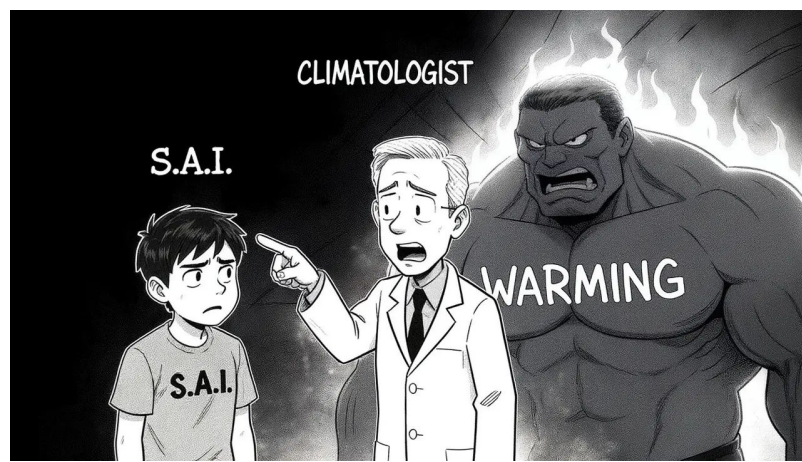
- On clear days our blue sky could be a lighter shade of blue and our sunsets more vivid.
 - Americans will despise that a decision is being made for us. Environmentalists will weep.
- Minor increase in acid rain though this is dwarfed by our willful production of it in the troposphere.

B: Risk from both S.A.I. AND un-offset warming:

Shifting air and ocean currents:

(By 2050 This issue will be MUCH worse, S.A.I. has at least a lever for control)

- NEGATIVES (for both)
 - Could produce spots of extreme heating
 - Changes in monsoons and general precipitation patterns.
- If we choose S.A.I. we can stop any time and the aerosols dissipate in months. (initial tests, see termination shock section)
- Keeping aerosol injections at the poles could minimize risks for S.A.I.; We have no control levers at all for un-offset warming's effect.
- If we choose warming there is no easy off ramp...
 - except S.A.I.. Ironic.



No research = uninformed criticism. If S.A.I. was the greater evil they'd prove it

- **KEY FACT:** It may seem that warming and S.A.I. have a few similar dangers but on the most important effect they are opposites:
S.A.I. is reducing the global mean temperature;
Warming is, of course, increasing it.
 - S.A.I. can delay/prevent threshold events, warming causes them.
 - North Atlantic Current Collapse (this might be unavoidable)(AMOC)
 - Self sustaining permafrost melt feedback loop. (scary amounts of CO2/methane)
 - Total coral extinctions (discussed earlier)
 - Boreal/Rain forest dieback (-> savannah)
 - S.A.I. maintains our current climate preventing countless extinctions
 - Environmentalists still hate S.A.I.
 - Tunnel vision Puritans (I digress)

If we decide LATER to cool the earth with S.A.I. we'll create see-saw climate shock. Species roll the extinction dice twice.

COLD → HOT  ***HOT → COLD***

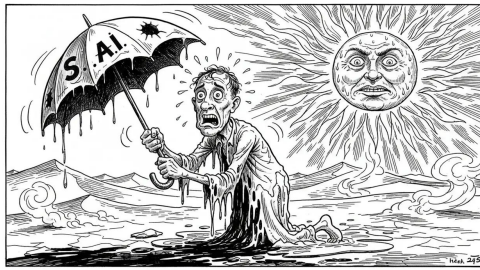
#1: MAJOR RISK OF S.A.I.: worst case scenario

Ozone degradation, DANGEROUS.

