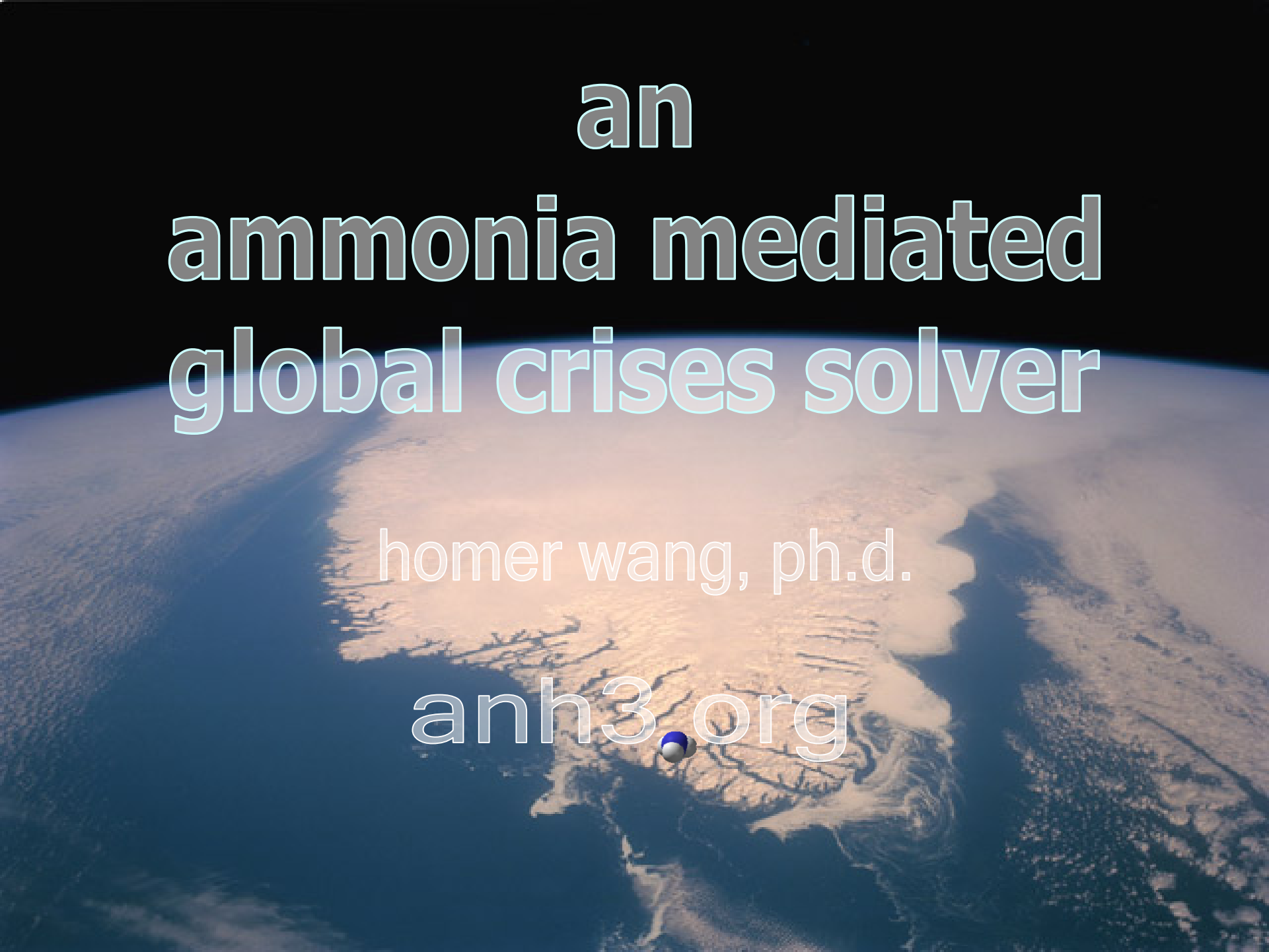

an
ammonia mediated
global crises solver
homer wang, ph.d.
anh3.org

"AN" OMEN

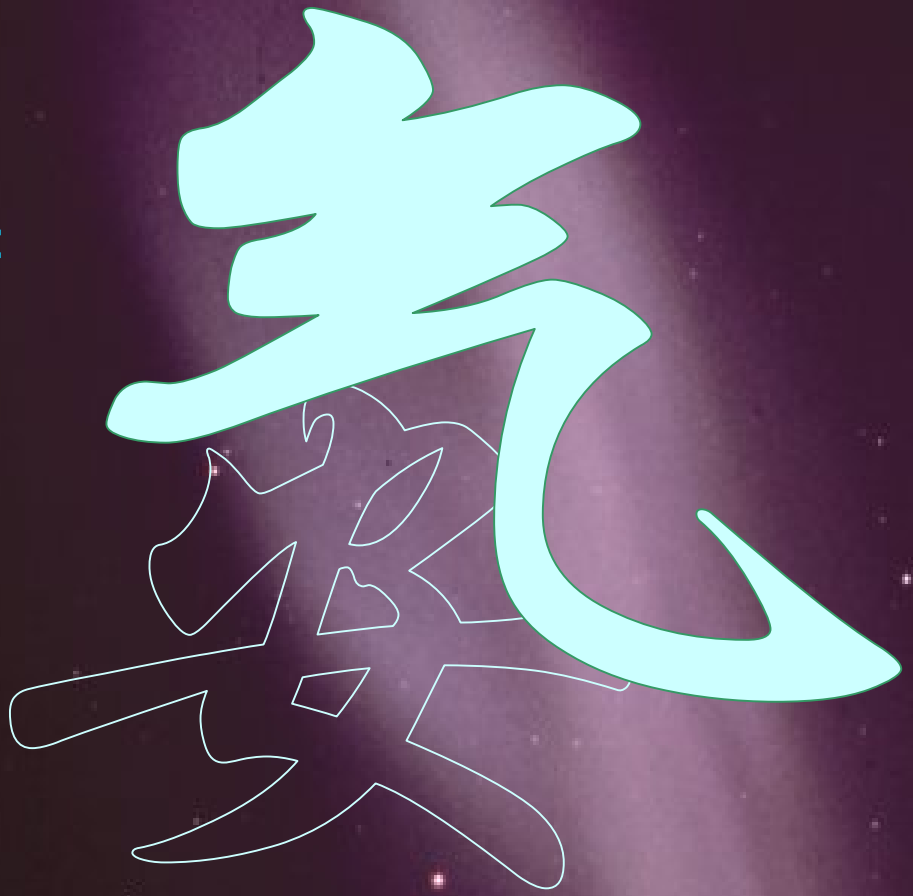
the Chinese character or name for NH_3

pronunciation: *an*

definition: ammonia

formed with two characters,

on top:



pronunciation: *chee*

definition: 1. gas 2. vitality 3. *energy*

at root:

pronunciation: *an*

definition: 1. *peace* 2. safety 3. *security*

the combination of two characters with the meanings of:

energy *peace* *security*

symbolizes:  NH_3

NOMEN OMEN

will the omen—*ammonia, the energy for the peace and security of the world*—become a reality? if so, how?


what are the gravest threats to the peace and security of the world?

e pluribus, ~~*unum*~~ *duos*:

fuel supply *shortage*

abrupt *climate change*

climate change, fuel shortage

two crises, both alike in severity

- either of the two can disrupt the availability of food, water and habitation globally
- either of the two can trigger other more acute crises and conflicts globally
- causes of major contention globally
- *in fleeting irretrievable time,* the crises deepen globally

end of arguments?

- even if hydrocarbons are *renewable* in a meaningful time frame, has the current consumption rate made them as plentiful and easy to extract as before?
- even if our usufruct of hydrocarbons was justifiable in the past, is it still so at such a rate?
- even if the climate change is 0% anthropogenic, should we just let it cross the threshold while some preventive measures are still possible?
- even if the climate change may not be as abrupt as in the past, can we afford to wait till the runaway is beyond the biosphere's ability to cope?

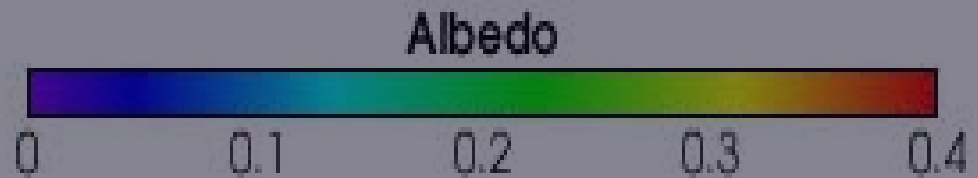
remedies to the crisis of fuel shortage

the status of alternatives (in TW)

• bio-fuel	0.2	(exclude biomass burning of 5TW)
• geothermal	0.03	
• hydro-electric	0.36	
• nuclear (U)	1	
• ocean thermal	0	
• solar	0.016	
• tidal	0.0005	
• wave	0	
• wind	0.06	

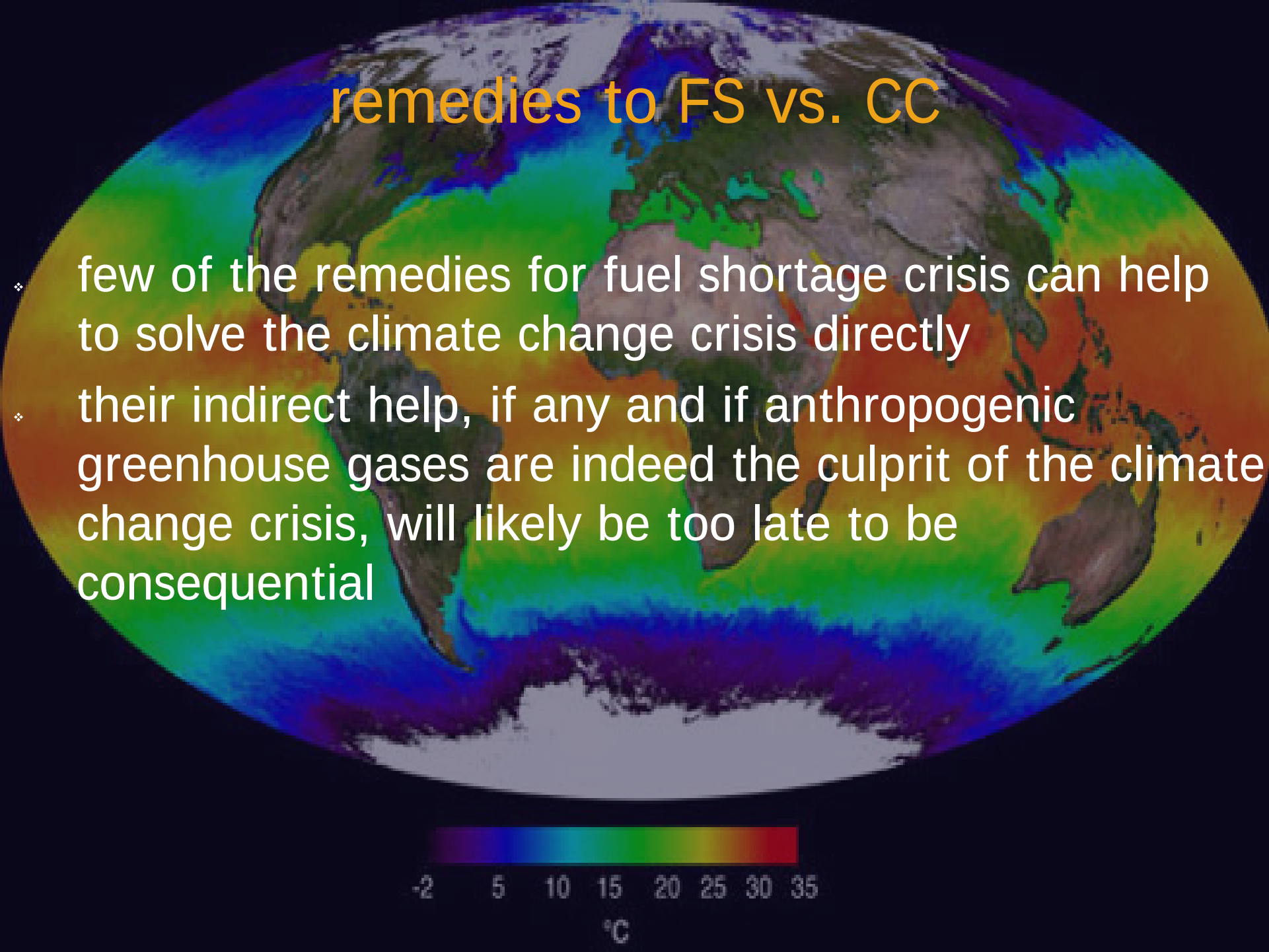
proposed quick-fixes to the crisis of climate change

