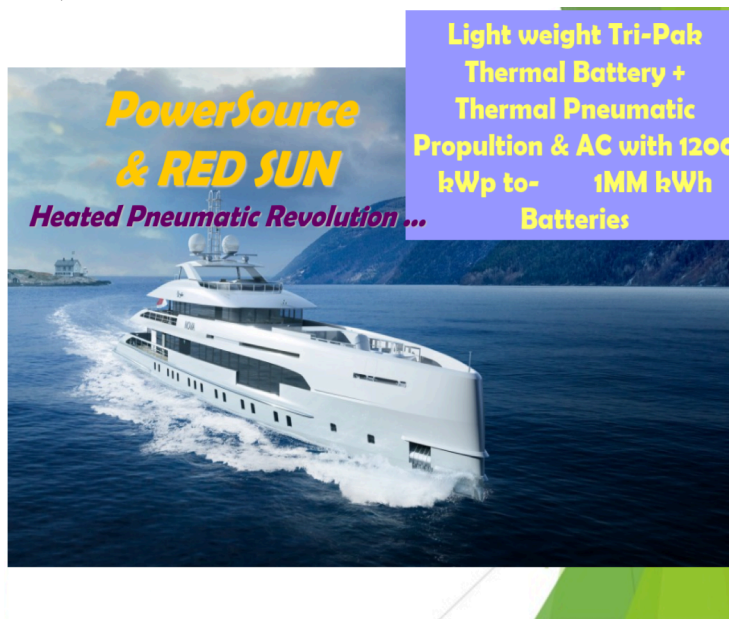


**5.55 MW Red Sun Power Block
& AQUEOUS HOMOGENEOUS...**

REACTOR (AHR)



**AHR + Red Sun Battery/Transformer/ Amplifier
Wireless Power Executive Study**

Jay Dubinsky, CEO ~Bioengineer
Alex Paurom ~Lawyer
Dan Winter EE ~H2 Engineer
Jack Wong~Hydrogen Reactor Eng
Andrejs Zagars Formulary Chemist

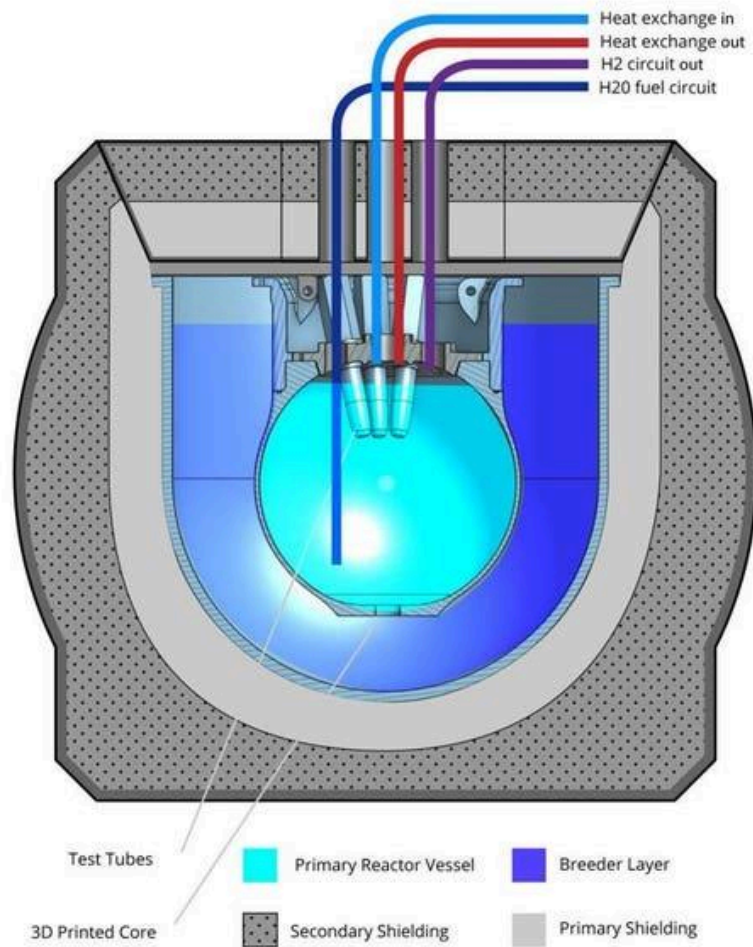
Only SMR Tested & ORNL Certified
5 yr ORNL Testing & Feasibility Study
Lloyd's Wrap on Red Sun & AHR



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330 MW Siemens + AHR + Red Sun 32 MW Wireless Thermal Batteries ~0 CO2



Aqueous Homogeneous Reactor (AHR) is a two (2) chamber reactor consisting of an interior reactor chamber and an outside cooling and moderating jacket chamber. They are a type of nuclear reactor in which soluble nuclear salts (usually uranium sulfate or uranium nitrate) are dissolved in water. The fuel is mixed with heavy or light water which partially moderates and cools the reactor. The outside layer of the reactor has more water which also partially cools and acts as a moderator. The water can be either heavy water or ordinary (light) water, which slows neutrons and helps facilitate a stable reaction, both of which need to be very pure.



Aqueous homogeneous reactor at **Oak Ridge National Laboratory-ORNL**

Their self-controlling features and ability to handle very large increases in reactivity make them unique among reactors, and possibly safest. At Santa Susana, California, Atomics International performed a series of tests titled The Kinetic Energy Experiments. In the late 1940s, control rods were loaded on springs and then flung out of the reactor in milliseconds. Reactor power shot up from ~100 watts to over ~1,000,000 watts with no problems observed. With full **ORNL AHR Feasibility Study**, Redstar reactors will be insured by **Lloyds Syndicate** with Red Sun batteries providing the transformer to retrofit the AHR to all existing diesels, turbine gensets and propulsion systems.

Aqueous Homogeneous Reactors were sometimes called "**water boilers**" (not to be confused with boiling water reactors), as the water inside appears to boil, though the bubbling is actually due to the production of hydrogen and oxygen as radiation and fission particles dissociate the water into its constituent gases, a process called radiolysis. AHRs were widely used as research reactors as they are self-controlling, have very high neutron fluxes, and were easy to manage. As of April 2006, only five AHRs were operating according to the Research Reactor database.^[1]

Corrosion problems associated with sulfate base solutions limited their application as breeders of uranium-233 fuels from thorium. Current designs use nitric acid base solutions (e.g. uranyl nitrate) eliminating most of these problems in stainless steels.

<https://www.youtube.com/watch?v=dEUxEZ2sfUM>

Retrofitting a Molten Salt reactor on the deck of any ships can be implemented putting the RedStar's Red Sun Thermal Generator in the Engine Room connecting the MSR with the engine by a simple power cable, thereby the fuel cost could be zero. **Lloyd's insurance** is available with full financing package.

Paradigm Shift:

Applications of Modern Aqueous Homogeneous Reactors using 32 MW Red Sun mobile 29 ton thermal 360 MWh transformer/ battery / 32 MW amplifier connecting nuclear energy into direct 65% efficient propulsion; making steam- to electricity; and electric charges the battery 98.6% to 1850°C to run diesels, heating long- forgotten cryo nitrogen to triple torque and expand range 10 x's. Thus, the AHR can run any ship, train, truck,turbine with 0 emissions

Red Sun Insured by Lloyd's; and AHR has only **Oak Ridge National Laboratories** feasibility study:
<https://www.ornl.gov>

(Below Link) This is exactly what we do, but amplified 350% with Cryo nitrogen + Red Sun Battery 32 MW (29 tons in container) but also retrofits in engine room (18m³) to run existing diesels injecting N₂ from air compressed. 32 MW gives 360 MWh per charge, which runs the ship non-stop 3 days and saves P11 mln per day for 150 ft patrol boats and coast guard cutters!

<https://www.channelnewsasia.com/commentary/singapore-nuclear-energy-small-reactor-smr-safety-floating-4997551>

Nuclear Fission - From Fundamentals to Applications

These reactors were some of the first nuclear reactors ever constructed, and provided valuable information on critical mass and other nuclear physical properties on fissile solutions. The compact nature of these reactors, combined with their inherent safety characteristics, have made them attractive for the generation of medical radioisotopes and neutrons for experimentation. However, material corrosion issues and advanced development of solid-fuelled light water reactors would curtail much interest in the technology in the 50's. Although operating temperatures of this type of reactor are usually low, even such low temperature heat is useful in process and industry; such a reactor can be used for environmentally-friendly district heating or the supply of process heat in industry, and could even be used to produce hydrogen. With modern advances in physics and chemistry, and disruptions in conventional energy sources; such reactors in their modern form may serve an important role: supplying various energy demands that could be derived from nuclear power, but may not require more advanced and costly reactors.

Introduction

As we face an increasing issue of energy scarcity in light of a global energy crisis [1], nuclear energy is once again gaining attention as a way to reduce our reliance on fossil fuels and the often questionable sources that supply them [2]. Interest in nuclear energy is some of the highest it has ever been, and has seen many nations such as Bangladesh and Egypt build nuclear power plants for the first time, or others like Japan, return to the construction of new reactors after a long hiatus on construction [3].

However, research and development in nuclear energy can be said to be progressing at a slower pace relative to other technologies. Many kinds of fission reactors have been developed since the first was assembled under university football bleachers in 1942, but only a few types are in commercial use today; most using solid fuel with some form of water as coolant and moderator. These solid-fueled reactors have performed well in their service as power generators, proving themselves through tens of thousands of reactor-hours of operational experience, but are often large, complex machines that have become increasingly difficult to finance and construct and are rather inflexible in their siting and energy output [4].

It is important to note that not every application of nuclear energy should be handled by a select few or even a singular reactor type(s), nor is it possible to do so in many cases. As the uses of nuclear energy expand, the flexibility in design of nuclear reactors should also increase. For example, high-temperature reactors are being developed to replace coal-fired boilers *in-situ* [5], and fast-spectrum reactors are being explored as a way to burn up plutonium and other minor actinides as part of closed-cycle nuclear waste management programs [6].

Amongst the flurry of hypothetical fission reactor designs that were being considered for development in the backdrop of the Manhattan Project, there is one that holds great promise for modern applications — but has been side-lined and underdeveloped. In 1944, the brilliant Enrico Fermi decided to construct the first of a set of reactors at Los Alamos that would use liquid fuel mixed homogeneously with water as the moderator (wartime secrecy stipulated that they be called “water boilers”) [7]; it was a little spherical reactor, contained in a stainless steel vessel no more than a foot across, filled with a solution of uranyl sulfate and light water, reflected by beryllium and graphite, and called LOPO (for low power) as it produced almost no energy in operation.

LOPO reached criticality in May of 1944 and was instrumental in determining the critical mass of uranium solutions. As experiments with LOPO concluded, it was disassembled later that year to make way for a higher-power solution reactor: HYPO [7]. HYPO was a larger reactor with cooling provisions that allowed it to operate at a higher power of 5.5 kW and provide a stronger neutron flux for experiments. HYPO was brought critical in December of 1944 and would be the key for the neutronics measurements needed to design the nuclear fission assemblies for the first atomic weapons.

HYPO itself would be, in turn, upgraded to SUPO (Figure 1) in March of 1951 with improved cooling and an increased neutron flux in sustained operations up to 35 kW of power [7]. SUPO would go on to operate until 1974, and the whole water boiler program would provide critical information that would be useful for the construction of other aqueous homogeneous reactors to come.

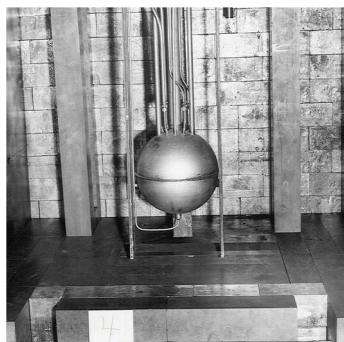


Figure 1.
SUPO reactor vessel without its graphite reflector in place. Public domain.

After the success at Los Alamos, engineers at Oak Ridge set out in 1952 to construct a far more powerful solution reactor under the auspices of the Homogeneous Reactor Experiment (HRE) [8]. This reactor, the HRE-1 (Figure 2), was much larger than previously built, with a power level of 1 MW thermal. The HRE-1 had an output temperature of 250 degrees, and was also coupled to a steam turbine, demonstrating an ability to produce 140 kW of electric power from its heat (Table 1). The HRE-1 used a novel control system utilizing magnetically coupled neutron absorbing plates between its core and reflector, dispensing the need for traditional control rods.

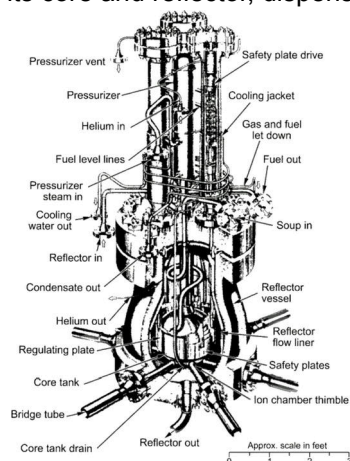


Figure 2.
HRE-1 internal details. ORNL drawing D-9065A. Public domain.

Thermal power	1000 kW (1600 kW max)
Fuel	93% enriched UO_2SO_4 in H_2O
Fuel inlet temperature	210°C
Fuel outlet temperature	250 °C
Core working pressure	6.9 MPa
Reflector	254 mm D_2O in pressure vessel, $\varnothing$ 1067 mm, forged steel
Core vessel	$\varnothing$ 457 mm, type 347 stainless

Table 1.
HRE-1 design parameters. Adapted from Murray [8].

The HRE-1 was the first solution reactor that was built with the goal of extracting power in mind and would go on to conduct experiments regarding control and power output. During such experiments, it was further confirmed that AHRs possessed a very strong negative thermal reactivity coefficient [8], owing to the effect of voiding in the solution at higher-than-designed power levels and subsequently reduced moderation; something originally discovered during an accidental reactivity incursion with SUPO.