- Not instant risk, cumulative risk
- Before we suddenly NEED it right away, we need to test smaller amounts of aerosols... RESEARCH.
- Only after *decades* of use S.A.I. could, worst case scenario, *significant rise* in world skin cancer rates.
 - A genuine doubling is a crazy outlier but this is worst case scenario.
 - S.A.I.? America is OUT. American kids put at ANY cancer/cataract risk? no way!
- Given their perspective, Americans are right. America is far from a warming December 7th. It's understandable they try to protect their children and discourage S.A.I.
 - Context: By 2050, even achieving 2° warming limit there will be ~60,000 AMERICAN deaths from just wildfires (smoke/pulmonary). (Nature 2025 study)
 - USA calculus will eventually change
 - But today even if better sunscreen and sunglasses prevented 90% of the risk Americans would say, "Hell No!" to S.A.I.



- Indonesians or Brazilians or Nigerians are also 100% right in protecting their societies and women and children.
 - Simply numbers: Even in this worst case scenario, by the time (decades) skin cancer rates double in the developing world those annual EXCESS cancer deaths will be a tiny fraction of the warming related annual EXCESS deaths.
 - The ratio is less stark but this would also be true of the rich world. (~10,000 Americans die from melanoma each year.)



bullsh*t
accusation

#2 MAJOR RISK - TERMINATION SHOCK:

Blaming the chemotherapy for the cancer

Technically, Termination Shock is real and straight forward:
First, if we start S.A.I. today then global temperatures will stay the same as now.

-> Fast forward to 2060:

- If a crazy event suddenly stops S.A.I. in 2060 the earth will quickly heat to what it would be in 2060 as if we never used S.A.I. at all.
- That sudden warming will cause a lot of sudden deaths.
 - It's like stopping suppressive chemotherapy and the cancer quickly rebounds.

KEY FACT:

The sudden deaths that start in 2060 from termination shock could be **MORE** than the accumulated deaths from un-offset warming between now and 2060.

That is a serious argument **AGAINST** Stratospheric Aerosol Injection. We must admit it's true in a worst case scenario.

The above is a fair representation of the facts.
Termination Shock is extremely dangerous.

However...

By "sudden" reheating we mean 1-2 decades;

Not some instant deadly 12 month spike. (a few years to hit really hard)

KEY POINT: Not solving Greenhouse gases adds heat to the additional reheating from Termination Shock. GG are the issue.

Why TERMINATION SHOCK is a *false* risk.

Climatologists need to look up the word “**redundancy**”,
it’s under “**R**”.

They already work with NASA who are brilliant at redundancy.

S.A.I. is dirt cheap compared to most climate costs.
(10’s of billions) So money isn’t the issue.

We could have 2 or even 3 backup fleets of airplanes for S.A.I..

And If one country stopped S.A.I.?

Others would restart from self-interest.

No World governance needed, just self-interest.

“Sudden” Rewarming still takes a few years to hit hard.

We can rebuild a fleet in a couple years if we put our minds to it

EVEN BETTER! Combo Cooling.

While using S.A.I. we can ramp up Albedo cooling and use Marine Cloud Brightening in polar regions. We’ll have more money for these solutions because S.A.I. is staving off the worst damages.

If a termination shock occurred, this multi faceted cooling strategy
would significantly reduce it.

We can quickly scale up the backups. (we’ll have years to do it)

Every bit we diversify our cooling, we need to use less aerosol for
S.A.I., which also reduces the severity of termination shock.

- We still need some S.A.I. to effectively slow sea level rise.

FLEXIBILITY

There are alternative aerosols to Sulfur Dioxide (Alumina or Calcite) that
need to be studied. A mix of aerosols instead of one could significantly
mitigate risks. Maybe alternate between them throughout the years?

Albedo and Marine Cloud Brightening can also be used locally to offset
the uneven cooling effects of S.A.I. (Uneven regional heating is eventually
FAR worse with un-offset warming)

**If climatologists are right then how could
MAXIMUM Termination Shock occur?**

What's a situation where we don't have airplanes and can't manage Albedo or MCB?

- World War 3? An asteroid hitting us?
 - Termination Shock is then the least of our problems

(we have to keep saying this)

S.A.I does not heat the world. It COOLS it!