- cloud-making
- desert reflective mirrors
- space-shade
- stratosphere SO_2 aerosol
- OTEC(?) *from BBC News: "Two of Britain's leading environmental thinkers say it is time to develop a quick technical fix for climate change" —bring up cold water from deep ocean using millions of long pipes to increase the absorption of CO_2.*



remedies to FS vs. CC

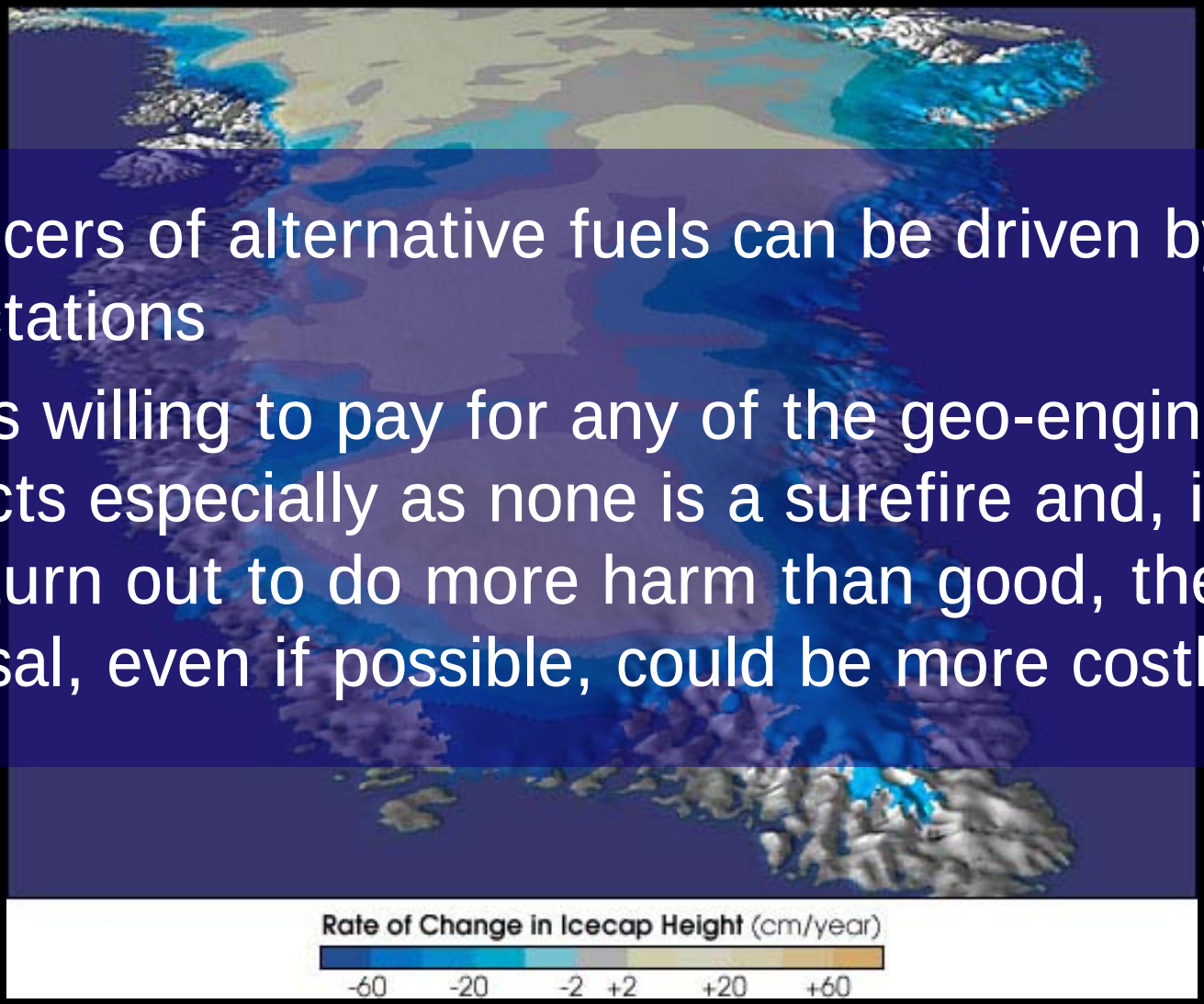
- few of the remedies for fuel shortage crisis can help to solve the climate change crisis directly
- their indirect help, if any and if anthropogenic greenhouse gases are indeed the culprit of the climate change crisis, will likely be too late to be consequential



remedies to CC vs. FS

- worse yet, none of the proposed geo-engineering climate change "quick fixes" can offer any relief to the current crisis in fuel shortage
- they might help to prevent greater future crises in fuel supply for the need of dealing with disasters caused by climate change, i.e. heat-waves, severe floods and droughts, etc.—IF the proposals can actually work and won't cause big, or even BIGGER, unforeseen disastrous side-effects or consequences

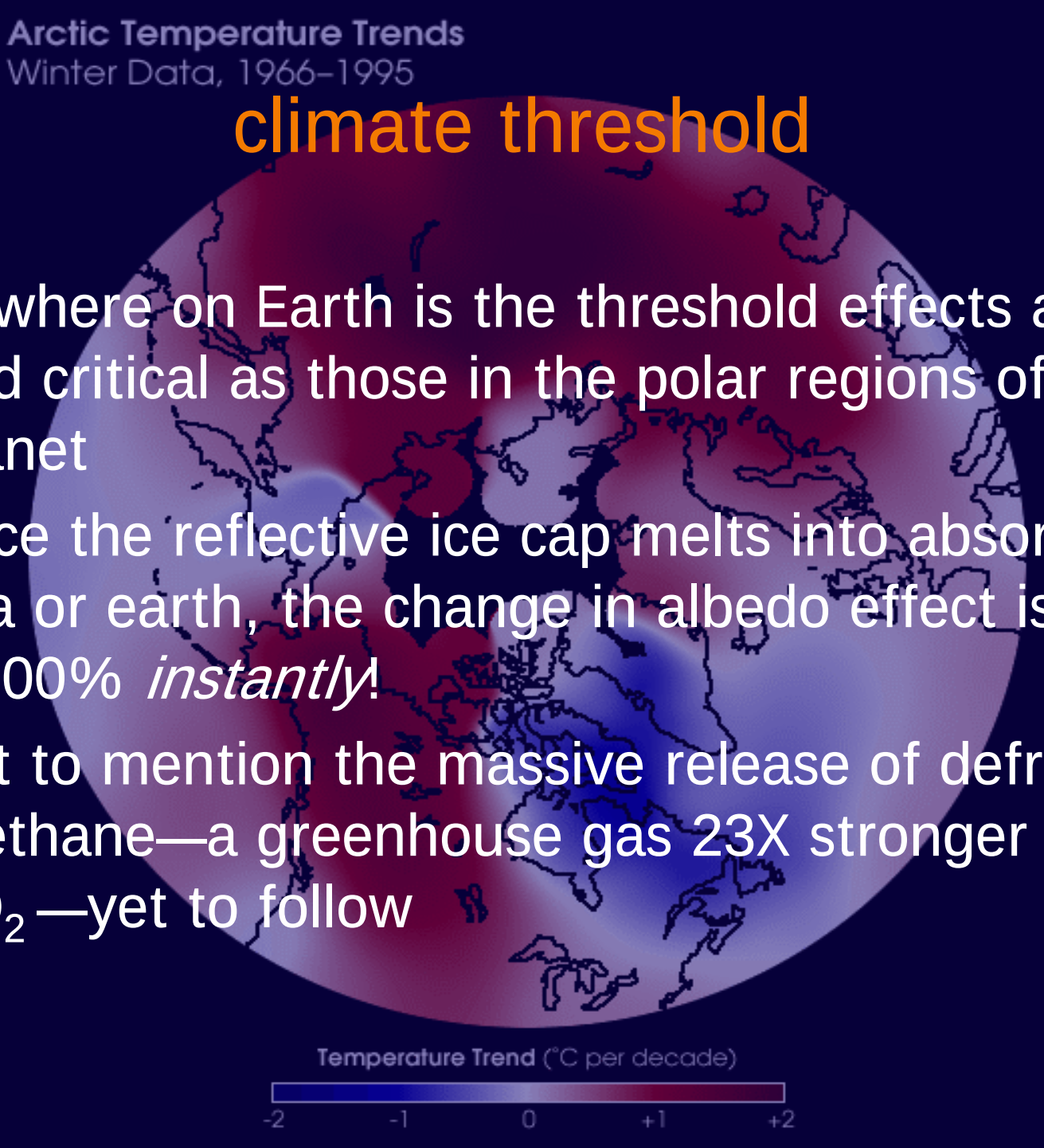
motives for solutions



- producers of alternative fuels can be driven by profit expectations
- who is willing to pay for any of the geo-engineering projects especially as none is a surefire and, in case they turn out to do more harm than good, the reversal, even if possible, could be more costly

a reality check

- if the world is hard-pressed in dealing with one crisis, will it really be able to fight a two-front war to tackle both of the crises at the same time?