These aqueous homogeneous reactors usually have a simple construction relative to solid-fuelled reactors, often consisting of simple tank-like structures, and requiring far less fuel fabrication (a very expensive and complex task in itself) as the fuel is not held in rods, but kept in either a solution or a slurry [9]. This design makes the possibility of meltdown with reactors of this type highly unlikely, and reduces the volume of active coolant, possibly making containment structures more compact and economical.

They have found themselves today as convenient sources of neutrons and fission products, and are often used today to produce radioisotopes for medical and industrial uses [9], as processing of the liquid fuel solution can be done *on-line* to continuously extract target isotopes before they decay, or done after batches of short reactor runs. However, there are other characteristics of these reactors that could also make them attractive for a wider range of applications.

The thermal energy of the AHR may come in useful in applications where the complexity and cost of high-temperature reactors is not needed, such as for district heating and seawater desalination. With a high fuel burn-up and simple control stratagem, such reactors could be used for long periods of time, almost — if not entirely unattended, as clean and sustainable industrial and commercial heat sources, much like a traditional fuel-fired hot water heater or boiler. All the while, the aforementioned problem of hydrogen arising from radiolysis may actually be a blessing in an era where we are starting to use hydrogen as a fuel itself but find it difficult to produce without fossil fuels.

2. AHRs for the supply of heat

While the limited output temperature of the AHR makes it unsuitable for power generation, this low-grade heat is still usable for other industrial and commercial uses. A plethora of applications that currently utilize process steam could possibly be made nuclear using the AHR at a low capital cost, and replace combustion-fired boilers and heaters at many industrial sites +heating districts & greenhouses.

The output temperatures of AHRs are limited partly by the high amounts of radiolysis encountered in operation; this, combined with heat, causes dissociation and precipitation of the solution at higher temperatures. These effects limit the output temperatures of AHRs to around 300°C, lower than the output temperature of modern PWRs and far lower than that of gas cooled designs, such as the 1200°C of the output of the HTR-PM [5].

However, with higher temperatures come higher pressures and stresses, requiring stronger, heavier, and more expensive structures to deal with such heat, especially those that hold water under pressure. As most AHR designs are not designed for two-phase flows (boiling) in the main reactor, this would necessitate a pressure vessel strong enough to keep the water from boiling at the reactor's operating temperature.

Such a pressure vessel could be selected for specific operating conditions and built accordingly, with lower temperature reactors requiring thinner vessel walls and lighter ancillaries compared to higher temperature reactors. This could make lower temperature reactors simpler and more economical to design and construct. Reactors could even be designed for near-atmospheric pressures if temperatures under 100°C are needed.

Low-complexity reactors that have been designed for such low-temperature applications are not a novel idea. For example, the SLOWPOKE Energy System was conceived by the AECL in Canada, and was a pool-type reactor with an output temperature of no more than 100°C. The low temperature allowed for non-pressurized construction and an increased margin of safety, obviating the need for operators; extensive automation was a goal of the design [10].

In the Czech Republic, the TEPLATOR project proposes to use spent PWR fuel bundles in a tank for the express supply of district heat at 98°C, and although it is not a homogenous design, and runs on spent fuel, the low capital cost of constructing such simple reactors may allow TEPLATOR to deliver heat at prices significantly lower than with fossil fuels [11]. A purpose-built AHR for such a purpose could, in theory, be able to do the same, if not more effectively.

Such heat from a low-cost and low-complexity source could enable greater use of nuclear power in seawater desalination and district heating. Contemporary multi-stage flash distillation (MSFD) processes can usually only work with temperatures under 120°C, while multiple effect distillation (MED) processes can only work with temperatures up to 70°C before scale formation becomes an

issue [12]. Although nuclear desalination is a tried and tested concept, most implementations have used steam or hot water extracted from the turbines or condensers of power-producing reactors, increasing implementation costs. An AHR could be used solely as a heat source, and be designed for lower temperatures, potentially lowering implementation costs and making desalination a more accessible endeavor.

District heating has historically used network temperatures upwards of 200°C, but modern “fourth generation” systems are trying to bring this down to as low as 70°C [13] in a bid to capture more waste heat from various sources. As a compact and inherently safe design, AHRs could be sited very close to the built-up areas where district heating networks exist, lowering transmission losses and decreasing the need for expensive network piping. The heat could also be used to facilitate district cooling with the use of absorption chillers, allowing for such a plant to operate all-year round in temperate climates by supplying customers with chilled water.

Although direct production of steam is possible within the AHR itself (much like a BWR) [8] it is impractical due to the presence of fission products in the steam. Because of this, most schemes to extract heat from AHRs would have to employ the use of intermediate heat exchangers and/or steam generators. Such a heat exchange loop would probably be of the *hi-lo-hi* type with high isolation loop pressure that is seen in nuclear desalination applications to preclude the possibility of contaminating network fluids with reactor solution [14].

3. AHRs for hydrogen production

The rapidly developing hydrogen economy currently relies on natural gas reforming to produce the vast majority of the substance, but has been transitioning to use sustainable sources of energy to lessen its reliance on fossil fuels. The use of hydrogen from nuclear sources would greatly help this effort. Most other schemes to produce hydrogen with nuclear energy involve either high temperature reactors using thermochemical cycles, or the use of electrolysis from nuclear electricity [15]. Such schemes involve equipment ancillary to the reactor itself, and require diversion of energy, reducing the power output of the associated plant in cogeneration. Such capital and running costs make nuclear hydrogen production difficult to viably implement at present.

However, the AHR is able to produce it *directly* as a by-product, potentially at a lower cost than other nuclear-based options, and would provide heat that could be useful for other parts of the hydrogen production process. As the very ions of uranium fuel in the AHR are in direct contact with the water as fission occurs, the intense energy from the fission, fission fragments and other energetic particles cause the water to disassociate to its constituents: hydrogen and oxygen [16]. This radiation-driven process is called radiolysis, and is responsible for the large amounts of hydrogen produced by the AHR. However, combined with the oxygen produced, this potentially explosive atmosphere would constitute a hazard inside the reactor and necessitates its constant recombination and removal. Soluble ionic catalysts were proposed and tested to reduce this production, with copper shown to be effective in virtually stopping all production with the HRT [8]. But the hydrogen created by the reaction may be a far more valuable commodity going forward. World hydrogen demand is projected to grow 5 to 7 times larger than it was in 2021 by 2050, with hydrogen making up 15–20% of all energy demands [17].

As hydrogen is known to cause embrittlement issues in many materials, and creates an explosive atmosphere, the construction of such a reactor would require the use of novel techniques for extraction of the hydrogen and mitigation of the associated corrosion. Engineers at Los Alamos used mechanical gas separators that would use swirl-vanes to centrifuge out the gas in the HRT and send it to recombiners [18]. It should be noted, however, that hydrogen production in the AHR requires moderately high temperatures, and it would be inefficient to use AHRs to solely produce hydrogen [19]. Such hydrogen producing AHRs would inevitably have to be heating or power reactors, where the production of hydrogen could be seen as a bonus product or be used as a process gas alongside its associated nuclear process heat in industrial settings.

4. AHRs for the supply of power

As demonstrated with the HRE, production of power using steam turbines is possible with the AHR. By running the core solution through a steam generator, the HRE-1 was able to produce almost 1 MW of steam at 250°, giving its 140 kW power plant an efficiency of 14%. Later, the HRT increased this temperature to 300°, but had issues with the solution dissociating; creating hot spots and power fluctuations. These issues were caused by phase instabilities of U₂SO₄ in water at temperatures above 340° [8], and limit the efficiency of such a setup. Increasing the temperature beyond this also increases the corrosion of reactor internals greatly. Other experiments with different acid-based chemistries were able to increase the operating temperature to 450° [16], but high rates of corrosion make such exotic chemistries impractical even today.

Due to these corrosion issues limiting the output temperature, an AHR would not be the best choice of reactor for power production, but nonetheless, could be a simple way to implement nuclear power in mechanical or electrical applications, limiting reactor temp to 320°C and using new special high temp stainless steel alloys. The design and construction advantages could be useful in applications where the increased fuel costs from the inefficiencies of the reactor plant do not warrant the need for a more efficient, yet, more capital intensive type of reactor. Such applications could include powering remote towns and facilities, or powering coastal and riverine vessels as part of a nuclear propulsion scheme. An AHR could also be coupled to a stirling engine, eliminating the need for a traditional steam plant and associated steam generators, potentially reducing implementation costs in certain scenarios. Another option would involve using an organic rankine cycle (ORC), as temperatures below 350° make the use of steam rankine cycles particularly inefficient. ORC systems use an organic working fluid, such as pentane or R134a to achieve higher efficiencies at lower temperatures, and have seen use for capturing waste or low-temperature heat from industrial processes and renewable energies [20]. Such alternative cycles would make the power production from AHRs a more efficient undertaking in the present day.

Given its placid control characteristics, an AHR power plant could be operated autonomously, only needing personnel on-site for periodic maintenance and refueling. This characteristic, combined with the potential for cogeneration with heat, potentially makes such plants particularly attractive for arctic areas, where keeping personnel around is a challenge in itself.

If further drops in implementation costs are desired, the AHR could be used as a two-phase reactor, and include boiling in the core [16]. This would eliminate the need for steam generators, but would also expose the steam plant to fission products, contaminating it in the process. Such a design would also be problematic for the supply of heat, as it would have to be extracted from either the condenser, or off of the turbine stages, and then sent through a heat exchanger to render it safe for use.

5. AHRs as radioisotope sources

Owing to the compact size and intense neutron flux provided by the AHR, it makes it an excellent producer of radioisotopes from various sources [use the IAEA book on Mo-99 production for this section]. The solution chemistry of the AHR allows it to burn-up uranium almost completely and simultaneously remove fission products — both poisons and potential commodities, such as Xe-135 or Mo-99, for use as industrial and commercial sources of radiation.

The extraction of Mo-99 in particular from AHRs is of great interest. Mo-99 is an essential radioisotope for the medical industry, as it is used to produce Tc-99m for use in medical imaging as a tracer [21]. Mo-99 however, has a very short half-life of 66 h, which complicates its production and transportation. The use of an AHR would allow for the use of on-line processing to continuously produce Mo-99 whenever needed. By use of chemical extraction methods, the Mo-99 condensate can be collected from the reactor loop without removing the fissile fuel. This method would also eliminate the amount of waste that would be generated when using a solid uranium target, of which the uranium is only 0.4% spent, and the processing of which releases fission products and unused uranium into waste streams [22].

Other isotopes like Sr-89 are often also difficult to produce using solid target-based systems. With the AHR, it is possible to create Sr-89 without the associated Sr-90 impurity by using extraction of the precursor gasses. At the ARGUS reactor at the Kurchatov Institute, Sr-89 of high purity is extracted by running the reactor for a few minutes at a time to generate the needed krypton precursors, then waiting for the shorter-lived Sr-90 precursor, Kr-90 (half-life of 33 s), to decay out faster than the relatively long-lived Sr-89 precursor, Kr-89 [22].

This Kr-89 is then pushed out of the reactor into a sorbent bed with the help of inert gasses, where it decays to produce Sr-89 and awaits further processing to remove other fission products. After purification, the Sr-90 content of the Sr. recovered is insignificant. Although running such a reactor for the sole purpose of extracting Sr-89 would be impractical, it is something that can be done alongside the production of Mo-99 and other radioisotopes.

The production of other useful isotopes such as Xe-133 — another useful medical tracer, I-131 — a radiotherapy agent, and Cs-137 — a potent gamma emitter with many industrial uses, is also possible, and was demonstrated with ARGUS [22]. If other radioisotopes needed to be produced in solid form, an AHR could be designed with provisions for the insertion of targets. If, for example, Co-60 needed to be produced in rod form, the reactor could be designed to accommodate for irradiation of such rods within its core.

Other radioisotopes of interest may be the Pu-239 or U-233 generated during fission by transmutation in uranium and thorium powered reactors. By using a breeder design with a “blanket” solution around the core, lost neutrons could be absorbed by fertile material such as U-238 or Th-232, rendering it

fissile [16]. Such a system could also be adapted, in theory, to produce H-3 (tritium) from either H-2 or Li-6 for use in many applications.

6. Preliminary Conclusions

The unique design features of the aqueous homogeneous reactor make them a valuable tool in increasing the uses of nuclear power. The simple design and control characteristics of AHRs could make them very useful wherever heat and/or steam is required, but the complexities of solid-fuelled reactors are unwarranted and unwanted. Moreover, if hydrogen needs to be produced, the AHR is capable of doing so directly. Various radioisotopes or fertile fuels could be extracted from such reactors as a value-added product during their normal operations, or be produced by reactors exclusively designed to do so.

Industrial and commercial users could benefit from a heat source that has the potential to be far cheaper than fossil fuels, yet cause far less environmental harm. This will be especially important in an era where governments worldwide are trying to wean themselves off of fossil fuels, which supply over 50% of the world's heating needs [23]. AHRs can supply heating to entire district heating networks, or be made small enough to supply individual buildings. Cooling can also be provided with the use of absorption chillers, and if done so while generating electricity, could comprise an economical CHP (combined heat and power) or CCHP (combined cooling, heat and power) scheme. Thermal energy from the AHR could also be used for nuclear desalination purposes, where the energy costs of the process heavily determine the price of the purified water produced. Low-cost nuclear desalination could help arid areas of the world gain access to clean water without the associated fossil fuel needs or pollution. An AHR built expressly for this purpose has the potential to be far more economical than using power reactors or combustion boilers, as its material, logistic and safety requirements are greatly relaxed.