**Greenhouse gases heat the world and
increase Termination Shock.**

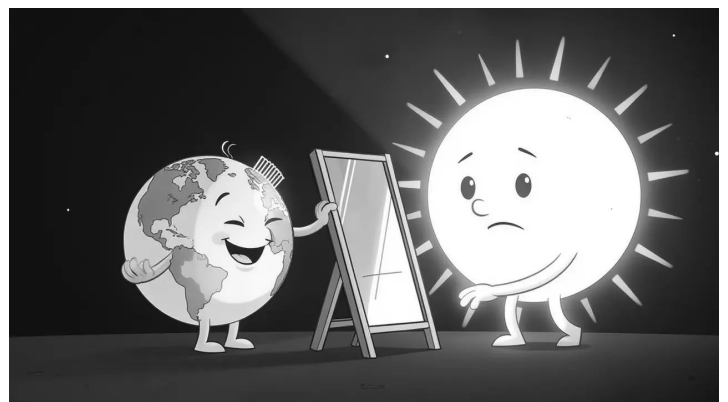
- A: The amount of S.A.I. we use is proportional to our greenhouse gas problem.
- B: the severity of termination shock is proportional to the amount of S.A.I. we use.
- = The severity of termination shock is proportional to our greenhouse gas problem.

Stratospheric Aerosol Injection is a lesser evil, but it is evil.

It's also a miracle.

**The effectiveness of S.A.I. and the efficiency of solar panels
are essentially gifts from God.**

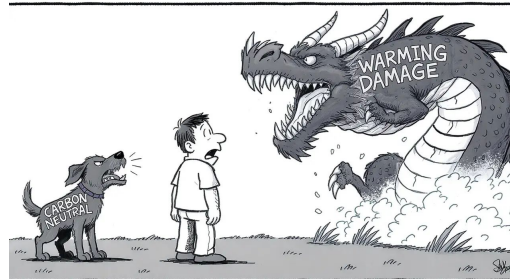
We'd be in deep SH*T without them.



**CARBON
NEUTRAL**

APPENDIX

CARBON NEUTRAL REALITY



*(2050 annual warming Damage ~16 Trillion Dollars)
(Swiss Re Study; a reinsurance company; current trajectory)*

Stratospheric Aerosol Injection saves the RICH world:

Money is the vehicle to accomplish everything.

S.A.I. is about ECONOMICS.

What's important near-term for the rich world?

S.A.I. is about preventing taxes, not deaths.

"Trillions" is overwhelming. Let's simplify:

Imagine paying \$9 every day for an after-school tutor (green transition). But each day a school bully took another \$16 from you (current trajectory warming damage). The bully doesn't just threaten tutor funding, he threatens everything we need money for (military, social)

The 16\$ Bully = annual warming damage costs.

Standing up to the bully = Stratospheric Aerosol Injection

The \$9 (max) = annual green transition costs.

(S.A.I. does cause some damage but much less than warming in the future)



9 trillion green transition seems crazy but it's doable.

2050 World GDP = ~160 Trillion. (Swiss Re)

16+9=25 Trillion every year; **NOT** doable.

The bully is eating our TAXES!

Why warming damages (not Greenhouse Gases)
are THE threat to rich world economies

Let's assume the world goes all-in on green investment and we achieve carbon neutral by 2050!

If we went all-in today on the green transition every year between now and 2050 will cost, **AT MOST**, 9 trillion dollars (We chose the "at most" number to show feasibility)

- 2026 investment? 9 trillion
- 2050 investment? 9 trillion (+ inflation)

In 2025 warming damages **only** cost the world \$220 billion dollars. That's not much.

- That 220 Billion warming damage number is a low estimate but let's triple that and it's still a LOT less than the annual green transition cost (9 Trillion max)
 - So the green transition is more expensive than warming damage, right?

Wrong.