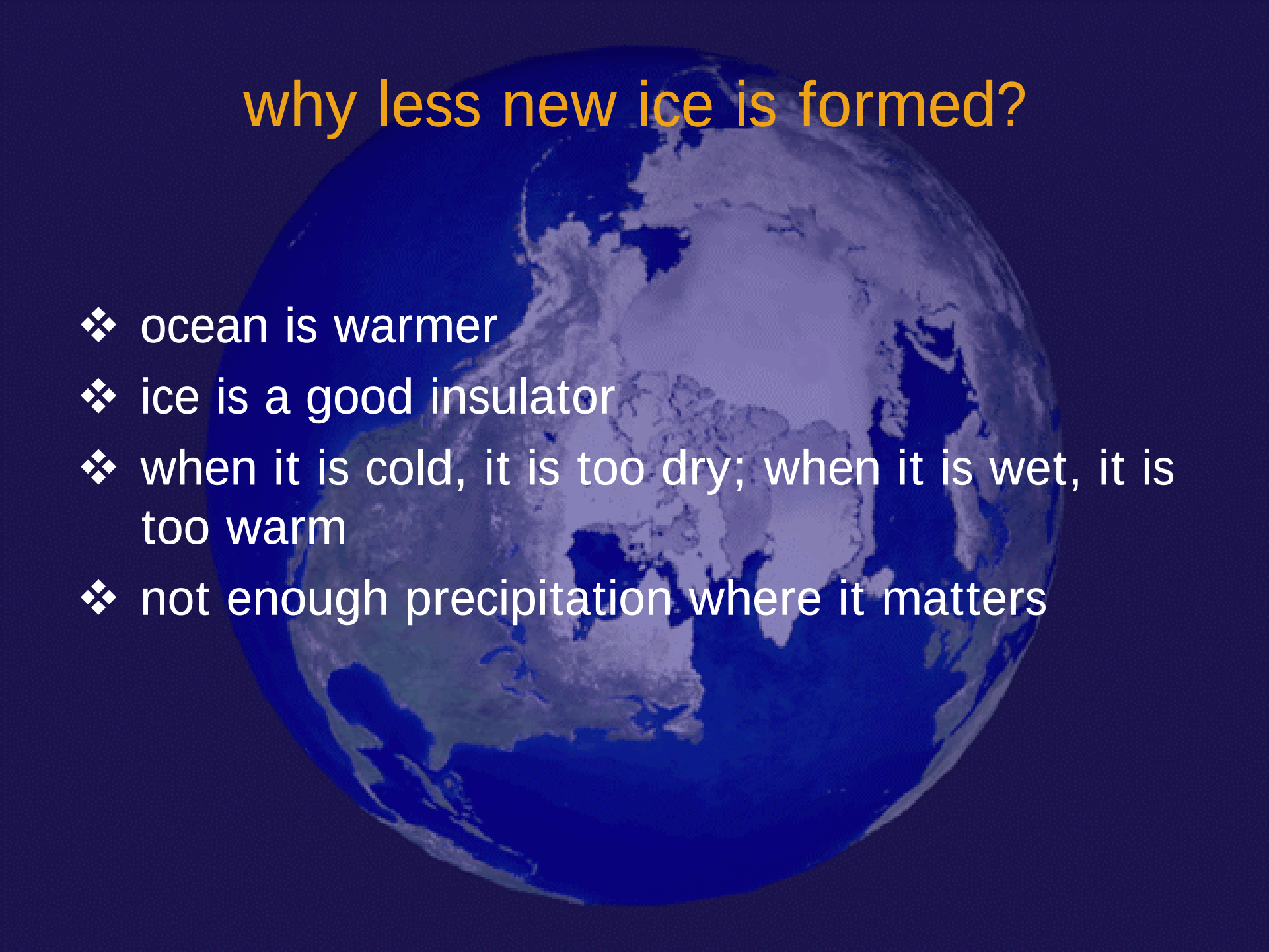
climate threshold

- nowhere on Earth is the threshold effects as clear and critical as those in the polar regions of the planet
- once the reflective ice cap melts into absorptive sea or earth, the change in albedo effect is >900% *instantly*!
- not to mention the massive release of defrosting methane—a greenhouse gas 23X stronger than CO_2—yet to follow

how does polar ice disappear?

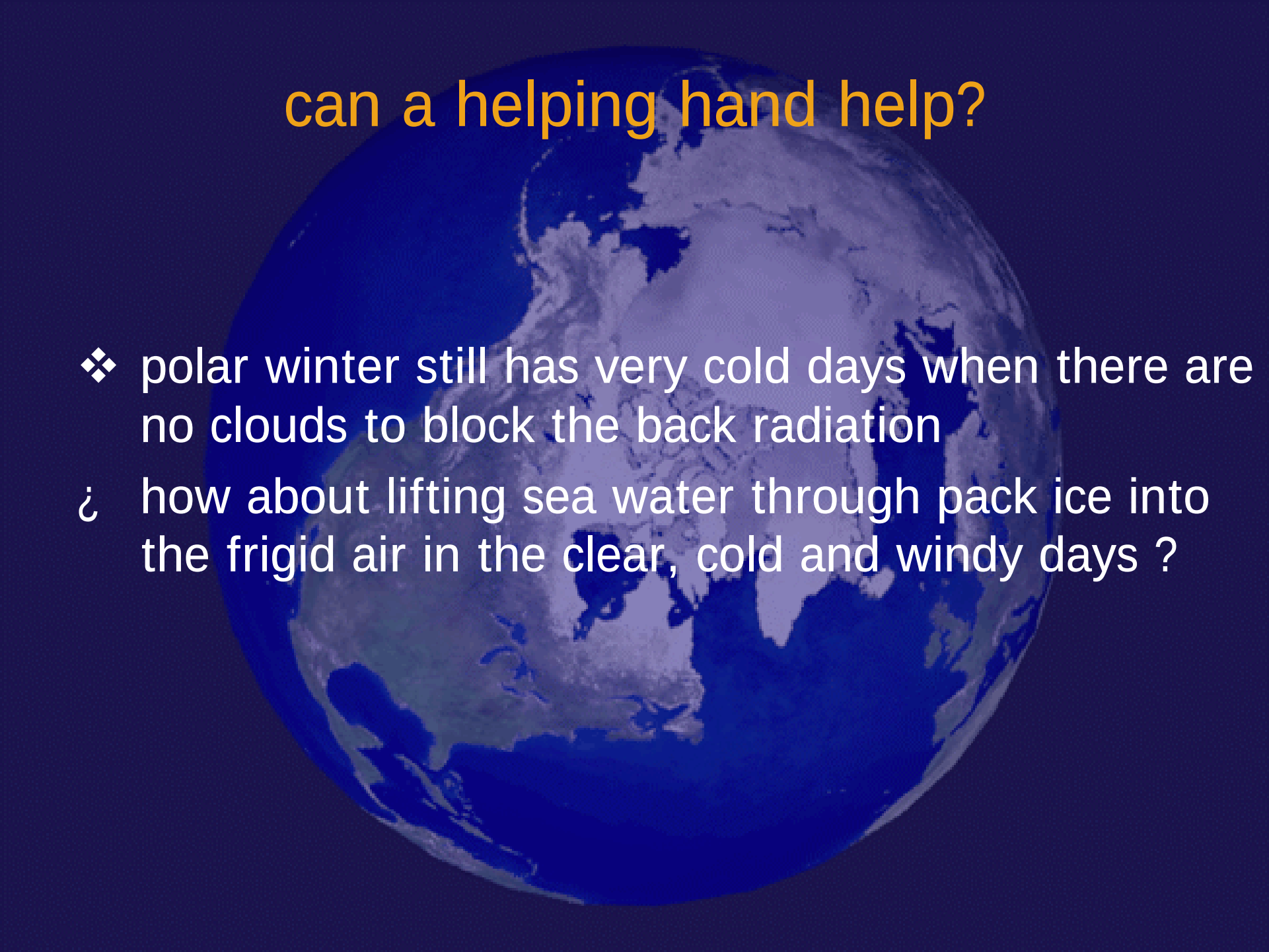
- pack ice melts away in summer when its end-of-winter thickness is <3-4m
- ice shelf breaks off when its weight (melt↓ form↑) is not enough to press itself down to the continental shelf
- ice sheet flows off when there is no massive enough ice shelf to hold it back

why less new ice is formed?



- ocean is warmer
- ice is a good insulator
- when it is cold, it is too dry; when it is wet, it is too warm
- not enough precipitation where it matters

can a helping hand help?



- polar winter still has very cold days when there are no clouds to block the back radiation
- how about lifting sea water through pack ice into the frigid air in the clear, cold and windy days ?

at what cost?

- equipment: vessels, pumps, water cannons, etc.
- energy: >2 EJ/yr. —just to make up the arctic ice cap loss in 2007 alone into 4m-thick multi-year ice by lifting water 30m in average
- can only operate intermittently, so the power generation capacity must be much bigger

who will pay?

where will the energy come from?

- hydrocarbons are out of question
- nuclear, even if we have the usufruct, takes too long, not to mention the cost and controversy

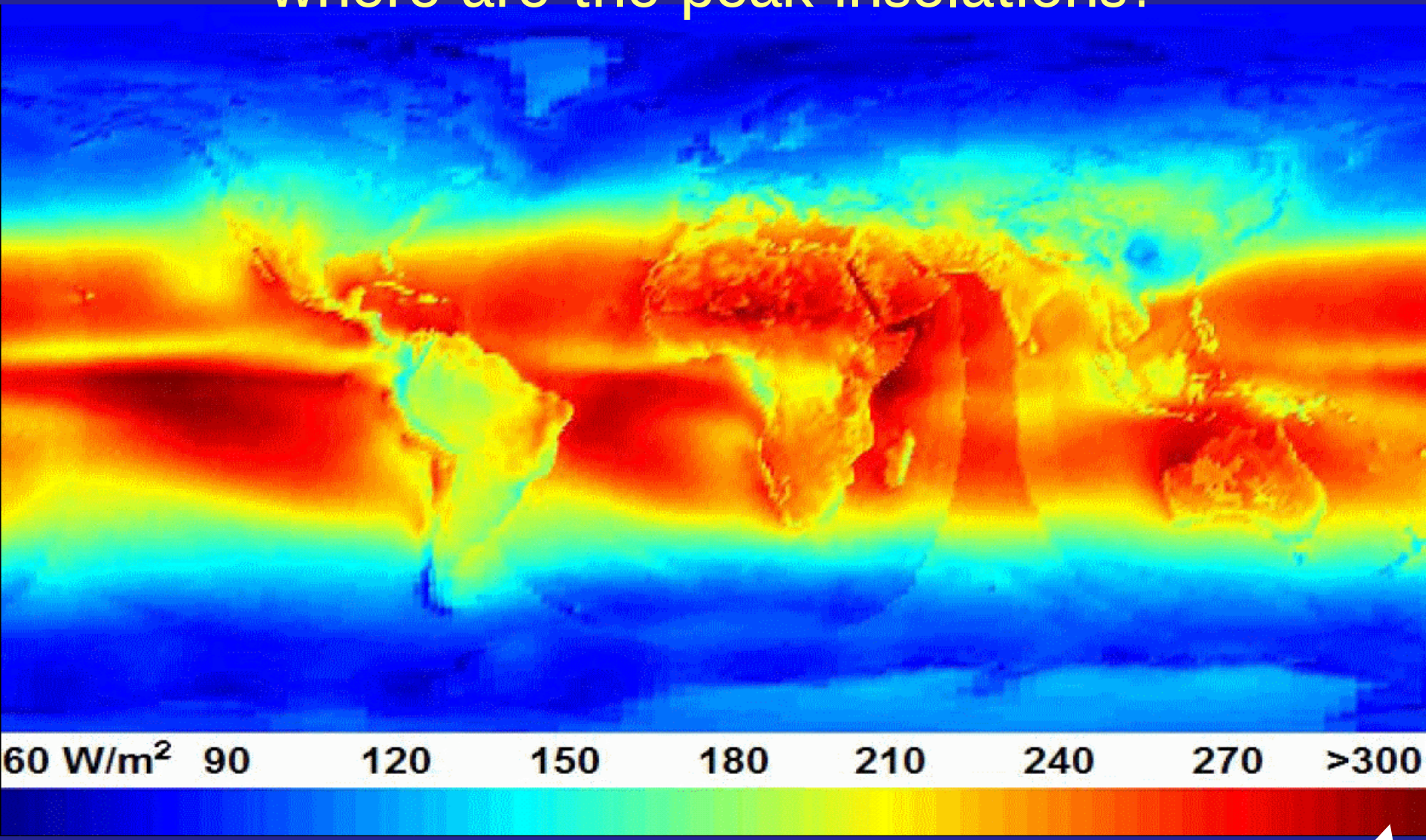
potential of the renewable alternatives

(in TW, current world power consumption: ~18)