The production of hydrogen in the AHR is something that would usually comprise a problem, but with clever extraction techniques, this annoyance may turn out to be a lucrative opportunity in light of the growth in the hydrogen economy. Of course, if the complexities arising from hydrogen production in such a reactor are found to be a concern, catalysts may be added to the solution to facilitate complete recombination of these radiolysis products. But, as very little extra equipment is required for its extraction, the AHR could easily produce hydrogen as a value-added product for sale, or for use in industrial processes as feedstock or fuel. As the use of hydrogen as a fuel grows worldwide, the AHR finds itself uniquely suitable for the production of the gas without emissions or extra costs.

The production of radioisotopes would be another value-added product that could be produced in heating reactors, or produced by reactors purposely built for such a purpose. The solution chemistry of AHRs allow for the extraction of a wide range of radioisotopes without the production of large volumes of waste as seen with traditional target-based systems, and permits the extraction of certain radioisotopes that would otherwise be impractical to do with traditional systems, such as Sr-89. This same chemistry allows AHRs to achieve a high fuel burn-up, as well as a high breeding ratio, potentially allowing AHRs to operate as breeder reactors.

Although the output temperatures of AHRs are limited, they can still be used to generate power as demonstrated before (albeit, with lower efficiency than higher-temperature reactors). An AHR could provide just enough electricity through a Rankine or Stirling cycle to power itself and associated facilities, or generate enough to power other loads, such as industrial, commercial, and residential consumers of electricity. If done alongside thermal and hydrogen production, this could make the AHR a very flexible reactor type in cogeneration. This energy could also be used for propulsion at sea and inland waterways, where such reactors may enable economically-built nuclear-powered vessels that would require little justification for a more complex reactor type, such as tug boats or coastal bulk freighters.

As the world increasingly becomes more conscious of the deleterious effects of fossil fuel consumption and strives to move away from fossil fuels altogether, nuclear energy will be a vital tool in facilitating its replacement. In doing so, many different designs for nuclear reactors will be needed for the different applications they will be optimal for. The AHR has the potential to economically decarbonize industries and sectors that rely on low-temperature heat, or supply clean electric power. Hydrogen created from the regular operation of such reactors may be harnessed and utilized as a fuel, or be used for other industrial processes. These reactors are also optimal for the production of radioisotopes — especially those for medical uses, and could be made compact enough to be installed near or at the facilities that need them on a regular basis. Using modern technologies, it is not beyond the realm of possibility that the AHR can be deployed for commercial use in the near future. With its inherently safe and simple features bolstered by the use of our advanced tools and knowledge, the AHR is a very promising design looking forward.

Aqueous Homogeneous Reactor - Part II - 1000 x's Better Efficiency & Isotope Production Simplicity and lower costs vs Traditional Target Isotope Production in Heterogeneous Fuelled Reactors

Aqueous Homogeneous Reactor II

Ability to process other isotopes more efficiently using off- gas extraction

Advantages of Solution Reactors for the production of Medical Isotopes

The use of solution reactors for the production of medical isotopes is potentially advantageous because of their low cost, small critical mass, inherent passive safety, and simplified fuel handling, processing, and purification prospects. These advantages stem partly from the fluid nature of the fuel and partly from the homogeneous mixture of the fuel and moderator in that an Aqueous Homogeneous Reactor (AHR) combines the attributes of liquid homogeneous reactors with those of water moderated heterogeneous reactors. When practical methods for handling a radioactive aqueous fuel are implemented, the inherent simplicity of this type of reactor should result in considerable economic gains in the production of medical isotopes. The principle advantages include:

- Flexibility with respect to reactor parameter variation, fuel selection and geometry;
- Inherent nuclear safety characteristics;
- Efficient neutron utilization for isotope production;
- Elimination of targets, less uranium waste generated per curie of Mo99 produced, and overall less waste generated by 100 x's, and simpler waste management;
- Ability to process other isotopes such as Xe133, Sr99, Y90, I131 more efficiently using off gas extraction;
- Less capital cost and potential lower operating cost.

Reactor Design Flexibility

The flexibility of solution reactor design parameters is an important feature of the AHR that allows customized design configurations to meet required isotope production capacity while using proven design and the existing operating components and safety features. These design flexibilities include:

- The thermal power of the reactor which can be varied in the range of 50 kW to 300 kW (th);
- Selection of fuel base (UO_2SO_4 , $\text{UO}_2(\text{NO}_3)_2$, etc), chemical composition, fuel composition (uranium loading, solution pH, etc.);
- Thermodynamic operating state (low pressure, temperature) allows flexibility in selection of reactor core geometry to accommodate inherent safety characteristics and to meet specific project safety objectives and requirements.

The greater flexibility afforded by solution reactors with respect to core operating power range is an important advantage in Mo99 production demand. However power instabilities in that form from radiolytic bubble formation and thermal agitation can perturb the reaction on the surface of the fuel solution as power is raised toward the desired levels. This in turn generates reactivities that impair the automatic reactor control via the measurement channels that enable control rod displacement. As a result the power density becomes an important parameter that must be controlled to ensure operation in the selected power envelope. The use of low enriched uranium fuel (LEU), which is recommended by the IAEA for the AHR, requires a greater volume of fuel and therefore creates an increase of the core cylinder height which potentially diminishes reactivity variations induced by perturbation of the solution surface. Additionally, a non- cylindrical core tank design would probably attenuate the instability phenomenon, thus further enhancing safety.

The choice of fuel base and solution composition is contingent on core design, operation and isotope processing strategy. Typically uranyl sulphate fuel was preferred over solutions with higher distribution coefficient for Mo99 extraction than irradiated uranyl sulphate solutions; consequently, a nitrate based fuel is clearly more advantageous from a processing yield point of view. The fuel concentration is adjusted to minimize core volume/ fissile mass, optimising processing efficiency, or both. The solution pH is controlled within a range that ensures good uranyl salt solubility, and at the same time reduces corrosion effects.

Efficient Neutron Utilization

In the majority of reactors producing medical isotopes targets are irradiated in a neutron flux generated primarily by the reactor fuel. Typically the ratio between reactor power and target power is in the order of 100 - to 1 and this represents a cost in uranium consumption and waste production which must be added to that of the targets. Alternatively, an unique feature of using the solution reactor for medical isotope production is the reactor fuel and target are the same. Consequentially, a solution reactor can produce the same amount of Mo99 at 100th the power consumption and radioactive waste generation. Thus the potential advantage of utilising a solution reactor technology are lower reactor power, less waste heat, and a reduction by a power of a hundred in the. Generation of spent fuel, as compared with Mo99 production with target irradiation in heterogeneous reactor types.

Elimination of Targets, less Uranium created per curie Mo99 Produced, and overall Simpler Radioactive waste Management.

When one considers waste management, in terms of spent fuel and spent target disposition, waste management for the solution reactor is much simpler. A solution reactor has no need for targets, and therefore all processes related to fabrication, irradiation, fission assembly, and dissolution of targets are eliminated. Because these target related processes result in the generation of chemicals and radioactive waste, Mo99 production in solution reactors can significantly lower waste generation. Since the Mo99 recovery and purification of Mo99 in conventional targets after dissolution will be quite similar, to the solution reactor, the solid and liquid wastes will be similar, except for the disposition of the resultant uranium. For the target based technologies, Uranium from the irradiated targets is stored for disposal or recycling; solution reactor uranium is recycled and only disposed at the end of the fuel solution's viability (up to 20 years).

Ability to Process Other Isotopes Efficiently

In addition to Mo99, other radioisotopes used by the medical community can be processed more efficiently in a solution reactor. In particular, the intensive radiolytic boiling which occurs during core operation enhances the offgassing of fission products from the fuel solution in to the upper gas plenum of the reactor. A number of valuable radioisotopes such as Sr89, Y90, Xe133, I131, I132, and I133 can be recovered from the off-gas. Higher specific activity of these isotopes in the off- gas makes recovery more effective compared to traditional target irradiation technology. This is a far more effective way to recover fission Sr99 (about 1000 times) compared to production of this isotope from Sr88 and Y89 target irradiation.

AHR has the advantage of simplification for Less Capital Cost and Potential Lower Operating Cost Compared to Current Research Reactor Target Systems- **The Benefits Can Be Projected In Several Areas:**

- Since the fuel in a solution reactor is also the target, no separate fabricated target is necessary. While the fuel/target may require periodic additions of LEU, it is anticipated that the base load of the solution will be reusable over a significant period, potentially up to the life of the unit. Enriched uranium targets as fabricated for use in a traditional reactor are expensive consumables.
- Current practice involves transport of the irradiated target from the reactor to a processing facility for dissolution and product recovery. This operation typically involves an intermediate cooling step, transfer equipment, and an acid or base process to dissolve the target for product recovery. These processes require personnel and equipment that will not be required for a solution reactor in which the fuel / target can be pumped to the initial isotope separation device.
- Reactor control and operation are expected to be simpler than higher power research reactors which may result in decreased reactor operation staff.
- In a reactor/ target facility, only a small percentage of the target is transformed to useful isotopes, leaving over 99% of the target material which must be handled as waste or processed to recover uranium. With a solution reactor, target waste handling, disposition activities and costs are not necessary.

Summary Conclusions - Red Sun Thermal Battery- Universal Transformer and Missing Link to Retrofit Nuclear to Existing Propulsion & Power Systems:

The potential of the aqueous homogeneous reactor for medical isotopes and cleaning- up shipping cannot be ignored. The future applications for this reactor technology in producing medical isotopes is bright, as the solution reactor using uranyl sulphate enables high yield of otherwise impossible to recover radioisotopes, including super-valuable Mo99, Sr89, and Am241 (\$46,000/gm, \$2000/gm and \$1500/ gm respectively). Moreover, AHR reactors were designed by **Nobel Prize** winner **Glenn Seaborg (1951)**, prophetically, he's named after the sea, which maybe AHR's highest and best use- running ships cleanly without dumping bilge oil) who discovered plutonium and designed and built at ORNL some of the first nuclear reactors ever constructed, and provided valuable information on critical mass and other nuclear physical properties on fissile solutions in 1951. The compact nature of these reactors, combined with their inherent safety characteristics, have made them attractive for the generation of medical radioisotopes and neutrons for experimentation. However, material corrosion issues and advanced development of solid-fuelled light water reactors would curtail much interest in the technology in the 50's. More importantly for the military that runs the NRC, AHRs do not make plutonium. Although operating temperatures of this type of reactor are usually low, even such low temperature heat is useful in process and industry; such a reactor can be used for environmentally- friendly district heating or the supply of process heat in industry, and could even be used to produce hydrogen. With modern advances in physics and chemistry, and disruptions in conventional energy sources; such reactors in their modern form may serve an important role: supplying various energy demands that could be derived from nuclear power, but may not require more advanced and costly reactor technologies.

Importantly, the Red Sun thermal battery is the critical link and universal transformer to connect all nuclear reactors to all existing engines in ships, trains and power plants. The SMRs and AHR typically operate at sub-par heat around 320°C, just like all 440 light water reactors around the world. This is insufficient for diesels and turbines and 99% of installed engines and power plants. Nuclear plants run steam turbines or Rankine Cycle turbines below 700°C on MSRs to get 55 to 60% efficiency. Thus, to run all *existing* diesel, gensets and turbine propulsion systems that operate above 1350°C, only the Red Sun 1850°C molten metal 32 MW battery can power them with required heat to their rail and combustion chambers. Thus, Red Sun mobile is the missing link. Thus, Red Sun enables plugging in clean zero carbon thermal batteries and operates our \$150 trillion in existing power plants, vehicles, and ship power systems, while giving the necessary onramp to plug in renewable energy in charging them.

Turning dual mode, giving elec, heat and H2 on one channel, and superior income producing rare Am241, Mo99, Po208,209? 210 radioisotopes on the money channel at \$1500/gm - simultaneously on the other channel- the best of both worlds! Moreover, the AHR uses no water for cooling, saving up to 560 gallons per MWh over SMRs and all installed nuclear reactors for cooling.

And; "Nuclear-powered vessels can be a game-changer in the current shipbuilding market, where carbon neutrality is emerging. ABS and HD KSOE will contribute to accelerating the commercialization of marine nuclear technology in the global shipbuilding market," said Patrick Ryan, Chief Technology Officer of ABS, in a statement. Unlike conventional vessels, this SMR powered design eliminates the need for engine exhaust systems and fuel tanks, freeing up space previously occupied by large engine room equipment. The optimization allows for additional cargo capacity, improving economic efficiency.

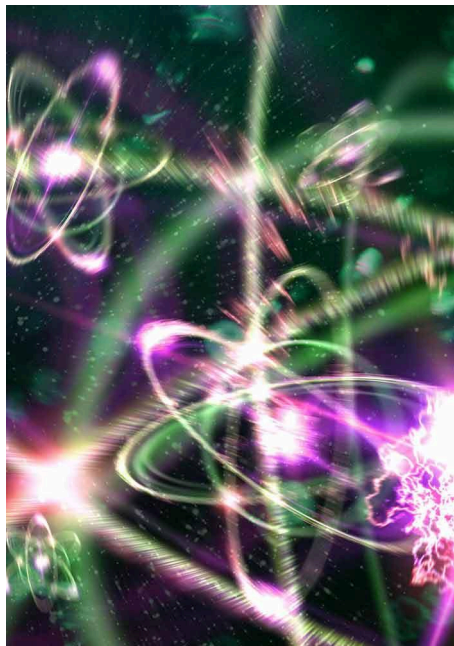
As the world races to combat climate change, the debate over the best energy pathway to a zero-carbon future has intensified. Should we invest heavily in nuclear power, a controversial energy source, or focus on renewable technologies such as solar, wind, and hydro, which have made rapid advances in recent decades? The viability, costs, risks, and waste management challenges of both nuclear and renewables are at the forefront. Only AHR and all MSRs have 1/100 the waste, 1/30th the footprint, and walk- away safe due to highly negative coefficient of criticality (minus - 1.13 for AHR) and automated shut- off protocols by installing dump tanks, And; AHRs and MSRs do not use water as Gen 3 SMRs and all previous nuclear reactors do for cooling - up to 560 gallons per MWh. Thus, while energy leaders such as the United States, Canada, and Europe are only so far mainly looking at Gen - 3 SMRs, yet SMRs make as much waste per MWh as their Gen-1 counterparts; and, as much water for cooling; only burning 1% of the solid fuel- thereby making 100 x's more wastes

than MSRs or AHR. Thus; they are missing the big picture, where water is the critical resource going forward- more valuable than oil; and waste problems are not being solved, only increased and unleashed on the world and public, due to lack of correct external facilities, economic incentives, and lack of good geological deep dump sites for both types due to NIMBY - both nuclear and renewables are missing critical end-cycle steps, facilities, and services, and; frankly, after 70+ years of no clear solutions in waste nuclear and plastic and heavy metals, there never will be! Redstar believes the only answer is designing nuclear and renewables that have low use of water and create minimal wastes- which AHR and 4th-generation⁶ MSRs do beautifully, burning-up 99% of fuel and not using water as cooling.