\$220 Billion is the tip of the warming damage iceberg.
(ironic analogy intended)



KEY POINT:

If we stay on track the green transition costs are ~static.
(~9 trillion every year, no change)

The un-offset
warming damage costs are **dynamic and multiplicative**.
(S.A.I could help a lot)

- 2025 warming damages = \$220 Billion.
 - 2050 warming damages = \$16 Trillion.
(16-29 current trajectory)
(That's not a typo.)
- The real warming damage cost plateau will be the 2060+ price tag after a warming lag.
 - Lag = ocean still absorbs heat for 1-2 decades
 - The damages on that peak year will become a permanent yearly cost. So the world pays/loses 16+ trillion every year? YES. BINGO. YES.
 - Those damage costs will still rise annually since sea level rise will be creeping up for centuries (much slower with S.A.I.)

"The first and most imperative necessity in war is money, for money means everything else - men, guns, ammunition." – Ida Tarbell



Fingers crossed! But the green transition by 2050 looks bleak. Do not despair. Here is a roadmap... an actual roadmap... to escape this problem

S.A.I. saves trillions

green transition becomes easier

cap established on how much aerosol we need each year

Trillions saved to develop/build mirror

Stop using Aerosol.

This appendix talks about the reality of Carbon Neutral.
It's a reality of half measures for the easiest gains.
Adding to our woes, Carbon Neutral isn't a finish line.

- It's a perpetual and costly process maintaining a carbon balance.
 - We'll be paying to offset other countries unavoidable emissions. Most of the world can't afford to offset their own.

\$16+ , 000 , 000 , 000 , 000
+
\$9 , 000 , 000 , 000 , 000

EVERY
YEAR

We just can't add 16+ trillion (16-29) in annual warming damages to Carbon Neutral transition or maintenance costs.

With S.A.I. we can keep our prosperity and still hit Carbon Neutral (not 2050 but hopefully not decades later)

We can do this:

Carbon Neutral is achievable and sustainable for humanity.

If we ever want to replace S.A.I. with the (someday feasible) space mirror we need MONEY.



The west will eventually use S.A.I.

Almost certainly BEFORE achieving Carbon Neutral
(research this given even optimistic politics which we otherwise ignore)

We simply cannot afford the green transition AND warming damages.

Let's put warming damages and S.A.I. aside for a moment.

We'll focus on green transition costs.

So, How difficult is Carbon Neutral?

Carbon Neutral: Reality Check

We'll assume 2050 Carbon Neutrality wherever we can.
(so generous of us!)

A: What have we actually achieved so far today? (2026)

Electric vehicles (EVs) and green energy production (solar/wind) are less than 50% of the greenhouse gas problem

- Almost all our green transition progress is in these two areas. EV's and green energy are the "success" stories.
- EVs and solar/wind are market driven products. Consumers purchase them.

- EVs aren't charity. Their owners feel their purchase reinforces status and identity.

- EVs have a political element.

- politics also unfortunately creates a ceiling on adoption



Solar/wind is more than competitive price-wise with fossil fuels. Governments have an actual financial incentive to choose green energy.

- Solar/wind is poisoned by politics, slowing adoption (everybody's fault)
- China's solar industry dominance also creates political headwinds for solar adoption. (years ago we dominated it)

EVs and green power generation are the low-lying fruit.

- Even though market driven, it will take decades for these technologies to become dominant.
- Even the low lying fruit takes decades? Yes.



Almost every other facet of the green transition is not market driven: pure cost, our taxes.

- The primary purpose of sea walls, land management, carbon extraction, and redesigning entire industries is defensive, not wealth creation.
- Taxes will pay for most of the green transition. It won't be consumers/governments buying competitive products.
 - Every man building a sea wall is not building something else.
 - Every dollar spent on a sea wall is not spent on something else.
 - Every tax dollar spent on a sea wall is a tax dollar that otherwise didn't need to be collected from the citizenry.

“Every tax dollar spent fighting a wildfire” etc...