- bio-fuels 90 (total photosynthesis on earth!)
- geothermal 32
- hydro-electric 7.2
- ocean thermal 100 (excessive use may affect THC!)
- solar >5000
- tidal 3.5
- wave 3
- wind 800

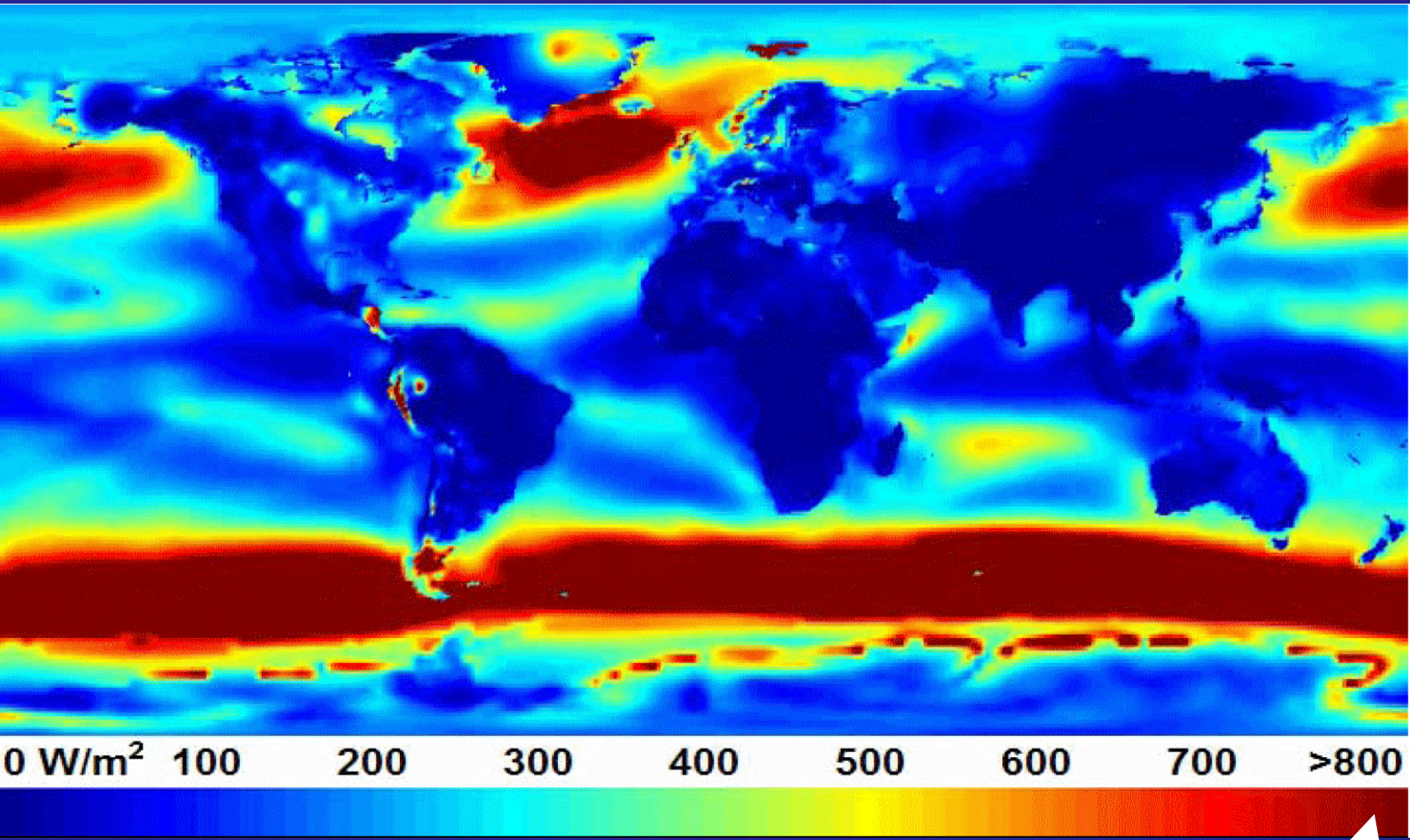
clear choices: solar and wind

where are the peak insolations?



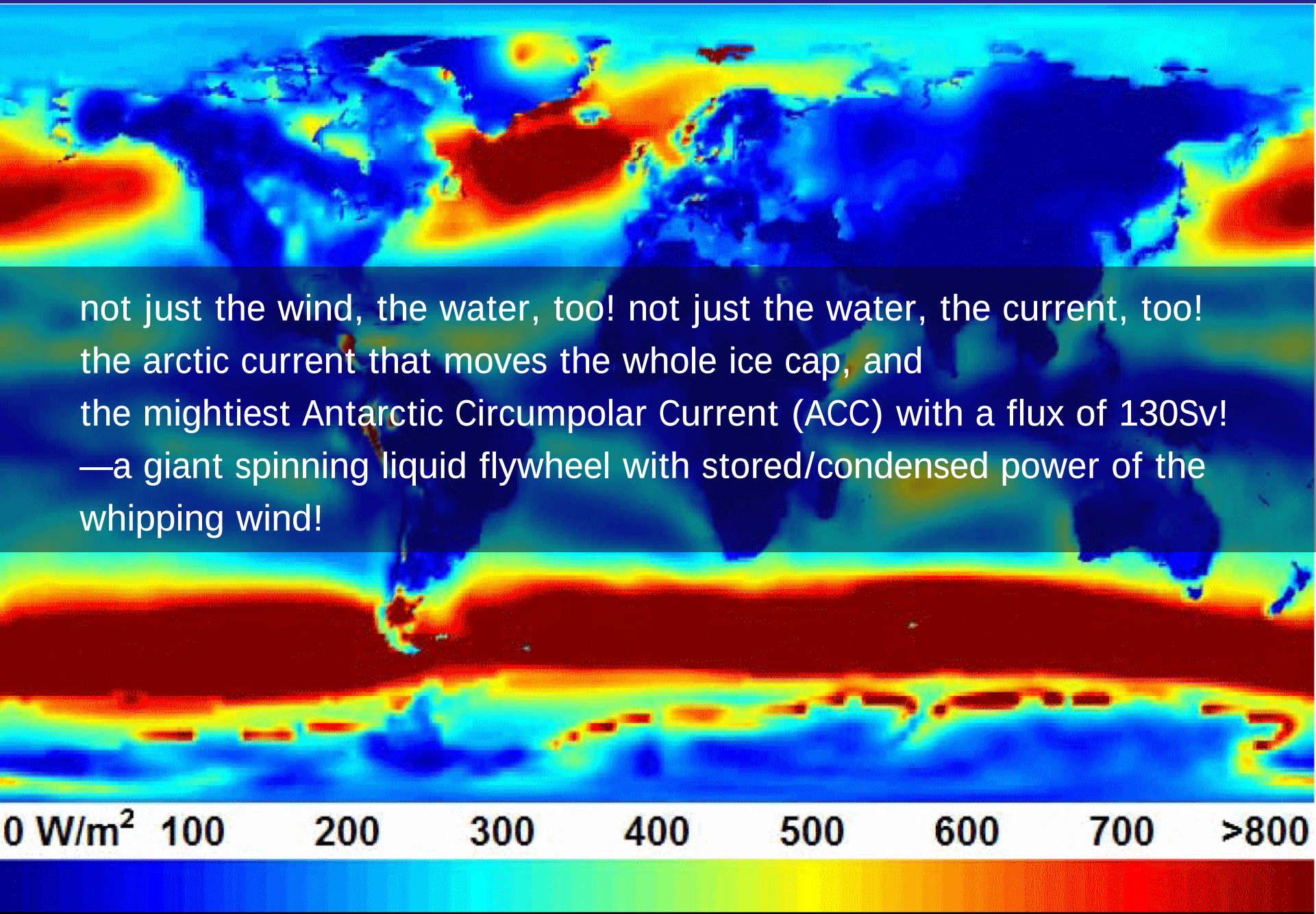
too intermittent, too expansive & expensive to collect, as yet