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Medical Isotopes, expanded focus (each is an additional product line)

Isotope	Direct from Core?	Source	Decay Path	half life	Medical Use(s)/other
⁹⁰ Sr	yes		⁹⁰ Sr → ⁹⁰ Y + β ⁻	28.8y	radiotracer, osteosarcomas
⁹⁰ Y	yes		⁹⁰ Y → ⁹⁰ Zr + β ⁻	64.6h	hepatocarcinomas
⁶⁰ Co	transmute with core	⁵⁸ Co + n → ⁶⁰ Co	⁶⁰ Co → ⁶⁰ Ni + β ⁻ + 2γ	5.27y	sterilization, radiation source
^{99m} Tc	yes		^{99m} Tc → ^{99m} Tc	65.9h	^{99m} Tc source
			^{99m} Tc → ⁹⁹ Tc + γ	6.01h	many tracer uses/nuclear med.
⁸² Rb	α flux from "core"	⁸² Kr + α → ⁸⁵ Sr/ ⁸² Sr	⁸² Sr + EC → ⁸² Rb	25d	⁸² Rb source
			⁸² Rb → ⁸² Kr + β ⁺	1.27m	radiotracer (K ⁺ , Na ⁺ sub), PET
¹³¹ I	yes		¹³¹ I → ¹³¹ Xe + β ⁻	8.02d	many med uses: tracer, ablation, thyroid
⁸⁹ Sr	transmute with core (enrichment req'd.)	⁸⁸ Sr + n → ⁸⁹ Sr	⁸⁹ Sr → ⁸⁹ Y + β ⁻	50.57d	prostate cancer, osteosarcoma (palliative)
⁸⁹ Sr	transmute with core (enrichment req'd.)	⁸⁸ Y + n → ⁸⁹ Sr	⁸⁹ Sr → ⁸⁹ Y + β ⁻	50.57d	prostate cancer, osteosarcoma (palliative)
¹⁷⁷ Lu	transmute with core (enrichment req'd.)	¹⁷⁶ Lu + n → ¹⁷⁷ Lu	¹⁷⁷ Lu → ¹⁷⁷ Hf + β ⁻	6.65d	scintigraphy, radiotracer, neuroendocrine, prostate cancer
¹⁷⁷ Lu	transmute with core (enrichment req'd.)	¹⁷⁶ Yb + n → ¹⁷⁷ Lu	¹⁷⁷ Lu → ¹⁷⁷ Hf + β ⁻	6.65d	scintigraphy, radiotracer, neuroendocrine, prostate cancer
¹³³ Xe	yes		¹³³ Xe → ¹³³ Cs + β ⁻	5.25d	radioimaging (lung, brain)
⁶⁸ Ga	α flux from "core" (enrichment req'd.)	⁶⁶ Zn + α → ⁶⁸ Ge	⁶⁸ Ge + EC → ⁶⁸ Ga + β ⁺	270d/67.8m	neuroendocrine cancer screening/PET
¹¹¹ In	α flux from "core" (enrichment req'd.)	¹⁰⁹ Ag + α → ¹¹¹ In	¹¹¹ In + EC → ¹¹¹ Cd + 2γ	2.8d	radiotracer: monoclonal antibodies, peptides, biologics
^{113m} In	transmute with core (enrichment req'd.)	¹¹² Sn + n → ¹¹³ Sn	¹¹³ Sn + EC → ^{113m} In + γ	115d/99m	radiotracer: monoclonal antibodies, peptides, biologics
¹⁵³ Sm	transmute with core (enrichment req'd.)	¹⁵² Sm + n → ¹⁵³ Sm	¹⁵³ Sm → ¹⁵³ Eu + β ⁻	46.28h	lung, prostate, breast, bone, palliative osteosarcoma
¹⁸⁶ Re	transmute with core (enrichment req'd.)	¹⁸⁵ Re + n → ¹⁸⁶ Re	¹⁸⁶ Re → ¹⁸⁶ Os + β ⁻	3.71d	dosimetry, imaging, radiotracing: peptides, pharmaceuticals, palliative osteosarcoma
¹⁸⁸ Re	transmute with core (enrichment req'd.)	¹⁸⁶ W + 2n → ¹⁸⁸ Re	¹⁸⁸ Re → ¹⁸⁸ Os + β ⁻	17h	dosimetry, imaging, radiotracing: peptides, pharmaceuticals, biologics, monoclonals
²²⁵ Ra/ ²²⁵ Ac	yes (breeding)	²³³ U → ²²⁹ Th...	²²⁵ Ra → ²²⁵ Ac → ²²¹ Fr → ²¹⁷ At → ²¹³ Bi → ²¹³ Po → ²⁰⁹ Pb → ²⁰⁹ Bi → ²⁰⁵ Tl Targeted Alpha Therapy (TAT) cascade: anticancer		

Above- Transition Chart of Radioisotopes the AHR can make for \$1500 to \$46,000 per gram giving 80% of AHR income with dual production.



Hyundai plans Nuclear Powered Colossal Cargo Ship:

*This is exactly what Redstar will do for shipping and Navy using Red Sun thermal batteries and retrofit Red Sun 3.5 x's greater cryo nitrogen expansion to increase torque 350% using thermal batteries as transformer between reactor running Steam and Red Sun running ship diesels with patented **Non-Combustion Brayton Cycle** and cryo nitrogen, which is 700 x's more powerful than hydrogen and 30 x's less per nautical mile on fuel costs is key to 3.5 x's more power while giving affordable cargo and passage.*

<https://interestingengineering.com/transportation/hyundai-plans-nuclear-powered-cargo-ship>

Redstar will build in Laguna Lake, connected to sea by Pasig River - its on the water and plan to make everything in Subic Bay, so oversize reactors and equipment go direct by ship/barge and lower smelter ore costs

<https://youtu.be/DKvXlus2HwE?si=S6Wc71cIWvwHTt9t>

*The Philippines LRT pricing wont work for normal distance rail..Moreover; now is the time for freight to get manufacturing and mining going. This is part of why **Jamie Bautista** (previous **Transportation Secretary**) wants **Red Sun** for Laguna - Bicol 1600 km Freight Line: using two x 32 MW batteries gives 1400 km range.*

<https://www.lrta.gov.ph/tickets-and-fares/>

<https://www.redstaregg.com/RedstarRedSunPowerRailroad.pdf>

Based on LRT - fare of 16.5 pesos boarding + P1.47 / km x 1600 km = P 2379 for Bicol to Laguna rail passengers = same as airline tix to manila.

This is not affordable for 95% of philipinos! This is the major reason you have to drop diesel- it wont work economically at \$430 USD LCOE FOR DIESEL/ MWh; thus, Red Sun at \$40 /MWh is mandatory to make tix P230!

<https://www.lrta.gov.ph/tickets-and-fares/>

H2MOF said hydrogen transportation remains costly and inefficient, yet crucial for the hydrogen economy. "Existing technologies for hydrogen transportation include pipelines, tube trailers, cryogenic tankers, and carrier materials such as ammonia. Despite some incremental improvements over the past decades, these technologies fall short of meeting cost targets and display some important limitations that may hinder their adoption on a larger scale: material compatibility, safety challenges, high investment costs, energy-intensive,," the company stated in its latest white paper. It noted that the world produced and consumed 97 million tons of hydrogen in 2023.

<https://www.pv-magazine.com/2025/02/28/the-hydrogen-stream-hydrogen-leakage-impacting-around-15-in-hydrogens-life-cycle-emissions/> Expanding hydrogen production on a large scale faces multiple obstacles during its implementation. Lack of funding for startup expenses, combined with regulatory barriers and the necessity of developing better electrolysis systems, will negatively affect its progress.

*The incorporation of hydrogen energy systems into current markets **depends on deliberate planning and joint efforts** between governments, industries, and scientific research facilities. The realization of success will depend on solving these obstacles by implementing specific policies and developing public-private collaboration systems.*

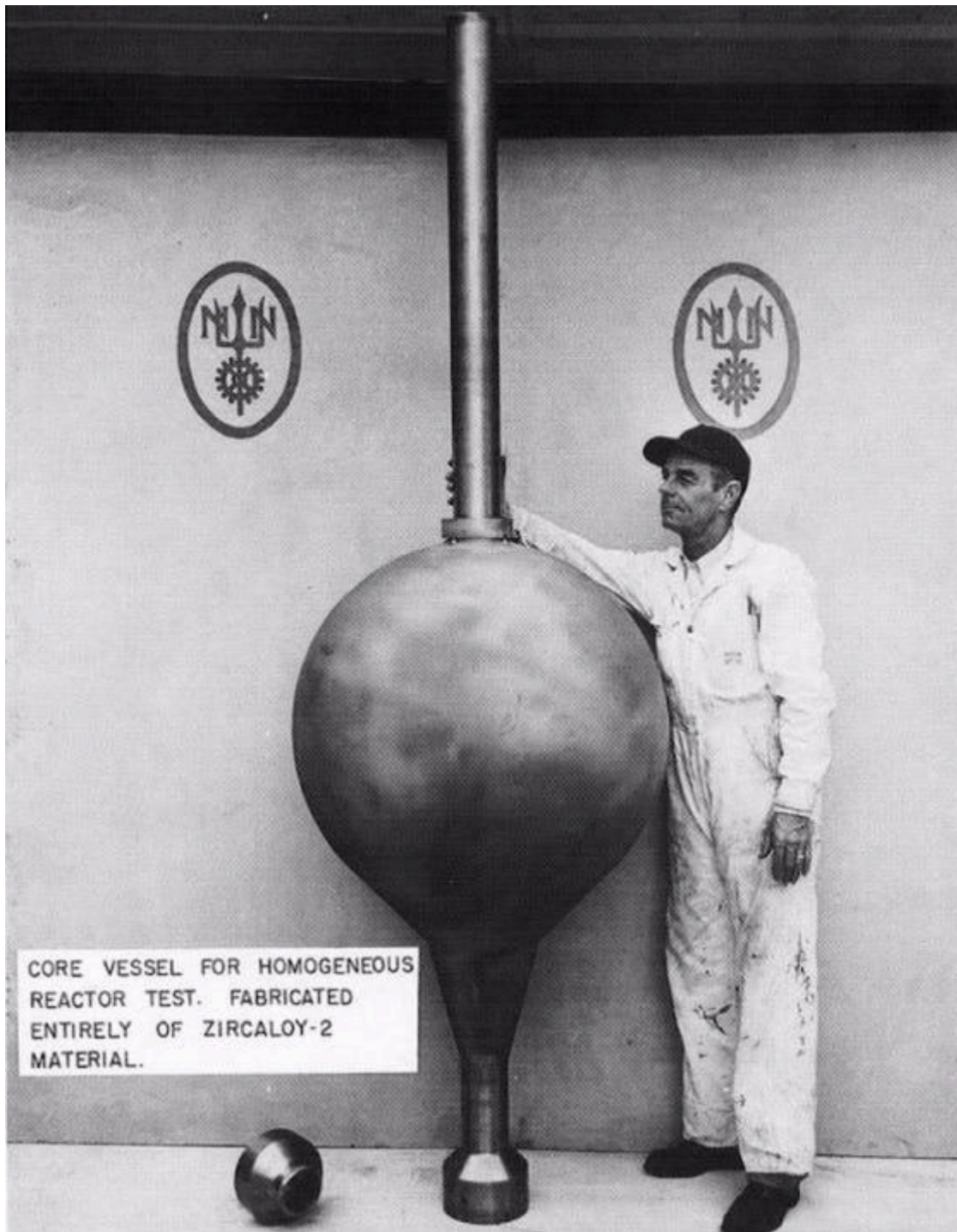
Carbon Credits:

Your charging batteries and delivering pure heat with cryo nitrogen to retrofit and run diesel generators. So, you get the credit of replacing diesel. Also on ships. This is the Wireless Red Sun System. This is 266.5 g CO2kWh; or 266.5 kg/ MWh

So, for our example

364,000 MWh/ year x 0.2665 MT/ MWh = 97,000 MT CO2 saved per year.

\$13.4/ tCO2 x 97,000 MT CO2 / yr = \$1,300,000 per year



Latvia Energy & Radioisotope USE OF FUNDS & Pro Forma

Saving over a \$100 million in licensing and permit fees, plus 3- 5 years, utilizing *Latvian University* nuclear License and permits in \$2.5 million buyout. And, adding 354 MW Siemens and series of AQUEOUS HOMOGENEOUS REACTORS (AHR) to make 20k gm/year med isotopes +364k MWh/year.