We have many problems

We have many workers

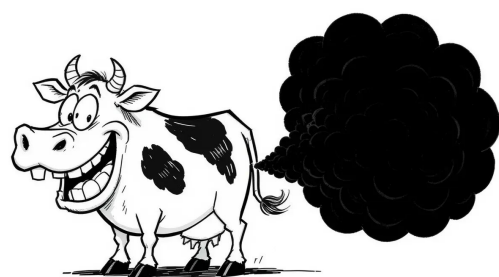
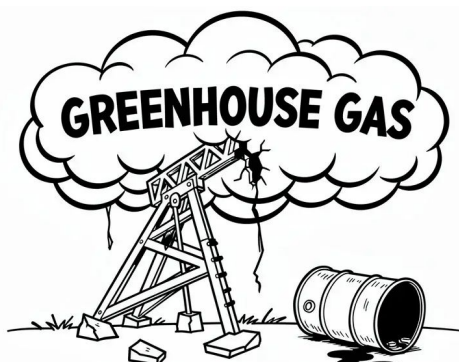
We lack solutions

- Mining, refining, plastics, cement, livestock, airplanes and farming (most pesticides and fertilizer are hydrocarbon based)... we have no near or mid term solutions to these.
- Advances in materials and feed etc. shave off *percentages* of greenhouse gas emissions but that points to a crippling issue:
- percentages are not complete capture/prevention.

There's a lot of gas we can't catch:

Example: There are millions of uncapped spent oil wells throughout the world leaking methane and CO₂. Many are in unfriendly nations. There are countless examples like this, emissions we can't control.

- When will the world's entire livestock population be kept indoors to capture methane?
 - We won't choose this impossible task because we have CO₂ general atmosphere extraction.
 - But Methane and CO₂ aren't the same.
- What does capturing CO₂ have to do with Methane? (see below)



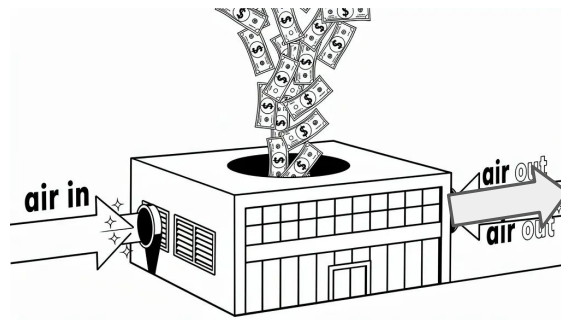
General Atmospheric Extraction:

Let's focus on CO₂ for a moment, for clarity.

Carbon neutral is far off because while we can reduce output and capture CO₂ at the source, there will be considerable excess CO₂ gas we can't reduce or capture.

To achieve Carbon Neutral we'll need to suck out that excess CO₂ from the general atmosphere.

- We'll need to do this every single year **forever**.
(Carbon Direct Removal via Direct Air Capture with Carbon Storage)(CDR via DACCS).



Every excess CO₂ molecule not captured or prevented will need to be extracted.

- CO₂ is .04% of our general atmosphere.
 - We will filter CO₂ out of the air with giant complexes (we are already testing) of fans and alkaline materials. This is like sifting Everest size mountains of hay for a few CO₂ needles.

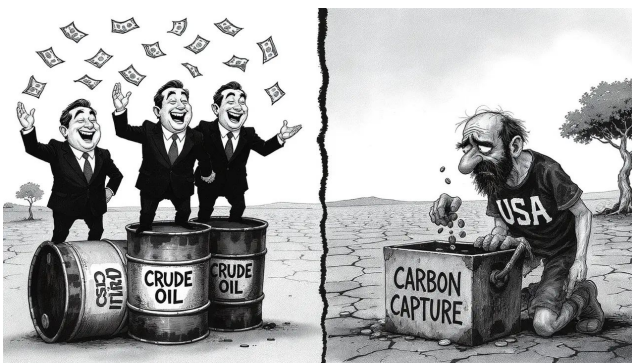
**We can sift air for CO₂.
it's just crazy
expensive and
inefficient**



UN-AMERICAN:

We'll be paying to extract all the greenhouse gas emissions from bad actors. Russia or others will sell a barrel of oil for profit and Americans will pay taxes to extract foreign countries excess CO₂. (really?)