where are the *buenos aires?*



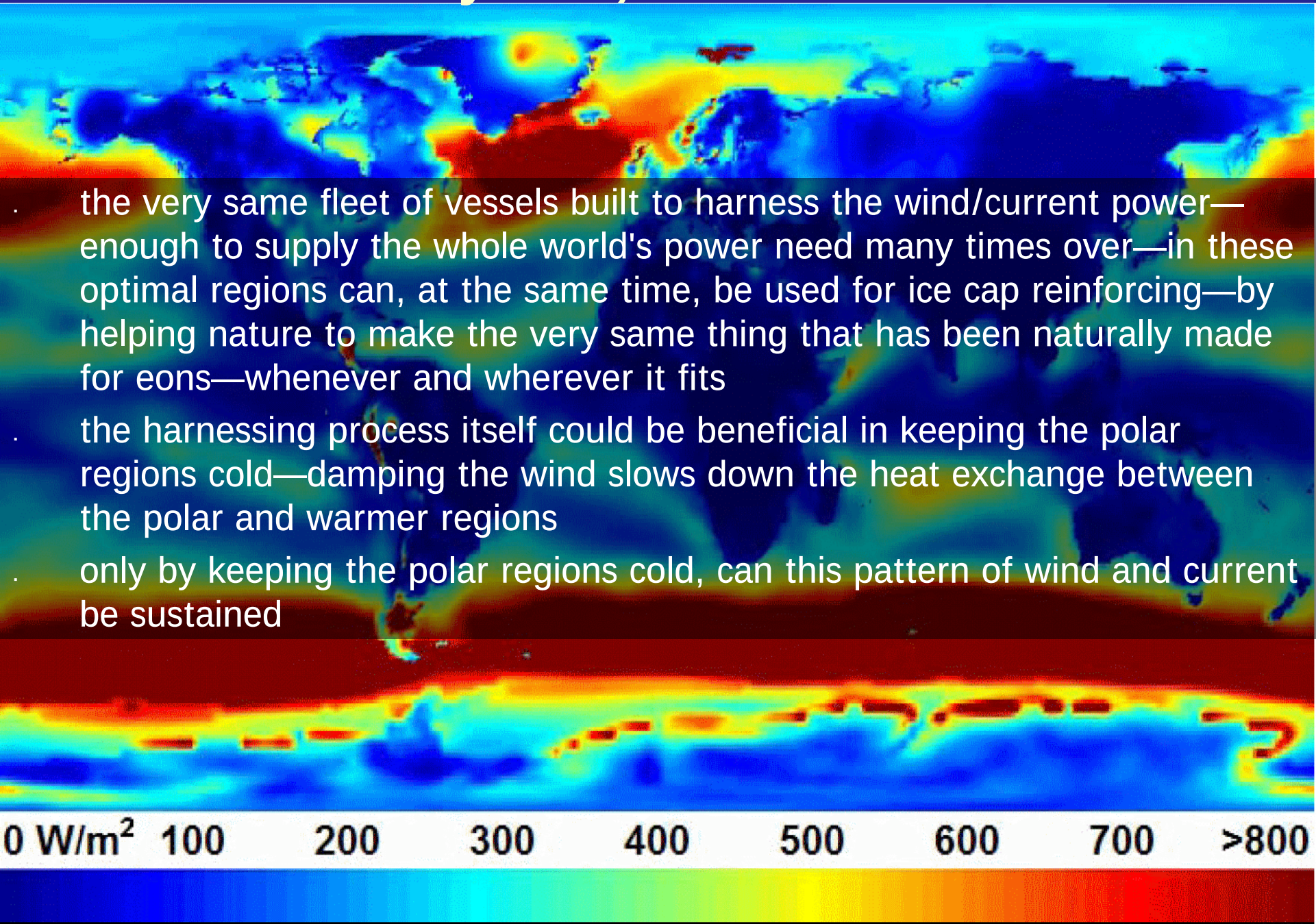
RIGHT THERE!

at the right places



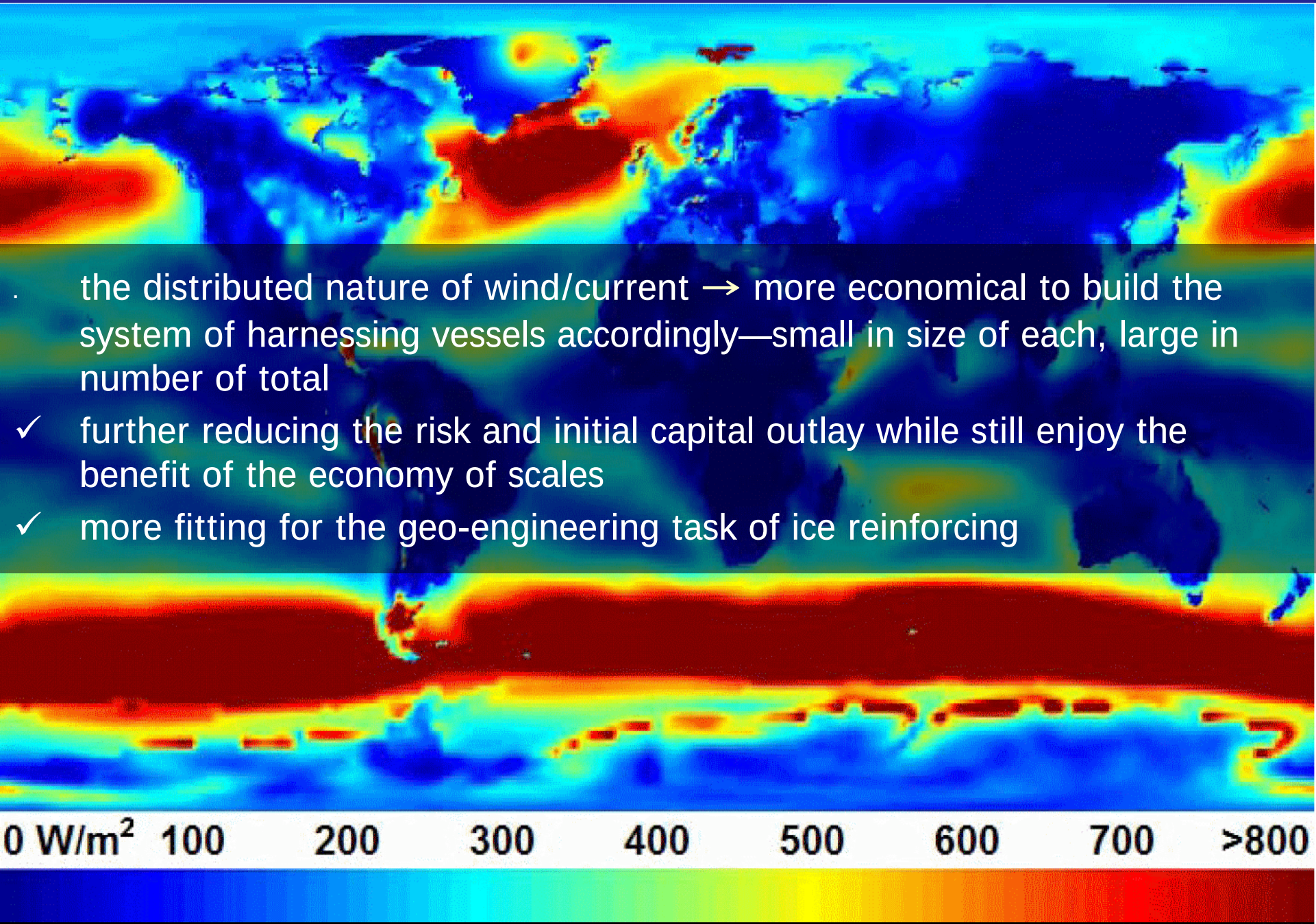
not just the wind, the water, too! not just the water, the current, too!
the arctic current that moves the whole ice cap, and
the mightiest Antarctic Circumpolar Current (ACC) with a flux of 130Sv!
—a giant spinning liquid flywheel with stored/condensed power of the whipping wind!

1 system, 2 functions



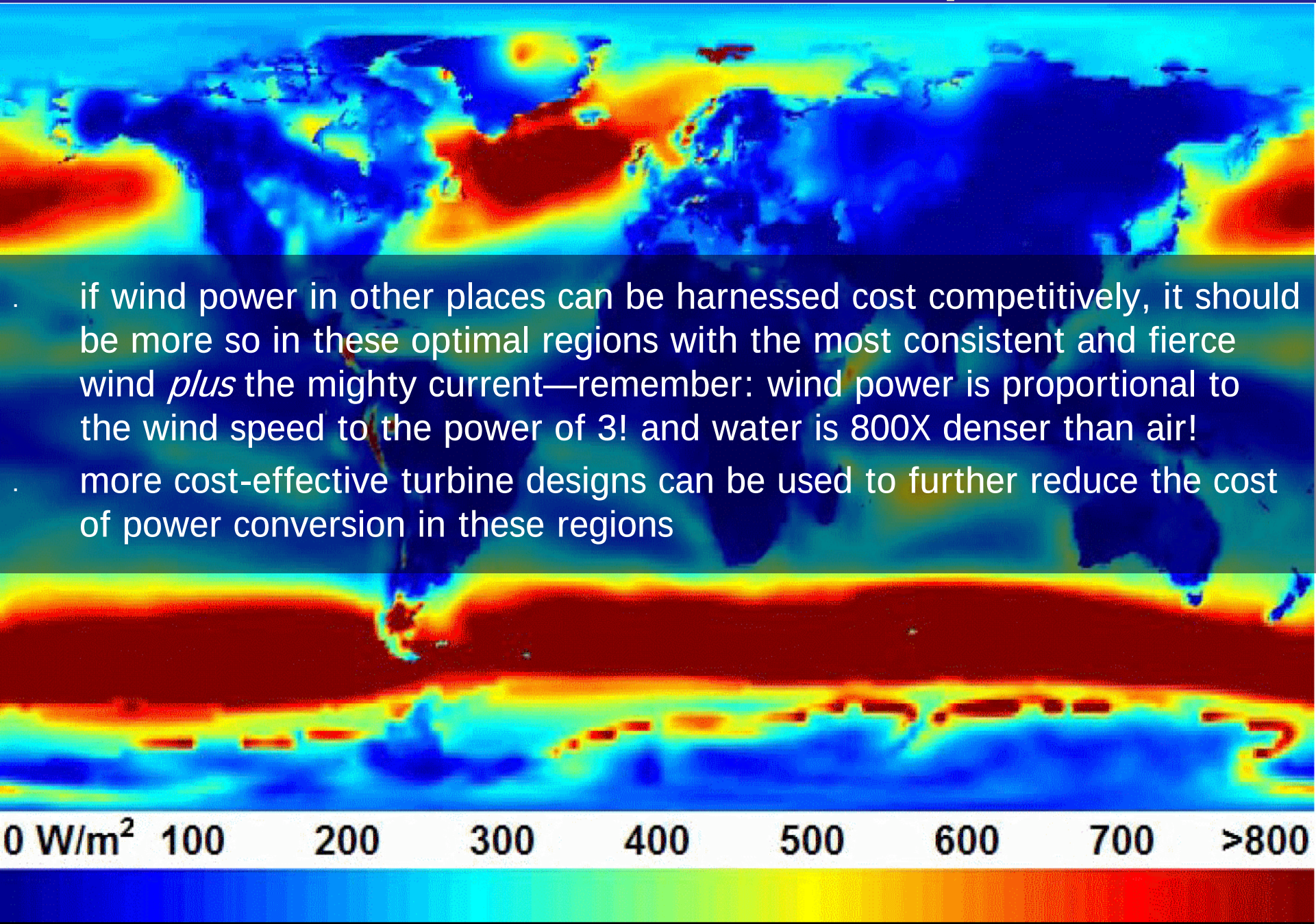
- the very same fleet of vessels built to harness the wind/current power—enough to supply the whole world's power need many times over—in these optimal regions can, at the same time, be used for ice cap reinforcing—by helping nature to make the very same thing that has been naturally made for eons—whenever and wherever it fits
- the harnessing process itself could be beneficial in keeping the polar regions cold—damping the wind slows down the heat exchange between the polar and warmer regions
- only by keeping the polar regions cold, can this pattern of wind and current be sustained