Using 32 MW Red Sun mobile 29 ton thermal 360 MWh transformer/ battery to connect the nuclear energy into direct 65% efficient propulsion; making steam- to electricity; and electric charges the battery 98.6% to 1850°C to run diesels, heating long- forgotten cryo nitrogen to triple torque and expand range 10 x's. Thus, the AHR can run any ship, train, truck or turbine

50 MW Salt Battery – 150 Wh. per Kilogram



Lithium Battery – 270 Wh. Per Kilogram





RedStar's Red Sun Thermal Battery Generator 2000 – Wh Hours per Kilogram with Steam Generator



18 Cubic Meter, 26 Tons - Transportable by truck ship and other locomotives in 20 foot Container

Aqueous Homogeneous Reactor 360 MW Red Sun Mobile thermal battery EXECUTIVE SUMMARY:

Red Sun, insured by Lloyd's and AHR, is the only SMR with **Oak Ridge National Labs** feasibility study. The AHR is \$500 per kW installed vs eVinci from Westinghouse at \$19,500/kW untested with no battery batteries.

5.5 MW Red Sun Power Block AHR + 6 MW thermal battery - 360 MWh/ charge + 3 Opra 1.85 MW Turbines is **\$ 9.5 million**.

<https://www.ornl.gov>

https://docs.google.com/document/d/11Xa6boDEdv5liGbUsiOti_UzWUUjh2cwoj_yfKQ_vS4/edit?usp=drivesdk

EVinci 20 MW at \$16.45k /kW= **\$329 million USD** for 5 MWe. 35x's more!

<https://interestingengineering.com/energy/penn-state-house-evinci-microreactor> this is not affordable nor easy to plug into other than steam.

USE OF FUNDS:

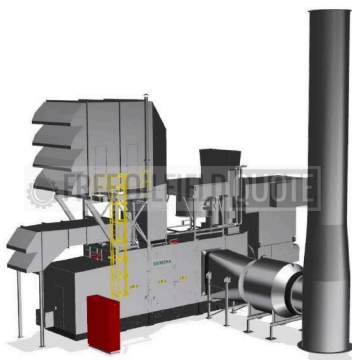


162 MW	~Three	Brand	New	Siemens	SGT		

800 Turbines - 54 MW - \$22,520,000 @ \$50/ kW



26 MW ~ Two x Brand New SGT 400 Turbines - \$19 million



13 MW Siemens SGT 400 - \$11,650,000 - new



108 MW ~Siemens- Two SGT 800 Turbines -:\$5.25 million - \$48.6/kW



12.9 MW 2011 Siemens SGT 400
-\$5.94 million - used



25 MW Siemens SGT 600 - \$15.66 million - used - china
13 MW ~ 2013 SGT400 Duel Shaft

10:05
4G 57%
Main Equipment_Egco...
เสร็จสิ้น

Steam Turbine (STG)
ALSTOM, 42MW

Steam Turbine Design Data	
Control	TURLOOP
Output	42MW
HP steam press/ temp	85 bar a/ 518 C
HP steam flow	130 t/h
LP steam press/ temp	8.4 bar a / 228 C
HP steam flow	27 t/h
Steam Turbine Generator	
Output	49.2 MVA
Rated power factor	0.85
Rated frequency	50 Hz
Condenser	
Steam flow	40.556 kg/s
Steam enthalpy	2,297 kJ/kg
Pressure in condensor	0.095 bar a
Temperature	44.9 C
Cooling water flow	2,560 kg/s
temp - in	32 C
temp - out	40 C

82 MW ALSTOM Turbine Cogen

82 MW - Alstom STG @\$45/ kW = \$3.6 million - used from EGAT 7yo

Use of Funds :

Equipment Totals:

Turbines:

352 MW for \$31.37 million = \$89/ kW

Moving Costs

\$250,000

Rewiring

\$105,000

Installation

\$150,000

INSTALLATION & MOVING TOTAL:

\$32 million

Permits & license

\$850,000

Buying *Latvian University* 40yo Sodium Cooled Fast Reactor + Rehab and upgrading parts:

\$2.5 million

AQUEOUS HOMOGENEOUS Nuclear reactor - (AHR); 40 x AHR's x 4 MW = 160 MW

\$24 million

Total \$59.25 million

320 MW~ 10 x 32W Red Sun Batteries 3600 MWh/d -\$3 million

Total Loan = \$62.25 million

AHR + 354 MW Siemens Power + 360 MW Red Sun Pro Forma:⁶¹¹

Siemens354
MW RED
SUN Power Radioisotope + Relocating 354 MW
Radioisotope Siemens gas cogen + steam

Year	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
	<u>2026</u>	<u>2027</u>	<u>2028</u>	<u>2029</u>	<u>2030</u>	<u>2031</u>	<u>2032</u>	<u>2033</u>	<u>2034</u>

CAPITAL EXPENDITURES (\$1000 USD)

Project Cost 62250

REVENUES (\$1000)

kWh/yr	1000's	364	364	364	364	364	364	364	364
PPA Rate- grid & transp cost (\$/kWh)		0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
C-BED Rate (\$/kWh)		0	0	0	0	0	0	0	0
Electricity Revenue per PPA		24600	24600	24600	24600	24600	24600	24600	24600
20k g Am241/Po208		30000	30000	30000	30000	30000	30000	30000	30000
Rate (\$0.12/kWh)		0	0	0	0	0	0	0	0
Po208,209=1.5k/gm		0	0	0	0				
AM241= \$1500/ gm		0	0	0	0	0	0	0	0
*Carbon Credits		1300	1300	1300	1300	1300	1300	130	
Incentive Payments		0	0	0	0	0	0	0	
TOTAL REVENUE		55900	55900	55900	55900	545900	55900	55900	55900

EXPENSES (\$1000)

Operations & Maintenance		1045	1045,35	1047,741	1049,173	1050,648	1052,167	1053,732	1055,344
Operations & Maintenance Contingency Fund		25	25,5	26,01	26,53	27,061	27,602	28,154	28,717
Project Management Fee		70	71,4	72,828	74,285	75,77	77,286	78,831	80,408

Insurance	721	721,42	721,848	722,285	722,731	723,186	723,649	724,122
Property Tax	9,9	9,801	9,703	9,606	9,51	9,415	9,321	9,227
Leaseholder Payments	12	12,24	12,485	12,734	12,989	13,249	13,514	13,784
Admin/Fin/Legal	5	5,1	5,202	5,306	5,412	5,552	5,631	5,743
Lease Expenses	12.053	12.294	12.54	12.791	12.916	13.043	13.171	13,3
Smelter Flux	20	20,4	20,808	21,224	21,649	22303		
	0	0	0	0	0	0	0	0
Transport	3	3,06	3,121	3,184	3,247	3,312	3411	3,446
purchasing night hydroelec 3c/ kWh	900	900	900	900	900	900	900	900
Tot Annual Op Expenses	2822,953	2827,565	2832,286	2837,118	2841,933	2847,115	2852,281	2857,605

EBITDA & Taxable Income (\$1000 USD)

EBITDA	53077,047	53072,435	53067,714	53062,882	53058067	53052,885	53047,719	53042,395
Depreciation	6300	6300	6300	6300	6300	6300	6300	6300
Debt Interest Payment	6300	6300	6300	6300	6300	6300	6300	6300
Total Annual Expenses	14122,953	14127,565	14142,286	14137,286	14141,933	14147,115	14152,281	14157,605
Income	40477,047	40472,435	40467,714	40462,882	40458,067	40452,885	40447,719	40442,395
Accumulated	40477,047	80949,482	121417,2	161880,48	202338,55	242801,43	283249,17	323691,57
Taxable Income -1000	(22022,9500)	18449,483	58917,197	99380,078	139838,55	180301,43	220749,17	261191,57
Return on Investment (ROI)		29.5%	94.3%	159,00%	224,00%	289,00%	353,00%	417,00%

TAXES 15%

*Carbon Credits:

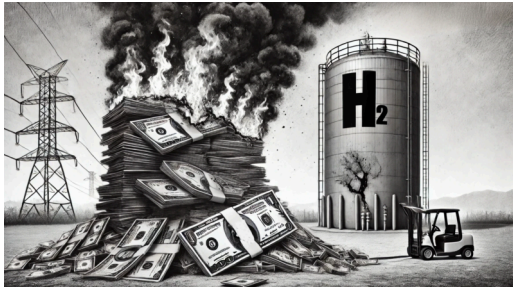
Your charging batteries and delivering pure heat with cryo nitrogen to retrofit and run diesel generators.

So, you get the credit of replacing diesel. Also on ships. This is the Wireless Red Sun System. This is 266.5 g CO₂/ kWh; or 266.5 kg/ MWh.

So, for our example:

364,000 MWh/ year x 0.2665 MT/ MWh = 97,000 MT CO₂ saved per year.

\$13.4/ tCO₂ x 97,000 MT CO₂ / yr = \$1,300,000 per year



Conclusions:

There is incredible value in AHR nuclear reactors at \$500/kW installed, yet, 40- year old Washington DC power plants with 87 MW sell for \$1.5 bn USD.

Meanwhile, AHR is only MSR with full feasibility study and 5 year test by ORNL. Plus, it makes super- valuable life- saving radioisotopes that can't be made in most reactors, including Sr89 and Mo99, the latter going for \$46k/gram! Plus, plugging in Red Sun thermal battery to the nuclear steam by 98.6% efficient induction - driving diesels and turbines directly as Red Sun transformer, 360 MWh battery, and 350% torque amplifier; increasing range on ships and trains by up to an order of magnitude with twice the efficiency of fuel cells at 65% with secondary steam generation and; in the case of metallurgical processing, blowing compressed air through slag to run LM 2500 38.5 MW. Red Sun started development with Csiro to capture waste heat in smelters, returning 40 MW in electricity to refineries while lighting Ni and Cu smelter furnaces with 650°C heated compressed air. Married together with AHR, Red Sun is next big thing in zero emission propulsion and manufacturing, with batteries that retrofit in most engine rooms and retrofit to run better, longer, further and cheaper than fuel- backed by Lloyd's Syndicate. Moreover; charging onboard with excess capacity and holding time to run all power, propulsion, heating, HVAC and even ovens, kilns for drying; laundry, boilers, while running at an order of magnitude less cost at \$40/MWh vs. diesel at LCOE of \$430/MWh!

The Red Sun heated nitrogen torque expansion of 1500 x's at 200°C beats diesel's 420 x's expansion at 650°C by 3.5 times tripling torque and delivering 700 x's more energy than hydrogen per Liter. Of course its made practically free from the air at 2 c/ L.

Especially if you consider **Nuscale** paid the NRC \$750 million just for the license on their 77 MW SMR, which wont operate till 2029- 2030 - and they have to wait 4.5 yrs and pay a separate permit of 6% of cap cost!

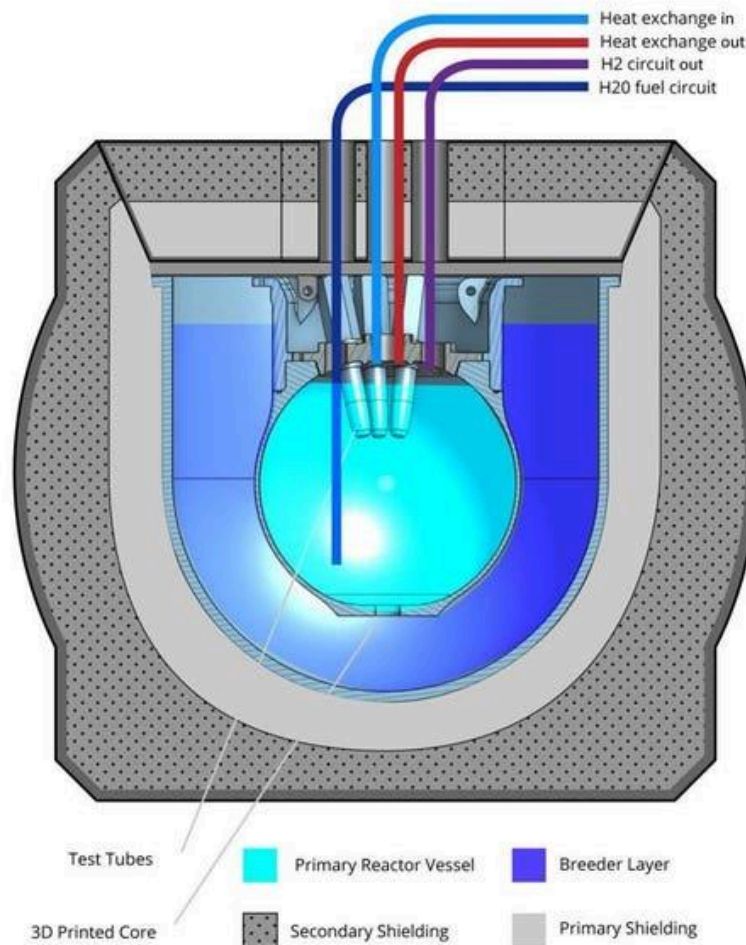
Plus, Redstar's head chemist dr Andrejs. Zagars Is magistrate of Latvian University, and will train our workers/ students and supervise.

The CEO studied under him for 6 yrs. We've been friends since he taught me hybrid recycling-composite chemistry and manufacturing that upcycles plastic rubber and biomass into building materials and railroad ties for my composite houses in 2003.

This is paradigm changing on many levels increasing range 10 x's and lowering costs an order of magnitude. We just saved 3/4ths of a billion dollars and 4.5 years buying the *Latvian University* fast reactor! CHECK MATE!