- Two barrels of oil = ~1 ton of CO₂ emissions (extraction/refining/burning)
 - Removing that carbon from the atmosphere costs ~\$300 - \$1000 per ton.
 - So Russia, Brazil etc sell oil and then America will **PAY** to clean up the CO₂?
 - even in 2050 it will be, best case, \$100+ to remove a ton of CO₂.
 - The amount of CO₂ we need to remove by 2050 is, best case, ~3 gigatons (could be 10 gigatons; that # looks like 10,000,000,000 tons.)
 - If we do the numbers? It's less than \$1 trillion. That seems ok except...



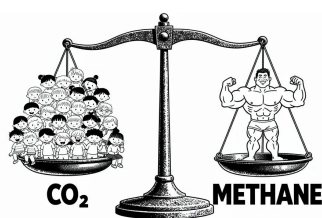
KEY POINT:

This work must happen **LONG** before the extraction price drops close to \$100 per ton. That strongly affects the 9 trillion #

*Scary, VERY Scary: Back to Methane and Nitrous Oxide...

Because we don't even have *conceived* methods to extract free methane and nitrous oxide from the general atmosphere we will have to extract their CO₂ warming equivalent annually.

- Methane and Nitrous Oxide are tens to hundreds of times more potent than CO₂ so that's a lot more CO₂ extraction to achieve neutrality. Cripplingly expensive!
- The magic number for methane is 400 million tons, which is the excess caused by human activity each year
 - Methane is 30X more powerful than CO₂ so we need to extract it's CO₂ equivalent each year. Let's assume the crazy cheap cost of \$100 per ton for CO₂ extraction.
 - 400 million X30 X\$100 = \$1.2 trillion annual costs for methane removal and it's actually a multiple of that given realistic prices.
 - That cost only offsets methane.
 - We'll need to pay this every year forever
 - World meat/dairy consumption is expected to increase for decades.
- Nitrous oxide is ~280X more powerful than CO₂ so, best case, we pay \$28,000 per ton.



The numbers above ONLY pertain to greenhouse gas removal.
Those costs don't include:

- Annual green infrastructure/R&D costs
- Every climate change issue not surface temp related.
- The truly unavoidable sea level rise damages (there's still some annually even if we use S.A.I.)

The RICH world needs Stratospheric Aerosol Injection.

The green transition is barely affordable on it's own.
The world will still have all the problems we have now...

In fact, we'll have many more problems!

- For the first time in the post-Neolithic (advent of farming) era, all of humanity will be under extreme stress at the same exact time.
 - Where do you emigrate when most ecologies are degrading?
 - Who do you borrow from when everyone is desperate for money?

We are using the LOWEST
damage estimate
combined with the
HIGHEST transition cost.
We falter (like we are) in
the slightest and damage
#s become dynamic



Every day past Jan 1 2050 without Carbon Neutral warming
damage creeps up PERMANENTLY past our low estimate.
Even desperate scientists don't think 2050 is plausible.

The rich world does not meet its own green transition goals:

Every year we barely achieve 20% (~80% short)

(Climate Policy Initiative)

The amount we fall short is added to the ever decreasing
remaining years before 2050.

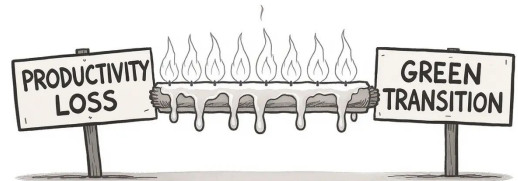
*You don't have to be a math wiz to see what's going on. Failure is a
certainty. Failure dramatically increases annual warming damage.*

S.A.I. is “America First”:

America needs S.A.I. economically and not just to afford the green transition.

- S.A.I. protects funding for the military, social programs and... PREVENTS FUTURE TAXATION!
- Warming is *insanely* expensive and warming reduces our productivity.

S.A.I. stops us from burning our economy at both ends.



We know conservatives hate any tax.

But liberals don't comprehend the needed tax levels.

The taxes for uncontrolled warming damages?

Liberals will **piss their pants**. Goodbye social programs!