1 solution for 2 crises



- the distributed nature of wind/current → more economical to build the system of harnessing vessels accordingly—small in size of each, large in number of total
- ✓ further reducing the risk and initial capital outlay while still enjoy the benefit of the economy of scales
- ✓ more fitting for the geo-engineering task of ice reinforcing

a crises solution with *windfall* profits



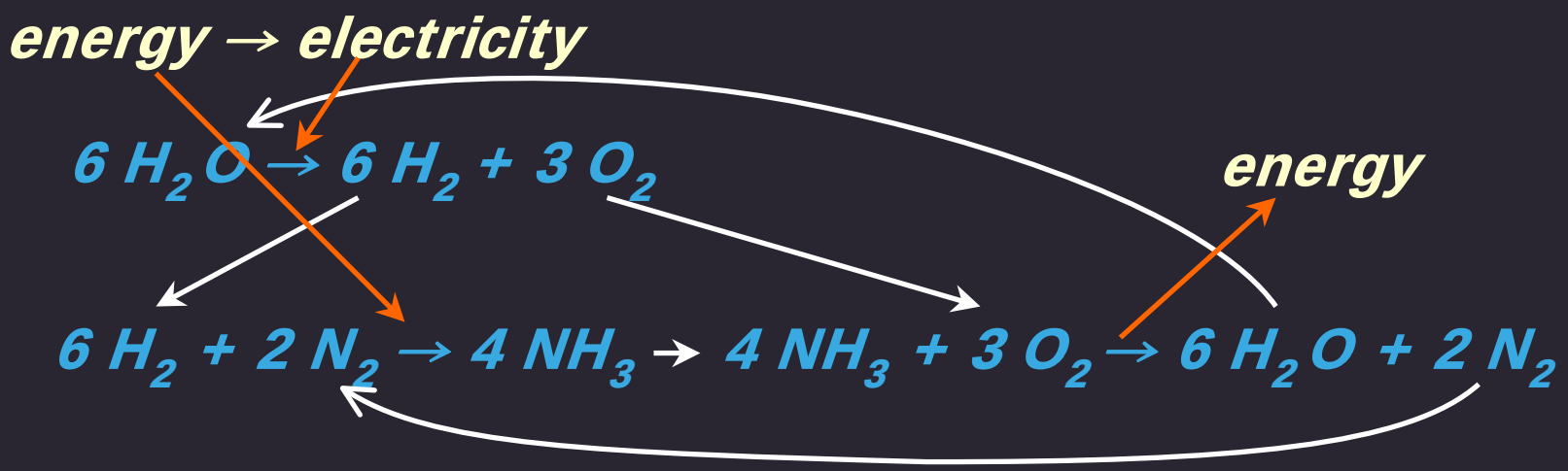
- if wind power in other places can be harnessed cost competitively, it should be more so in these optimal regions with the most consistent and fierce wind *plus* the mighty current—remember: wind power is proportional to the wind speed to the power of 3! and water is 800X denser than air!
- more cost-effective turbine designs can be used to further reduce the cost of power conversion in these regions

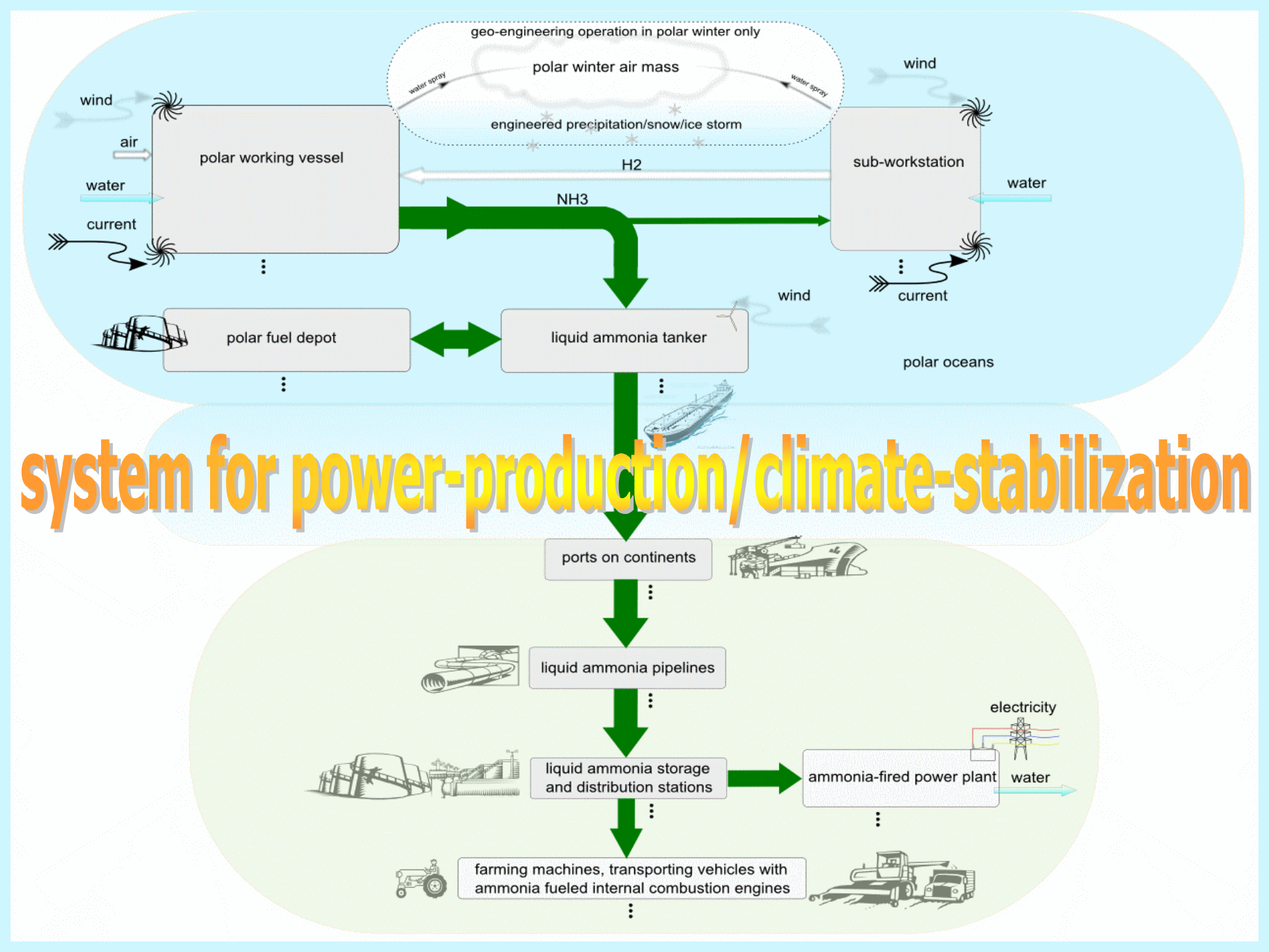
ammonia

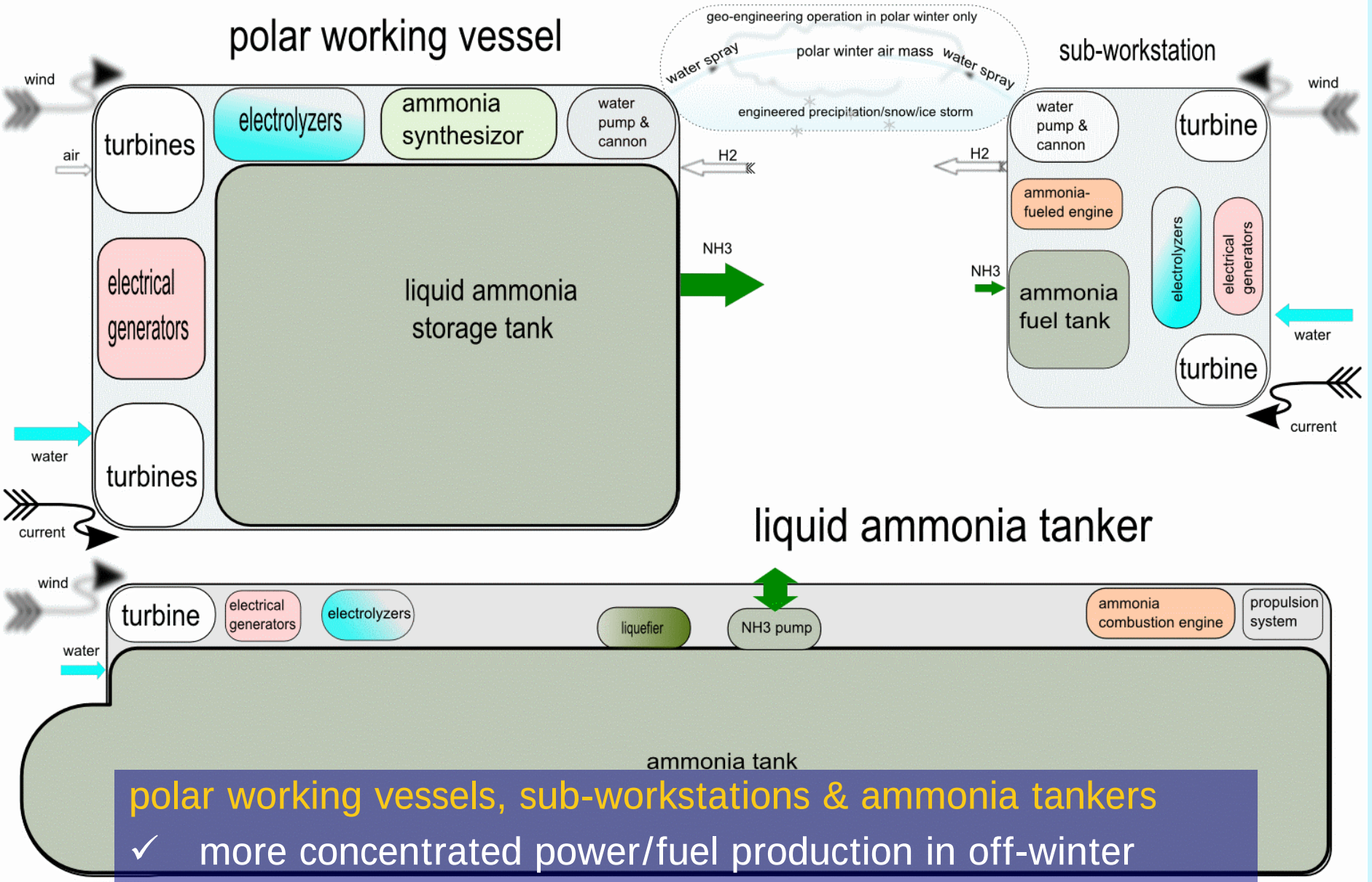
the medium of choice for power storage and transport

- ✓ everything for its synthesis right in place
- ✓ practical to handle, store and transport
- ✓ fuel life cycle inherently pollution free
- ✦ its (un-pressurized) vessel → ocean cooler!
- ✦ polar fuel storage → energy-cost free!