5.55 MW Red Sun Power Block

& Am241/Po211 Radioisotope production 16 g/day on \$500k reactor



8. Energy Comparisons With Fossil Fuels & Nuclear Power:

- With complete combustion or fission, approx. 8 kWh of heat can be generated from 1 kg of coal, approx. 12 kWh from 1 kg of mineral oil and around 24,000,000 kWh from 1 kg of uranium-235. Related to one kilogram, uranium-235 contains two to three million times the energy equivalent of oil or coal. The illustration shows how much coal, oil or natural uranium is required for a certain quantity of electricity. Thus, 1 kg natural uranium— following a corresponding enrichment and used for power generation in light water reactors – corresponds to nearly 10,000 kg of mineral oil or 14,000 kg of coal and enables the generation of 45,000 kWh of electricity. One tiny fuel pellet can contain the equivalent usable energy of 3 barrels of oil! Returning to nuclear power is the only thing that makes sense for Italy (and Germany, Spain, Latvia, Thailand, Philippines, etc.), the EU and Asia with oil at \$70/barrel and today's limited 18th Century energy technology the only other choice.

Now, nine years ago, Indonesia produced just 5% of the nickel according to *Benchmark Intelligence*. By 2023, it accounted for half the global copper output, with forecasts for 65% of global output by the end of the decade. And; the Philippines is second in copper reserves globally, with a huge upside potential once smelters and refineries are built. What is holding the Philippines back are sky- high utility and gas/ fuel bills, which Redstar 4th - gen nuclear-powered power plants will solve with greatly lower producing AHRs and MSRs for charging batteries and electricity and heat costs to \$40/MWh, the Philippines can be a major player in copper and nickel, including the new Aqueous Homogeneous Reactors that make 220 liters of H2 per minute to reduce copper and nickel concentrates in flash smelters perfected by **Outokamku** in Finland in 1949 and reintroduced by China for green steel last year. Redstar will build Cu Smelter in 2025 for 250 kt copper matte per year featuring the AHR and Red Sun thermal battery while cutting energy costs in half and hydrogen costs by. 90%.

Thus, Redstar's marriage of Smelting with Molten Salt Reactors (and SMRs) and Transforming 1850°C Red Sun thermal batteries bring pink hydrogen into metal business for the 1st time to make green copper & green nickel matte.

8. Introducing Redstar Aqueous. HOMOGENEOUS REACTOR (AHR):

The 112 kW AHR is operated on 20 x 1kg Uranium pellets of 5% U235, can be easily manufactured and current designs use 3- D printers, with novel patent- pending fluoropolymers that are neutron and strong acid- proof. Easily built up to 1 MW, although current starting model is 112 kW, puts out 22 liters H2 per minute and produces heat of 320°C to run standard steam and Ammonia engines, and is as big as a beachball. Financially, AHR breakthrough is making up to 32 gm per day of Am241 and Po208- Po209- and Po210 per day. The reactor and blanket have a neutron flux of 2 quadrillion neutrons per cm2 per second (@0.05), which is high. Thus, AHR is a super- light water moderated reactor of spherical design, good for Th234 blanket to transmute to U233(Pa234); and, perfect for production of much in demand radioisotopes Mo99, Am251 and Po 208 209 and 210 that sell at up to \$2000 per gram. With LOI and next month full contract for \$1500gm with *Stargen* for 1000 kg of material by 2030.

9. Red Sun Power Block - 5.55 MW:

This marriage of AHR and 6 MW -120 MWh Red Sun thermal battery is able to run 24 hours and charges by multiple AHRs in series; and, enables retrofitting all gensets and starting at 3 Opra H2 Turbines of 1.85 MW each gives 5.55 MW recharges at 28c/kg H2 = 3.1 c/kWh

Aqueous Homogeneous Reactor-AHR:

7

*Designed, built and tested by ORNL it went online in 1952 for 5 years successfully. A full feasibility study was done enabling the AHR to be insured and financed. Primarily making radioisotopes Am251, Mo99, and Po209 and Po210 for primary income at \$1,500 per gram, with a 10 foot wide reactor going up to several dozen grams per day. AHR also features the most cost-efficient Biohydrogen on Earth: the Aqueous Homogeneous Reactor (AHR) above with Tesla turbine or Opra Op16 1.85 MW turbine with 6 MW Red Sun mobile thermal battery retrofits all engines to run any ship train or industry on biohydrogen, nuclear, or RE with Red Sun universal transformer. Featuring the first mobile thermal battery at 120 MWh for 6 MW Red Sun / Powersource is heart and workhorse of 5.55 MW Red Sun Power Block putting- out 120 MWh per charge (2 hours) thermal at 1850°C and weighs 6.5 tons and 5.5 m3 and recharges at \$40/MWh LCÖE (vs. Diesel trains and ships at \$430/MWh) with exclusive fission hydrogen and rankine cycle turbines up to 1.85 MW Opra). The **Powersource/Red Sun mobile** 0.33 to 32 MW battery outer ceramic heat casing layers, similar to ceramic composite refractory *Space Shuttle* tiles, holds internal heat for a year up to to 2,000°C to 2500°C. This retention casing is designed by *Thyssenkrupp*, for 2,000°C molten Ni-Fe alloy; and 6 MW charges in 2 hours, weighs 6.5 tons, and has been successfully tested with *GE, VW, Cummins, Porsche, Isuzu, Kawasaki, Rolls Royce, Pratt and Whitney, Man, Kawasaki, and Siemens* turbines; successfully testing 2.5 MWe turbines; Red Sun runs up to 52 MW *Siemens SGT- steam generator set*. Red Sun lasts 50 years in 5.55 MW Power Block insured by *Lloyd's Insurance*. Plus, *Pink Hydrogen* at 28 cents/kg = 3.1 US cents/kWh plus labor = \$40/MWh.*

On the sea and hauling freight you need cost- efficiency and maximum horsepower and *Red Sun cryo nitrogen* delivers both at 3.5 x's the torque of current diesel. Forty x's less: hydrogen under *IMO* is 195 bar (25°C) maximum for marine hydrogen *compression limit*, which only gives 0.5 kWh/L vs. *Red Sun cryo nitrogen* at 20 kWh/L (at 200°C) - 40 x's more!

Red Sun Nuclear Charger- AHR

RED SUN Hybrid ~ eTram ~ Non-Catenary System

No Wires or Catenary System Needed - RED SUN re-charging onboard + thermal batteries = 1400 km range- save \$18m/mile construction

- HEALTHY +
- ...45% - 75% fuel savings
- ENERGY EFFICIENT
- SAFE
- LOW COST - ULR
- ECONOMICAL
- FLEXIBLE - ULR
- ATTRACTION
- PASSENGER FRIENDLY
- VERSATILE
- PUBLIC FUNDING

MAG POWER brings the **H2** ECONOMY to enable transport!

- 1300 kW Power Source = 2900kWh
- 10x's the Range of Competitors!
- 0.1 m3 = As big as 4 suitcases

POWER SOURCE 1300 = 2900 kWh + Gensets run by H2 & Mag Gas. Recharge or RED SUN 32MW Thermal Battery enables H2 Charging!

Putting out several hundred L/min hydrogen run 3 x Opra Op 16 (or Cummins or JCB H2 generator) by - AHR x 4 gives up to 600 L/min to run 3 x Opra Op 16 5.55 MW turbines + 6 MW Red Sun 5.55 MW Power Block 8500 hr/yr x 120/MWh = \$3.68M/year electricity & \$11.2 M/year from 5600 gm/year radioisotopes with 8 mo. pay-off.

PNR will run **RED SUN Bicol Freight Line** wirelessly once Loco is tested.

$5.55 \text{ MW} \times 8500 \text{ hr/yr} \times \$120/\text{MWh} \times 65\% \text{ eff.} = \3.68 M/year

Rockwool 5.55 MW Power/ Heat Block Total Cap Cost - \$6.25 M

Red Sun Battery - \$400k

3 x Opra OP16 - \$4.5 M

Carbon fiber Heatex - \$100k

Labor overhead & team \$150k

Lease payments \$248k/yr 48 mo lease 20% down = \$1.25 M

Lloyd's Syndicate Insurance

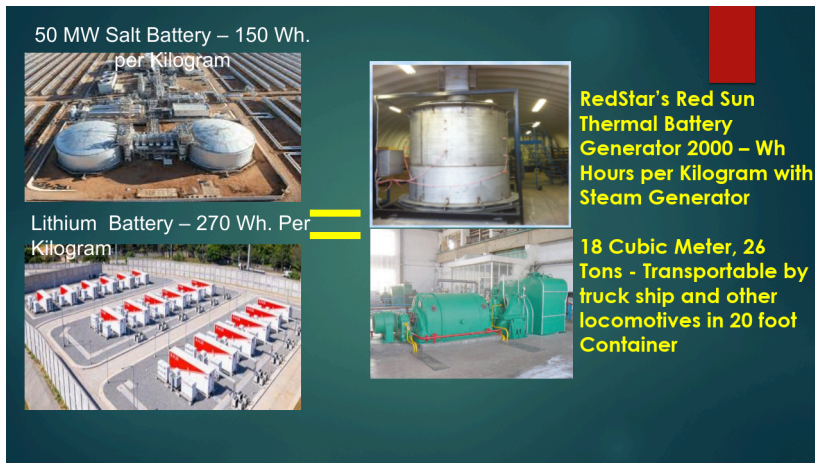
Electricity Gross Inc before - \$14.8M

Elec After expenses \$2.28 M/ yr

$16 \text{ gm/d} \times 350 \text{ d/yr} \times \$2000/\text{gm Am 241, Mo 99, Po 211} = \11.2 M

Isotopes after expenses = \$8.2

Total after expenses = \$10.48 M/yr



10. Return On Investment:

$$ROI = \$10.48 \text{ M} / \$6.25 \text{ M} = 168\%$$

There is a gold mine retrofitting ships with Red Sun and AHR with existing diesels onboard in the 5.5 MW Power Block. The Ph Admiral complained they go through P11,000,000 per day per ship! Red Sun would save them P5,500,000 per day (~\$64k USD/day and cost \$5.5 M for 5.55 MW with 6 MW Red Sun).

Price Comparisons on Reactors:

In comparison SMRs of **Nuscale** is \$19,500 an installed kW for 77 MW; and; mini SMR by **Westinghouse** the **E-Vinci** is \$16,450 per installed kW. Also, **UKRAINE** just bought two x 1,300 kWe old **Russian VVPR - 1000s** from the 70's and some ancillary equipment sold for **\$600 million!**

<https://kyivindependent.com/ukraines->

<https://kyivindependent.com/ukraines-parliament-approves-controversial-purchase-of-russian-nuclear-reactors-from-bulgaria/>

Pressurized water reactor developed in the seventies -**1300 MWe Ave.**

Stands for water pressurized reactor.

Water cooled and

Water moderated to slow neutrons

Old-1974-designed gen-1 light water reactor with solid fuels at \$600 million. 600 M/2600 MW= \$ 231/ kW

Adding turbine set 1000/kW+Labour permits and eng. 500/kW

Total projected cost = \$1731/ kW

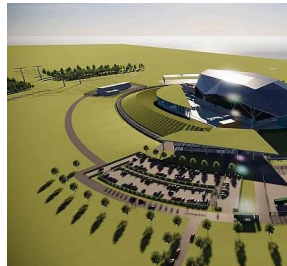
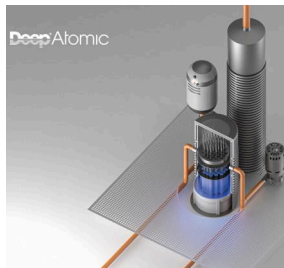
73.61

-0.22%



77.29

-0.26%



11. SMR & MSR Marine & Power Systems

- SMR technology is rapidly advancing, with numerous designs in development and several companies planning to deploy reactors within the next decade.
- SMRs offer a smaller, cheaper, and faster alternative to conventional nuclear reactors, making them suitable for a wider range of applications and locations.
- The growing demand for clean energy, particularly from data centers, is driving significant investment and innovation in SMR technology.
- <https://www.datacenterknowledge.com/energy-power-supply/nuclear-powered-data-centers-when-will-smrs-finally-take-off>
- <https://www.thebrighterside.news/green-impact/compact-evinci-nuclear-reactor-can-power-4500-homes-for-8-years-without-water/> Small modular reactors (SMRs) are expensive gen-3 (**Westinghouse eVinci** is \$16,000 per kW, and **Nuscale** is \$19,500 USD per installed kW) with the same 99% fuel waste and high waste production and water usage for cooling up to 560 gal per MWh, can go up to \$19,500 per kW for **Nuscale**, with worldwide average of

\$3874 per installed kW with genset. Whereas the 1 MW AHR is less than \$1 million to build, and; \$2 million retail to JV customers that partner with us at \$2k per installed kW.

SMRs have improved over the decades due to advanced materials and safety protocols as advanced gen-3 nuclear reactors with a power capacity of up to 300 MW(e) per unit, equivalent to about one-third the generating capacity of a conventional nuclear reactor. SMRs are much smaller than traditional reactors and are modular, making it easier to assemble them in factories and transport them to the site. Because of their smaller size, SMRs can be installed on sites that are not suitable for conventional reactors. They are also significantly cheaper and faster to build than traditional nuclear reactors and can be constructed incrementally. The SMR market is expected to grow from \$6 billion in 2024 to \$7.14 billion in 2030, growing at a CAGR of 3 percent. The Asia Pacific and Americas markets will likely be the main drivers of this growth. In the U.S., an increasing number of tech companies are investing in SMR technology with the hopes of powering their high-energy-demand data centers with clean energy. The sector hopes SMR technology will be available to power several data centers by the 2030s, as their power demand grows in line with the rollout of artificial intelligence and other complex technologies. This has led Google to order seven SMRs, and Amazon, Microsoft, and Meta to follow suit.

Molten salt reactors are powered by a radioactive solution that blends fissionable isotopes, including recycling used fuel rods, with a liquid salt. While they can be powered using uranium, they run optimally on thorium, a cleaner, safer, and more abundant nuclear fuel that, for the most part, does not make plutonium. The Thorium 1 is expected to be safer and more efficient than water-cooled plants, primarily because it runs on 1 to 12 atmospheres vs 150 bar for light water reactors, which is 15 x's more and require giant and very expensive containment domes.