All of us need to grow up about researching S.A.I.!



We just need to get ready for S.A.I.

Carbon Neutral gets ~\$2 trillion annually in investment.

S.A.I. gets at best 1/5,000 that amount

Just steal from Paul to pay Peter!

We do need to hurry.

The problem is the ocean surface temperature.

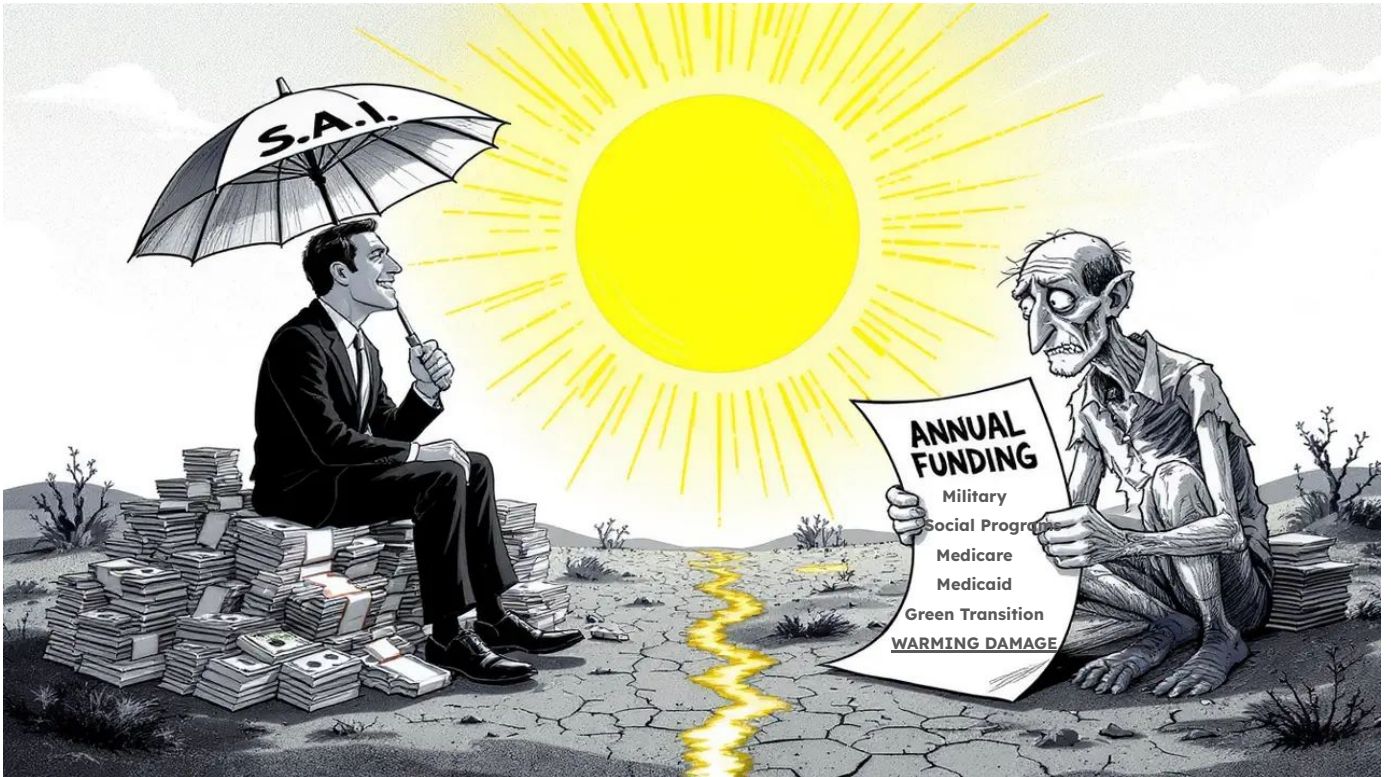
It causes most problems, and accelerates sea level rise.

Ocean surface temperatures take years, maybe a decade, to significantly drop once S.A.I. is implemented.