NH_3 fuel life cycle



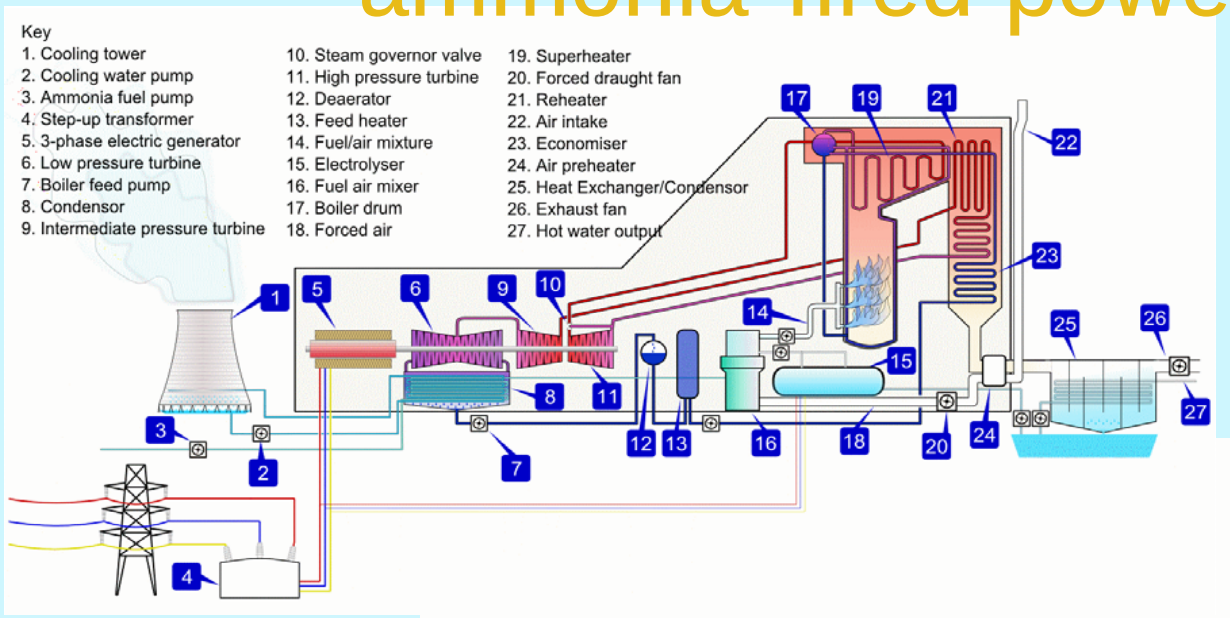

geo-engineering operation in polar winter only
polar winter air mass
water spray
water spray
engineered precipitation/snow/ice storm
wind
wind
air
polar working vessel
H2
sub-workstation
water
water
NH3
current
current
wind
polar fuel depot
liquid ammonia tanker
polar oceans
system for power-production/climate-stabilization
ports on continents
liquid ammonia pipelines
electricity
liquid ammonia storage
and distribution stations
ammonia-fired power plant
water
farming machines, transporting vehicles with
ammonia fueled internal combustion engines



polar working vessels, sub-workstations & ammonia tankers

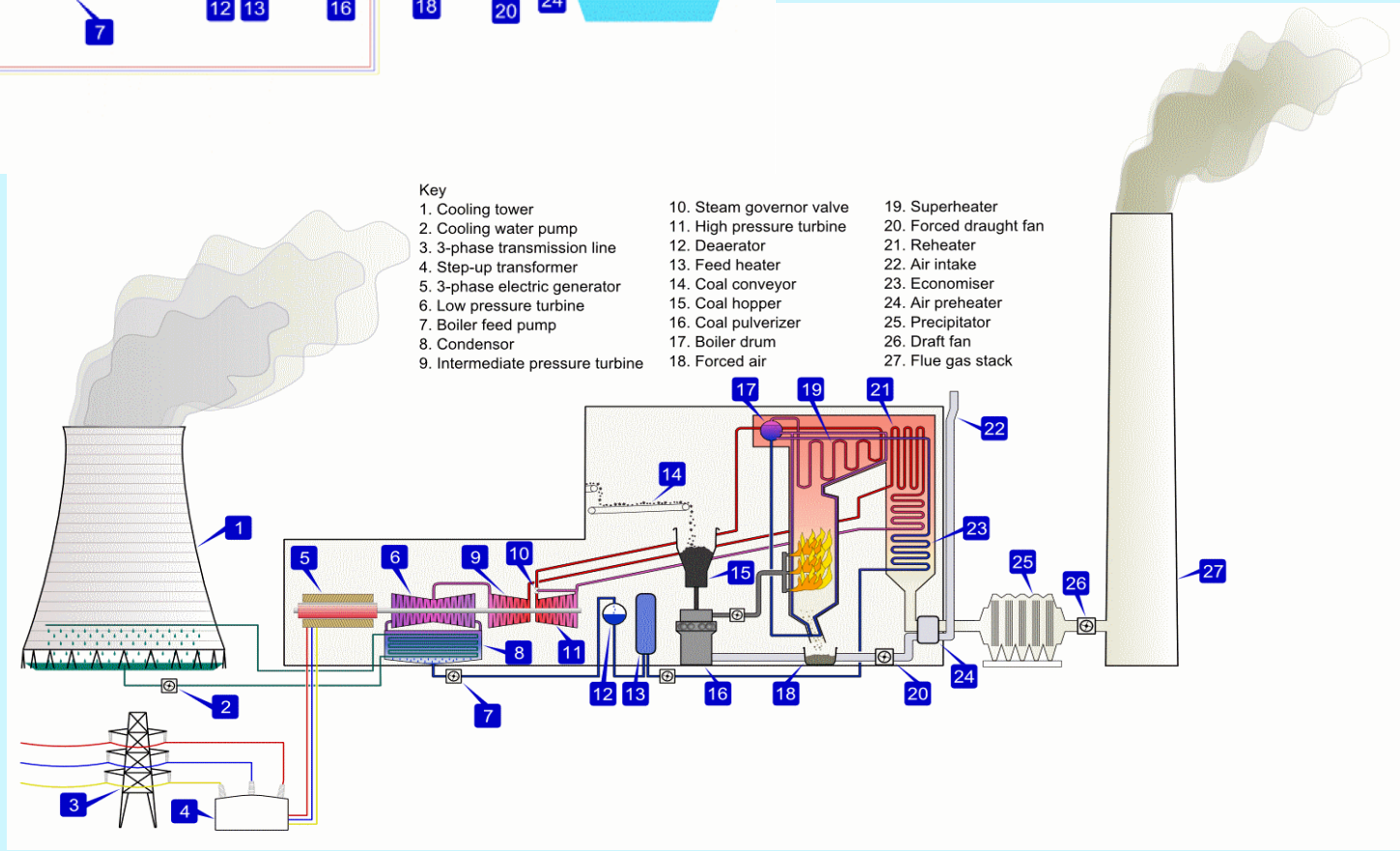
- ✓ more concentrated power/fuel production in off-winter
- ✓ more dispersed operation of power production and ice cap reinforcing in winter

ammonia-fired power plant



- ✓ electricity output
- ✓ fresh water output
- ✓ reduced cooling tower needs

- ✗ CO_2
- ✗ ash/soot
- ✗ flue gas stack

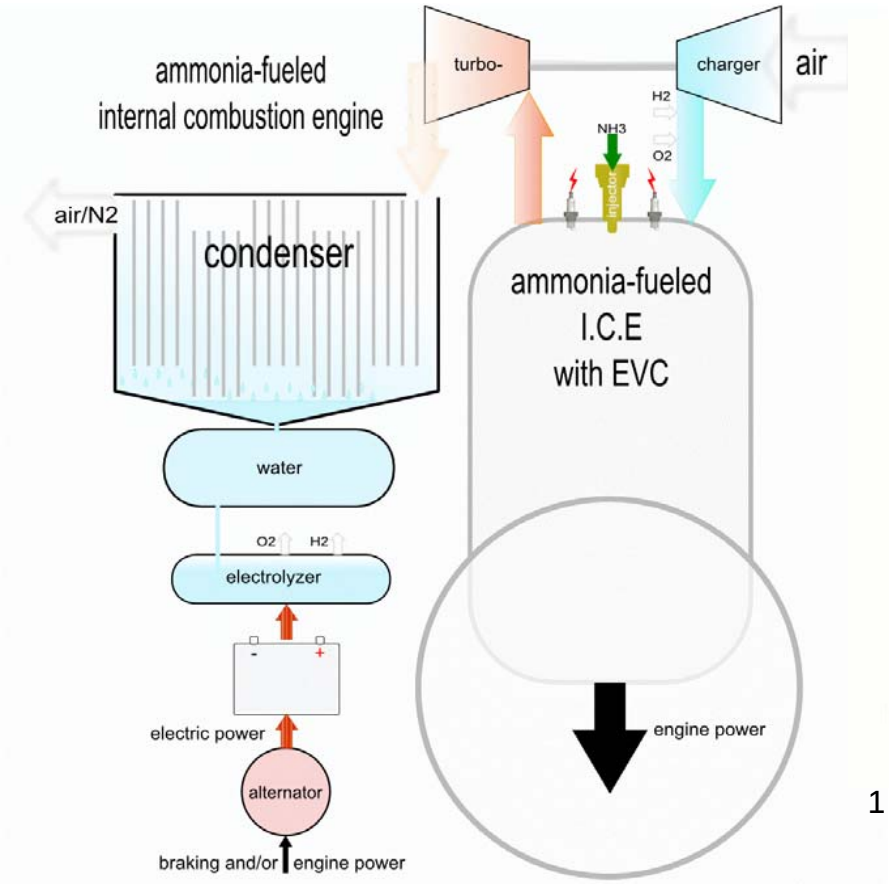


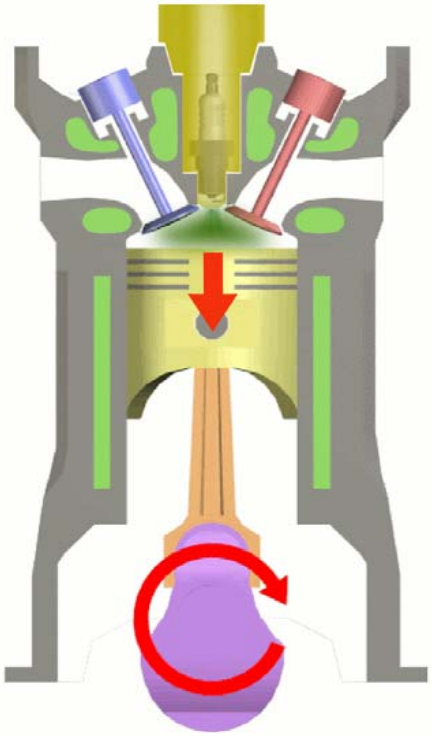
ammonia-fueled ICE for farming, industrial machineries and transportation vehicles

need every advantage to make up for the inherent low heating value:

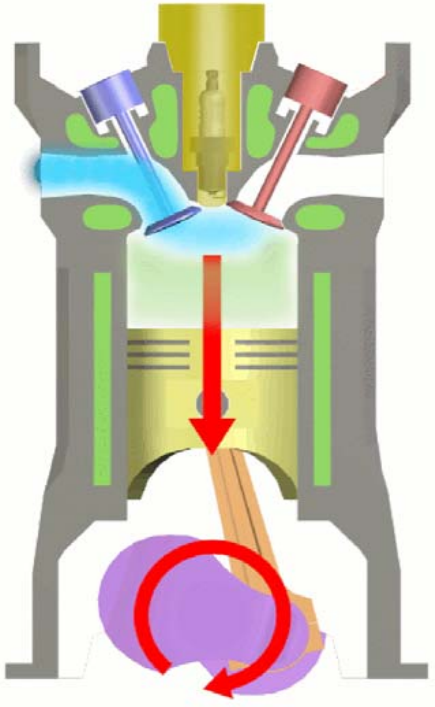
- ✓ high compression ratio
- ✓ turbocharger
- ✓ multi-spark ignition
- ✓ electronic valve control (EVC)
- ✓ combustion enhancer
- ↑ onboard electrolysis
- ↑ braking power generation
- ↑ onboard water production

a *double-punch* ammonia vapor+combustion powered engine





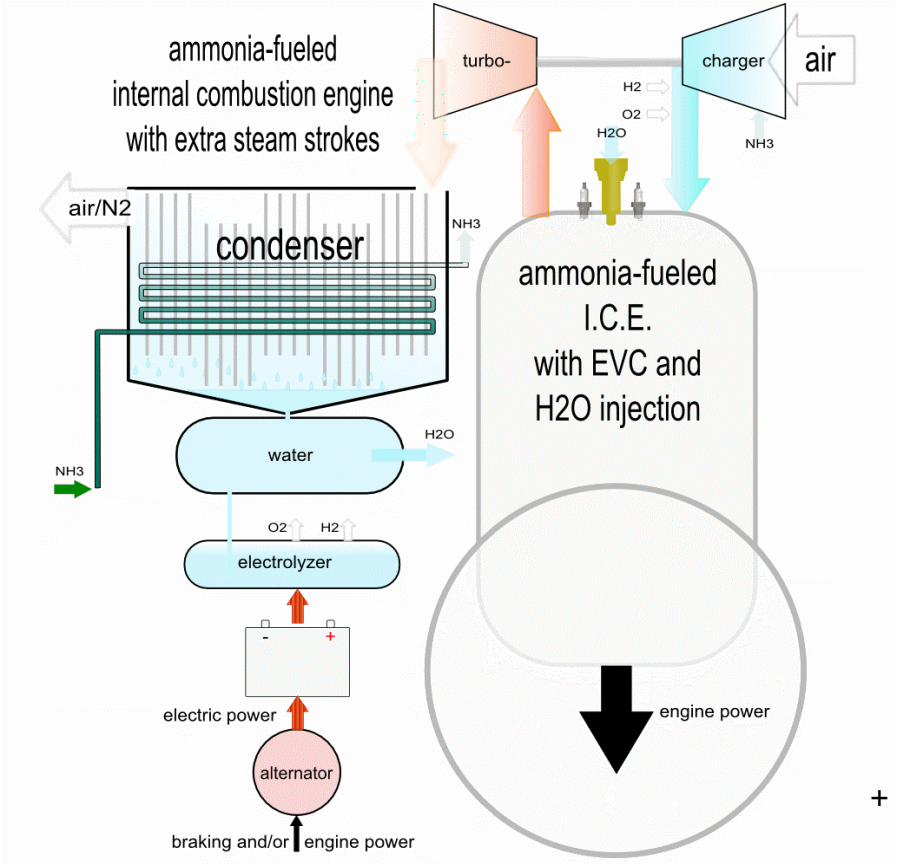
1 intake valve remains closed, ammonia injection *first!*

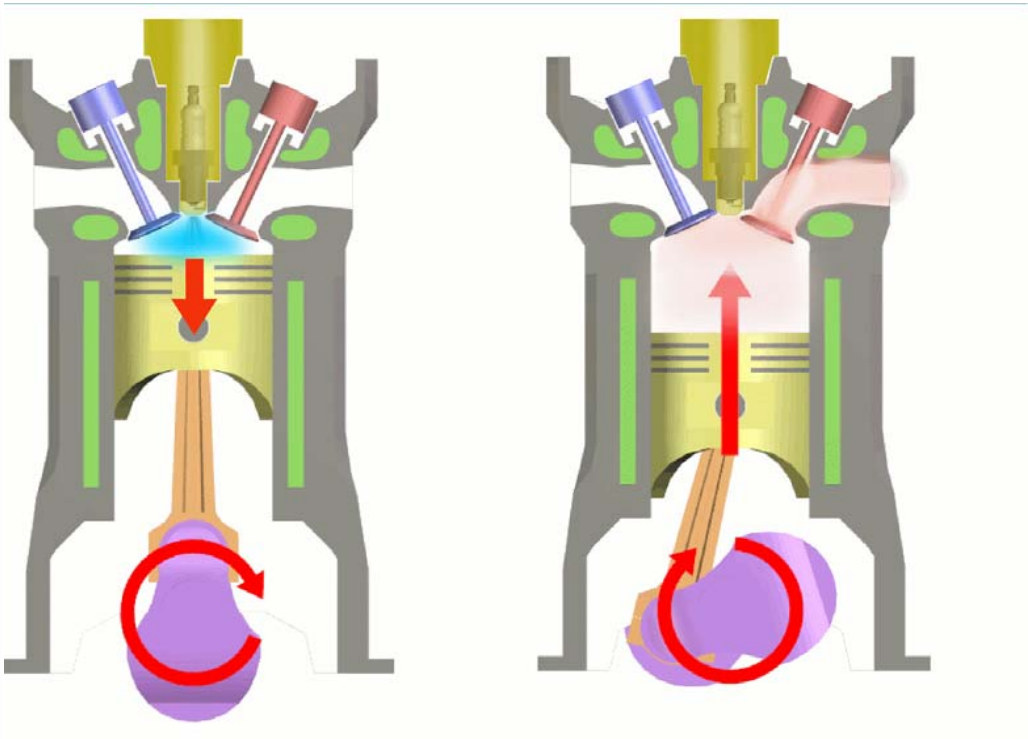


2 intake valve opens after vapor pressure drop

an ammonia fueled+cooled *steam-recycle* engine

engine-cooling + steam-power via injection of water
condensed from the exhaust by the vaporizing ammonia





\+ extra 2-steam-stroke for power and cooling, can be inserted in between normal 4-stroke cycle *on demand*

ammonia: fuel vs. fertilizer

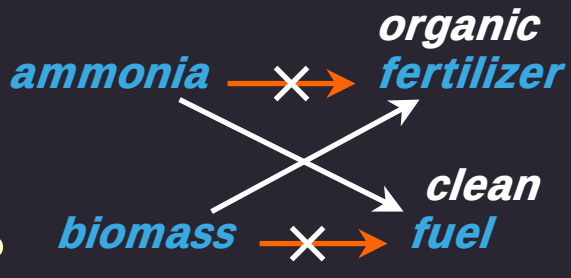
ammonia as fertilizer:

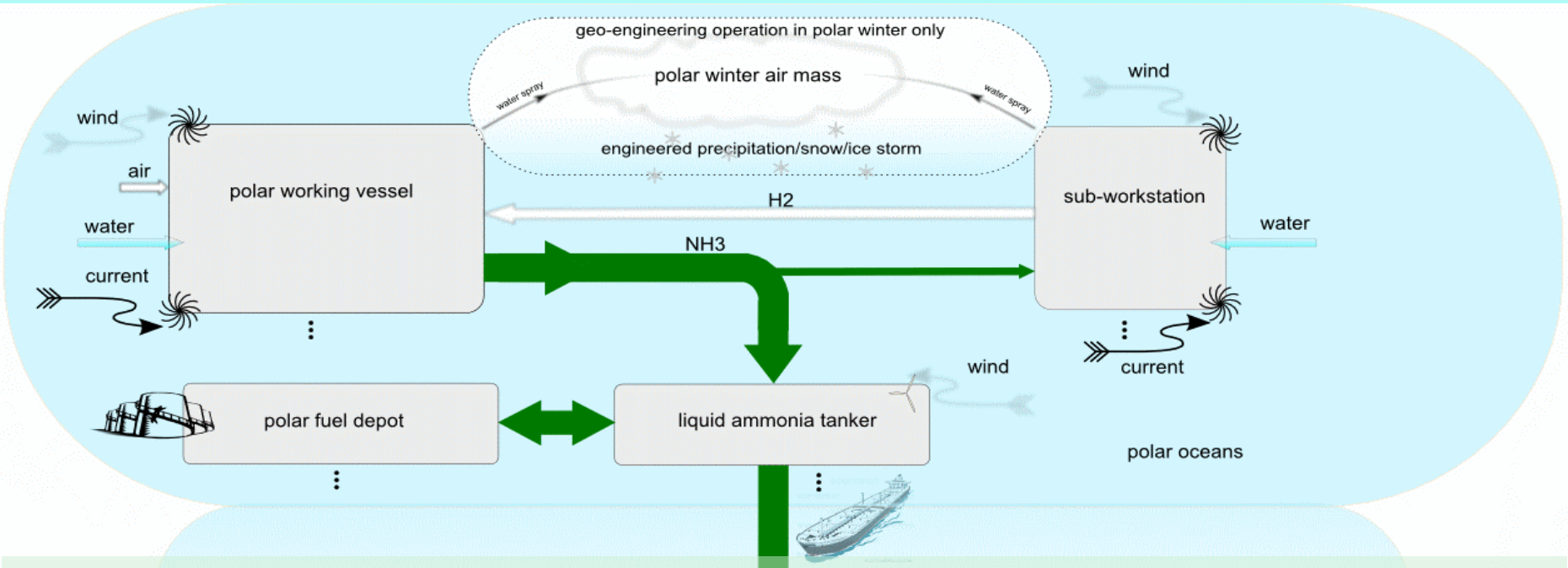
- wide application has made it a most voluminously produced chemical in the world
- has played a major role in increasing grain production, yet its long term effect on soil fertility and sustainable grain production is very questionable at least
- its run-offs have been causing major eco-disasters in rivers and oceans

ammonia as fuel:

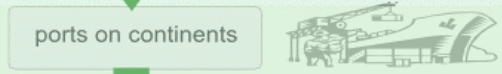
- completely sustainable with renewable energy sources
- CO_2 free, less likely to produce NO_x than hydrocarbon fuels

¿ ***wouldn't it make more sense to turn biomass into organic fertilizer—rather than bio-fuels such as ethanol—and use ammonia as fuel—rather than fertilizer*** ?



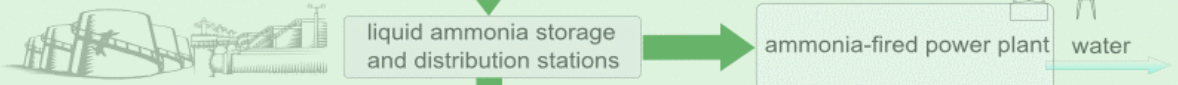


system for power-production / climate-stabilization

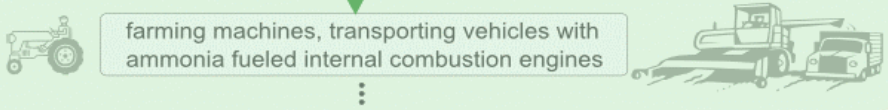


an ammonia-mediated global crises solver

an insurance for the peace and security of the world with *windfall* profits



an insurance not just for us, but also for other beings and yet-to-bes



two crises, both alike in severity
on fair Tierra, where they lay their scene
from our conscience, mandate an insurance policy
where arrogance shall bring more woe than we've ever seen

—paraphrased from a tragedy that should never be surpassed