12. About Redstar: RedStar Energime Green Group Corp. Features the top nuclear engineers and chemists of America, and Nuclear Advisor to the Office of the President and DOE, with 3 govt contracts pending as the 11th utility company of the Philippines developing the 1st mobile thermal battery and first mover in radioisotope production in Asia. Redstar has over 100 energy and engine patents now entering power build-out phase. "Red Sun Mobile" is proprietary mobile thermal storage power retrofit system 0.6 MW to 40 MW @360 MWh, which is transported by truck, ship or train to Cu & Ni smelters and power clients paying 15 cents US/kWh. With 25 x's less volume per MWh- which makes Red Sun the best for high power wireless propulsion for heavy trucks, ships, trains and planes. At 1000 Wh/kg to 1500 Wh/kg Red Sun is analog next generation, plus reliable with 50-year life.

Redstar Syngas Catalyst for Algae-Biomass with Gasification:

Hyacinth Catalytic Pyrolysis:

$250 \text{ kt} \times 17.9 \text{ MJ/kg} \times 0.278 \text{ kWh/MJ} = 1244050 \text{ kWh} = 1244 \text{ MWh} - 5 \text{ mo.}$

$1244 \text{ MWh} \times \$120/\text{MWh} = \$1.495 \text{ M}$

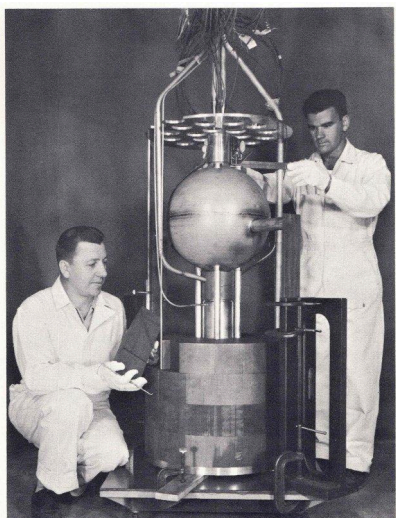
Coconut shells: catalytic pyrolysis

$500 \text{ kt} \times 34 \text{ MJ/kg} \times 0.278 \text{ kWh/MJ}$

$= \$2.28 \text{ M over 6 mo.}$

13. REDSTAR'S BIOH₂ CATALYST:

Designed bioengineered proprietary trade - secret cerium oxide metal complex with patentable calcine 8process, Redstar's trade- secret recycled catalyst gives 0.87 L *Biohydrogen* (STP) per one gram dried lake or sea algae, lake cyanobacteria and Sargassum. Two multi-million dollar awarded and pending contracts with **Laguna Lake Development Authority** and **Dept of Ecology & Natural Resources (DENR)** start Jan 18th 2025. Plus 50 MW PPA with Dept of Energy on 20 yr electricity service contract at 12c/kWh. Redstar and clients will lease the AHR with Redstar 150 MW service contract.



GRAPHITE REFLECTOR SURROUNDS L-54 CORE. After graphite logs are stacked, core is inverted and contained in an aluminum secondary enclosure.

Above - **Oak Ridge National Labs** successfully demonstrated the feasibility of homogeneous reactor design and went critical in 1952 and successfully ran till 1957: (study)
<https://www.osti.gov/biblio/4353671>

14. Redstar Patents: Catalyst & WTE Background: Am 241 & Po 209, 210

According to Sec'y of Transportation Jamie Bautista: "Red Sun saves Philippines National Railroad 40% on building tracks and operating trains and stations wirelessly without building catenary wire systems!" Headed by Nuclear Advisor to the president and DOE - Jay Dubinsky, UCI Bioengineer, developed breakthrough catalyst in 2018 that transforms biomass at 0.87 liters bio-H₂ per gram of dried algae and/or biomass like coconut shells (39 billion coconut shells fall per year in Philippines). This cerium oxide metal group catalyst is processed from red mud waste of Aluminum- Iron - Mn - Mg-Zn complexes- from Aluminum smelting/refining waste, transforming it like cement though high Red Sun Oven 2000°C heat in the calcine process. Called EGG Algae to H₂: world's strongest biomass catalyst by 700%, it enables gasifying algae or seaweed, hyacinth and coconut shells at t17.8 MJ/kg to 38 MJ/kg for clean coal replacement to produce syngas of H₂ and CO as primary reducing agent for increasing Cu and Ni to mainly separate out iron as slag: and secondary bio oil and tertiary biochar as reductant for Cu and Ni flash smelting. Three products with this super- efficient catalyst is 7 times more productive than platinum- ruthenium costing \$12,500 per oz.!

<https://cleantechnica.com/2025/01/17/1-66-billion-turbo-boost-for-us-green-hydrogen-industry/> Green H₂ \$5/kg

14. Redstar Biotech History:

With an extensive three decade career developing algae to energy tech- including ultrasound, and; featuring biotech and chemistry innovations. Early success utilizing ultrasound invented *Quantum Fractionation* in 1999; plus and 24 years developing hydrogen engines including **Mazda RX 8** in 1999 - 2007 with US Engineers **Jim Murray & Nick Eckelberry**. Studying under our **Chief Chemist Dr Zagars**, head Magistrate of Latvian University, **Jay Dubinsky - CEO** became a master of composite chemistry & biomass gasification and pyrolysis in catalyzed systems, waste to energy, composites and algae oil systems.

Top Redstar For many years, only the most powerful naval ships were allowed to use nuclear power. The question of whether nuclear technology can power commercial ships is now crucial for the maritime sector.

:

- ♠ Red Sun Thermal Battery +
- ♠ NON- COMBUSTION BRAYTON CYCLE
- ♠ Aqueous Homogeneous Reactor - AHR
- ♠ Redstar Crystal Fluoride Reactor Core & Neutron

<https://patents.google.com/patent/US20130247585A1/en> blanket- non- corrosive neutron and acid - proof & explosion-proof crystal

Redstar has exclusive rights for the transformative mobile *Red Sun thermal phase change molten metal battery* called *Powersource/Red Sun* 100 kW to 40 MW; and, second patent running fuelless *Non- Combustion Brayton Cycle* pure heat by Red Sun thermal battery 1000 to-1500 Wh/kg weighs 4x's less than Li-ion per kWh.

15. Retrofitting Diesels & Turbines

Featuring second exclusive patented *Non- Combustion Brayton Cycle*:

The second exclusive patent is Non- Combustion Brayton Cycle operating all engines and turbines on pure heat using heat exchangers in the fuel combustion chamber of *Brayton jet turbines* and injecting cryo nitrogen into rail systems of diesels. This brings power prices back 100 years with nuclear at \$40/MWh. For ships, the 5.55 MW Power Block is major transportation paradigm shift with a 12 m3 total footprint; the *Red Sun Power Block* retrofits small engine rooms, maintenance closets and transformer buildings, or bus & train station closets; plus 7 x's lighter than Li-ion.

Thermodynamically, economically and logistically the 16.65 MW tri- Red Sun Power Block runs destroyer- class 150+ m frigates to retrofit and run for less than one-eleventh diesel costs and zero emissions with \$1.5 M carbon credits per year. Plus 360 MWh Red Sun charges in 4 hours for \$14.4k to sell at \$28k at a rate of \$120/MWh.

Red Sun 33 MW gives 360 MWh per charge and retrofits all ships and runs 13,500 HP ships and freight with 700 km range. Whereas battery electric fails in all ship and train applications for range (and GE Battery Electric costs \$48 M) only gives 110 mile range for battery electric ferries and trains. Hydrogen, at only 2.22 kWh/L for cryo H2, fails in range here also with 1/5th the energy density of diesel at 9.7 kWh/L vs. Red Sun cryo nitrogen at 20 kWh/L - 700 times better performance and range per volume over cryo hydrogen and 30 times less expensive. Moreover; 98% of hydrogen is grey. Whereas Red Sun is master of green zero-carbon propulsion, and increases range over an order of magnitude! Thus, recharging 360 MWh for \$14,400 USD is one-eleventh (1/11) cost of diesel at LCOE of \$430/MWh. Diesel cost is \$155k on the same 360 MWh!

16. Satellite & Cell 24/7 Tracking:

The battery is tracked by state of the art communications company *Max- Tech*: www.max-mesh.com -can track on Google maps to within 2 meters by cell, satellite or internet for metering.

<https://www.youtube.com/watch?v=dEUxEZ2sfUM>

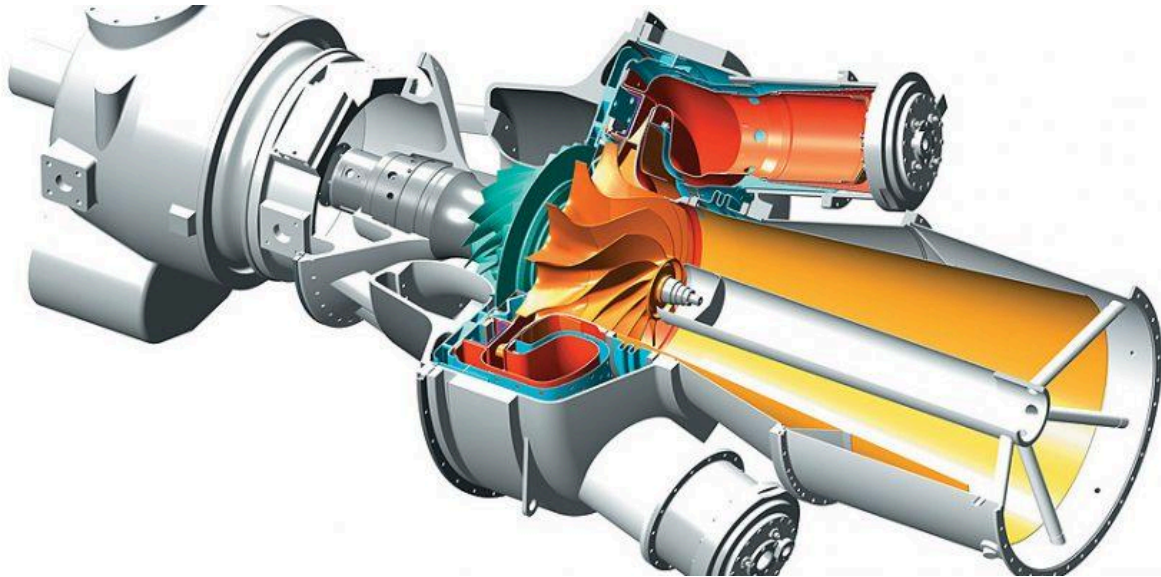


Retrofitting a Molten Salt reactor on the deck of any ships can be implemented putting the RedStar's Red Sun Thermal Generator in the Engine Room connecting the MSR with the engine by a simple power cable, thereby the fuel cost could be zero. **Lloyd's Insurance** is available with full financing package.

Red Sun with Molten Salt Reactors and AHR will be the first mover in Nuclear ship propulsion with Maersk

Transportation, industry, rail, bus and ships need to decarbonize, and more importantly- greatly lower costs to be economically viable and continue to play a key role in our way of life. Going wireless on the trains saves 40% on building without catenary wires saving \$1 bn USD on 1600 km *Laguna to Bicol Freight Expressway*, according to Transportation minister *Mr Bautista*, who is ready to JV with Redstar on 1600 km *Bicol Express Freight Line* under feasibility study now paid by \$3.5M ADB loan to

DoTr.



Opra Op 16 hydrogen turbine 1.85 MW x 3 = 5.55 MW

Mariner Series -150 m Sailboat/ Yacht to Large Frigates ☆ 16.65 MW

<https://energy-xprt.com/products/opra-model-op16-3a-gas-turbine-generator-306868>

17. RED SUN Line Of Ship Retrofits

Hercules: 6000 KW Thermal Battery (120000 kWh/chg) + 440 kW AHR 88L/min Recharging + Hybrid Electric Diesel + Azipods – ABB Bus- running cost -\$60/MWh.

20 hour operation – 800 km – 900 km Range – 30 knots - 40 knots

2 x 450 kW Tesla Turbine Gensets running on AHR 88L/min/ 44 -88 kW Genset 4hr charge with AHR 5.5MW



+ Induction 98%
Charging 728 kW
Total Wt4800 kg –
Recharge while
running Safe with
AHR+ MazdaRx-8

Atlantis Apollo
Series: 33tons
300+ Sailboat,
Cargo, Cruise
Ships, large



Retrofit Ferries Navy Vessel+€1.8 to €4.8 m with Double AHR 5.5 MW

RED SUN 32,000 KW (300 MWh) 4x AHRs + Thermal Battery + 480 kW AHR 88L/min H2 Recharging + Hybrid Electric Diesel + Azipods – ABB Bus+2Azi Pods+2 Opra turbine

48 hour operation – 2100 km Range – 25 kn 8 hr Recharging with H2/AHR 88L/min H2

2 x 250 kW Tesla Turbine Gensets running on 4x 500kW AHR 88L/min Charging *POWERSOURCE* while Running+ 3 Opra turbines 5.55 MW

RED SUN AERONAUTICS – Hydrogen Planes + AHR with 7250 kWh Battery+3 Opra Turbines Op 16

POWERSOURCE 1300 kW with RX-8 Genset can give 2500 km range by charging hydrogen into thermal *batteries*. *ZeroAvia* plane can fly 500 miles, powered entirely by hydrogen technology. *ZeroAvia*, the startup that designed the hydrogen-fueled electric powertrain inside the plane, has been testing the technology over the past year and it plans to begin supplying the powertrain for use in planes with as many as 20 seats, on flights up to 500 miles long. However, the hydrogen niche is small because big plane makers Airbus and Boeing have given up H2 for long-haul flights. Several other startups are also working on technology designed to cut emissions from local air travel, an industry responsible for nearly 900 million metric tons of CO2 emissions a year at a time when emissions need to begin to shrink to zero. But most other companies rely on batteries to store electric power. (*Ampaire*, a startup that recently took its first public flight, retrofits existing planes with hybrid-electric systems; *Eviation*, another startup, is designing 100% battery-electric planes.) *ZeroAvia* saw advantages in using hydrogen. "For the foreseeable future, actually getting a sizable aircraft in the air for a reasonable amount of time will be quite difficult with batteries". A system based on hydrogen fuel cells is around four times as energy dense as the best batteries currently available, he says.