Carbon Neutral is an insane challenge.

Key Note:

This argument hasn't addressed ***POLITICAL*** obstacles.
Our politics are dysfunctional and politics are everything.



No conspiracy but Scientists are wrong about S.A.I.

They have no grasp of how money = life.

The greatest threat to the green transition *isn't* that
S.A.I. could demotivate that transition.

The greatest threat is warming damages bankrupting us

Demotivation causes “do we want to?”

Extreme warming damages cause “are we able to?”
that second one is terrifying.



~Guaranteed S.A.I....

How long until we escape it?

The argument above is a harsh reality. But let's talk solutions.

Here is where the **PRIVATE** sector helps us avoid long-term stratospheric aerosol injection AND avoid warming damage.

Remember the space mirror?

That huge orbital array we couldn't possibly build for decades?

This argument lays out SAI's inevitability in order to prove that the need for the mirror or another escape hatch from SAI isn't a joke or easily dismissed.



But that escape hatch can be either a long-term solution or private investors can make it a *mid-term* solution.

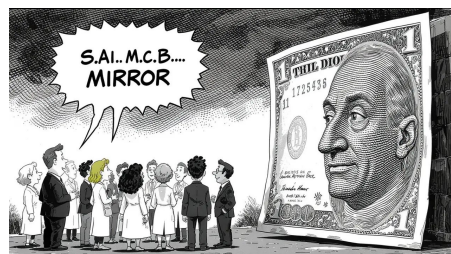
Stratospheric Aerosol Injection just entering the public debate will draw interest from investors. (SpaceX, ahem) Some might invest in SAI research which is a good thing to make it safer and happen sooner to prevent more loss of prosperity.

But, at least compared to now, there will also be increased forward looking investment into any feasible alternative as an SAI off-switch.

SAI negatives, while far less than un-offset warming, will still make us desperate for what the mirror accomplishes;

We must speed up that accomplishment.

Market driven forces are the answer.



Do we see how just talking about this is effective?

Even if it's *negative*, it works... Geoengineering is on the radar.

Investors smarter than us are always looking to get in early on an opportunity.

This is about money and fear predicated choices;

NOT a sense of international responsibility.

I will never personally invest in any project to keep this argument ethical but several companies are already testing the aerosols we've mentioned and even some different aerosols.

Different companies, different angles (e.g. Stardust Solutions or Make Sunsets). Each company and solution are hit or miss but this TYPE of investment is exactly what we want.

The long term solutions, Mirrors, etc., come sooner the very day we start understanding the harsh realities of our near-term solutions. (SAI)



Each individual great power, Including the UNITED STATES, should think on this:
WHEN SAI is implemented your people could be one of the losers with many areas suffering extreme local heating.

If the United States, Russia, India, Europe or China use SAI...

There is NOTHING the other great powers can do about it.

As we've mentioned any great power can also prevent termination shock caused by another. It's an auto-correct even without world governance.

And it's a standoff, All these nations have nuclear weapons.

(let's pause a moment on that)

And the UN helping?

The great powers we're talking about are the security council who control the U.N.
...and even they ignore the U.N..

The United States or Europe SHOULD use their resources and technical expertise on these projects for their own good but that won't happen anytime soon.



That's why
PRIVATE investment,
with it's risk tolerance and (useful) amorality,
is the pioneer.



We should have no problem with investors making billions in profit given what
all of us are getting from it.

Many facets remain to discuss but let's stop here.

There are supplemental videos for SAI/mirror you can check out.

Here's a teaser though... China hates sticking its neck out and prefers wait and
see patience. But the moment the party's control over the domestic population
erodes even the slightest? All bets are off.

And the Chinese know how to
get things done cheap and fast.

Look out America!

Someone else's hand will be on that lever!



Money = everything else, so let's preserve our prosperity.

Please use any and all ideas here, develop them, make them yours.

Working to spread this idea is all that matters.

Thank you.

If you watch the video you'll hear that gratitude in my voice.

Say hi if you see me spreading this idea in Boston!



sai-reality.com