For airlines, switching to hydrogen-fueled airplanes for short flights would save money. *ZeroAvia* estimates that the total cost of operation will be around half that of flying conventional planes because of savings on fuel costs, more efficiency. But using liquid hydrogen would require more work and 10 years in safety testing and certification; for now, the company is using compressed hydrogen stored in carbon fiber cylinders, similar to cars that are already on the road like the Toyota Mirai. The cylinders make the planes 10 to 14 x's heavier, meaning they can't travel as far. And; cryo nitrogen makes more sense/cents and saves 95% of the cost at 2c/kWh running in inexpensive available stainless steel tanks and can't explode or cause metal embrittlement and corrosion. Thus, the *Red Sun Non-combustion Brayton cycle* jet turbine propulsion or cryo nitrogen is only practical way forward at 14x's more energy dense than compressed hydrogen. Plus, 300°C hotter and 25% more efficient for jets and airplanes, plus range extended 7 to 40 x's because of energy density and by 700% has smallest footprint/ volume of any megawatt system (AHR as big as dishwasher) and weight(hydrogen carbon fiber tanks 14 x's heavier for equivalent diesel tank and fuel! GREEN HYDROGEN WILL REMAIN STUBBORNLY HIGH FOR

decades:<https://m.economictimes.com/small-biz/sustainability/green-hydrogen-prices-will-remain-stubbornly-high-for-decades/articleshow/116617497.cms> Nikola Motors goes bust-its over for H2 trucking:<https://cleantechnica.com/2025/02/19/nikola-bankruptcy-just-part-of-crumbling-of-hydrogen-for-transportation/>

Fresh Air

To clean up the aviation industry, NASA-funded scientists are working to develop an all-electric aircraft powered by cryogenically-liquified hydrogen.

But current hydrogen cells lacked the energy density necessary to power a jet without also weighing it down too much. Cryogenically cooling the hydrogen could give rise to fuel cells dense and compact enough to do the trick, but the technology to power a plane with them doesn't exist yet —

"Advances in recent years on non-cryogenic machines and drives have brought electric propulsion of commercial regional jets closer to reality, but practical cryogenic systems remain the 'holy grail' for large aircraft because of their unmatched power density.

Petroleum-derived liquid fuels currently provide around 95% of transport energy, and roughly 60% of crude oil produced is used to make transport fuels. The demand for transport fuels across the world is very large, at around 4.9 billion liters each of gasoline and diesel and 1.3 billion liters of jet fuel *each day*, with an expected yearly growth of around 1%. Changes in the transport sector are occurring because of increasing demand driven by increasing population and prosperity.

AHR *low band* waste heat *energy* down to 120°C to 320°C from the AHR reactors can run primary 2 MW steam turbines and use waste heat from turbines or biomass pyrolyser for desalination and kiln drying biomass. This gets your energy efficiency up to 75%. And utilizing heat to 120°C down to 60°C can be used to heat adjacent greenhouses, mushroom farms, tilapia & grow tiger shrimp (Redstar energy tech www.theimploder.com www.phiray.com with **Mindanao State University** growing fish +tiger shrimp).

"In hydrogen aviation so far, hydrogen chemical energy is converted to electrical energy through a series of fuel cells, which drive the ultra-efficient electric propulsion system, but lose 40- 50% in fuel cells to convert H2 to DC current. The low temperature requirements of the hydrogen system also

provide opportunities to use superconducting, or lossless, energy transmission and high-power motor systems. However, hydrogen has an achilles heel that is unsurmountable in that it has a very low volumetric energy density of 8 MJ/kg for cryo hydrogen at -253°C, which is only 2.22 kWh/L, while diesel is 9.7 kWh/L at 650°C! Doubling that, Red Sun cryo N2 for diesel retrofits is orders of magnitude higher than H2 at 20 kWh/L heated to 200°C (which is how the old nitrogen trains of the 19th C ran) vs 0.5 kWh/L for compressed H2 at 195 bar. Plus, nitrogen only costs 2c/L to make from the air vs. German hydrogen at €11/kg to \$6/kg in the US - 300 x's more in EU to 20 x's in US!

Advances in recent years on non-cryogenic machines and drives have brought electric propulsion of commercial regional jets closer to reality, but practical cryogenic systems remain the 'holy grail' for large carriers.

The Barrier: Cryogenic H2 at 2.2 kWh/L gives 30% more range as 700 bar H2. Yet, only 195 bar is allowed for all marine applications under IMO regulations, giving 1/5th energy at 0.5 kWh/L and 1/40th Red Sun's heated (200°C) cryo nitrogen at 20 kWh/L. Red Sun Power Pack converts and multiplies usable power of hydrogen through turbine genset to store hydrogen electricity as heat at 98.6% efficiency through induction, amplifying with cryo nitrogen for 3.5 x's greater torque+10 x's range.



18. Summary Conclusions- RED SUN Transition to Clean Energy:

Actually, nitrogen is 700 x's better than H2 for power and running piston engines and will take over, as heated cryo nitrogen gives 40 x's energy density of compressed H2 for marine use at 195 bar. And: cryo nitrogen gives 10 x's energy of cryo hydrogen at -253°C. The difference is, Red Sun patented *Non Combustion Brayton Cycle* and cryo nitrogen with density of 10 x's cryo hydrogen runs heavy ships 700 km with 32 MW. These power levels and high torque are forever out of reach of H2 cryo hydrogen at only 2.2 kWh/L unless tanks cover the entire ship. Plus at one- 39th the cost of cryo hydrogen as cost per liter of liquid nitrogen is 2 c/L; and; cost for AHR hydrogen is only 28 cents US/kg vs German hydrogen 1100 cents Eur/kg (1100/28 = 39.2 x's H2 vs Red Sun cryo nitrogen)! With cost pennies per kg for N2 made from the air- hydrogen can't compete and days are limited in transportation once the truth of cryo nitrogen is known!

Plus, at this time, when carbon taxes are set to go to \$150/tCO2 (see article below), ships, trains and trucks need clean working affordable solutions that enable retrofitting current fleets of diesel engines and ICE's that are using petroleum-based fuels for decades. With crude oil at ~\$70 USD/BBL today (Dec 30th, 2024), the shipping industry in particular is at critical crossroad. Trains, ships and planes need Red Sun cryogenic N2, or pure heat of *RED SUN MOBILE and smaller PowerSource* thermal batteries at 1850°C, tested and certified by *GE Marine, Siemens Marine, Rolls Royce, Pratt and Whitney* to *Cummins, Man, VW, Porsche, Kawasaki, Isuzu and Wartsila* - to run all jet engines, diesels and trains. For example, with a five-year old *GE Diesel Electric* purchase and retrofit costing \$4.9 m including a battery car consisting of 32 MW or 65 MW Red Sun on a budd car. This retrofit pays for itself in 196 days- including the locomotive! Plus; as part of the transition, Redstar has two proprietary hydrogen systems with the AHR; and; featuring the brand new *Redstar Algae to H2*

system for gasifiers makes 18 tons biohydrogen per day to run large gensets with high temp. catalytic pyrolysis syngas and hydrogen systems in 150 m2 footprint. Thus, RED SUN thermal battery AHR- is inly way forward economically with 2 million times the energy as fossil fuels, and zero emissions. Thus, the three keys to sustainability and affordability and good for the air and humans living and working in proximity. The 3rd key is efficiency in energy transformation, which hydrogen and all renewables to hydrogen in 7 steps, or turning biofuels to propulsion lacks dd., as 18% efficiency is actual, so that 5he LCOE is \$430/MWh. Red Sun changes this energy paradigm by induction charging the thermal batteries at 98.6% efficiency and discharging at 65%, only 35% is lost, vs 45% lost for fuel cells and other competing energy systems that lose as much as 88% of the energy in propulsion systems.

Thus, RED SUN Battery transformer runs all types of industry, refineries, and manufacturing - charging by 8 methods; plus enabling collection of inexpensive night energy to sell in day from hydro, geo or wind, *RED SUN gives these installed assets 30% more capacity by **Night Arbitrage*** carving a new energy niche and creating large financial gain by buying 3c/ kWh night energy and selling in day for 12 c+to 15 c/kWh with mobile 4 MW to 32 MW RED SUN battery (29 tons) at renewable sites from 10 PM to 8 AM and buying for 3c/ kWh, to deliver in day to distributed power plants to sell at peak rates when demand highest.

Hydrogen is expected to be a 211 billion industry by 2020, as hydrogen planes and hydrogen cars and trucks are already out now with Honda, Toyota and Nikola Trucks and now Zero Avia.. Furthermore, over the next 20 year generational scale, the shortage of oil will not constrain growth in transport; known reserves of oil have been increasing faster than consumption over the last several decades, and the current reserves should last for at least the next 50 years at current consumption rates. Therefore, it is imperative to improve the efficiency, environmental impact, and affordability of ICEs, which will mostly continue to power transport in the foreseeable future. This will cause a transition to hybrid ICE cars with electric power trains that have ability to use hydrogen also to power generators onboard, with the ability to scale up to large planes, trains, and trucks. Plus; charging the RED SUN thermal batteries with hydrogen running small H2 250 kW to 350 kW gensets or JCB RX-8 rotary hydrogen engine to run EMF crucible *Inductotherm charger*- www.inductotherm.com heats Ni- Fe batteries like electric stove at 98.6% eff

RETROFITTING DIESEL TRAINS & SHIPS TO RUN AT 20 CENTS ON \$! *Below-genset*



schematic: Tesla Turbine

With biohydrogen from the AHR at 28c/kg or 3 c/kWh, Red Sun can also run Mazda, Ge, JBC or Tesla Turbines as tertiary generators to operate on modest steam and hydrogen from AHR to monopolise ship and train propulsion! Plus, RED SUN gives highest energy density, critical for transportation and airplanes, tripling range and 32 MW gives 360 MWh to run GE Diesel Electric train 700 km with 64 MW batteries giving 1400 km (and is self-charging while running) utilizing the Red Sun thermal batteries onboard. Plus Red Sun gives a safe redundant back-up system that can store energy for

months, plus have the best energy per weight ratio of any battery, at 32 MW/29 tons = 1.1 kWh/kg; with amazing 120 MWh in 6 MW (5.5 tonnes) with *Tesla Model S* at 85 kWh/540 kg = 0.16 kWh/kg. Thus RED SUN has seven times the energy per kg as a *Model S*, and the 32 MW Red Sun battery contains the equivalent of over 4000 *TESLA MODEL S* batteries! Plus, cryo nitrogen at 20 kWh/L is 40 x's more energy dense than 0.5 kWh/L compressed hydrogen at 200 bars and 14 x's more energy dense than 700 bar hydrogen. And; stainless steel N2 tanks are eight times less expensive than cryo hydrogen carbon fiber tanks and order of magnitude lighter! Now, Longhaul Range of 1400 km is possible with two 32 MW Red Sun batteries on bud car with locomotive.

Thus, lithium battery can't compete in weight and size-sensitive transport and neither can hydrogen for shipping, and are being left behind in favor of biofuels or green methanol. Red Sun energy density and cost saving can save the shipping industry in cost and logistics and soon to be crushing carbon taxes, while giving one million long-lasting cycles! Red Sun lasts 50 years vs. 6,000 - 12,000 cycles (6 to 8 years) for *Tesla Model S*. And; introducing Redstar's AHR 88L/min, releasing hydrogen on demand at 28c/ kg vs. USA averaged \$4 - \$ 6 USD per kg (200 times more) and €11/kg in Germany- giving 1800 USD/ MWh vs *Red Sun Power Block* at \$40/MWh running nuclear AHR charging- thus giving better than 90% savings, or an order of magnitude cost per mile saving over traditional hydrogen. Moreover, all the big plane manufacturers, including Airbus Boeing and others have abandoned the idea of hydrogen planes, and; for ships its a foregone conclusion with a 195 bar **IMO** limit for hydrogen storage- giving only 0.5 kWh/L, there is no way to power even a dingy, as even that would take the place and weight of 9 passengers, that would obviously sink with the weight of the tanks that weigh 14 times the equivalent diesel tanks do! Plus, the expense is out of this world, which on the *Nikola Hydrogen Truck* is expected to be 90 cents per mile <https://nikolamotor.com/motor> . Thus, with AHR 88L/min would drop running costs to 3c/kWh or 3.1 cents per mile (30 x's less)! Thus, the Red Sun power Block plus AHR 88L/minute integrated thermal electric platform is the definition of the **HYDROGEN ECONOMY** at work now

<https://newsroom.mazda.com/en/publicity/release/2010/201005/100519a.html>



Redstar's CEO Jay Dubinsky helped develop the **Rx - 8 Mazda** ceramic hydrogen engine from 1998 to 2010, with duel ports and 2/3. A triple rotor 787 Mazda won Le Mans 1981! Single rotors can support 2 pancake axial generators running 100% hydrogen for 350 kW for 1.4 MW for 4, and 2.8 MW for 8 at Cost \$325k for 350 MW.

♠ The magic of *Red Sun Thermal Batteries* is heated compressed air gives twice the energy of gasoline 20 kWh/L vs 11 kWh/L for gasoline, and N2 gives 1500 x's expansion which is 3 times more power over gasoline (432 x's expansion at 550°C) - meaning o Sun is transformer that triples horsepower and carries 10 x's heavier loads for ship, train, and truck with more than double round trip green energy efficiency at 65% vs 25% Fuel cell round trip green energy efficiency.

♠ **RED SUN/PowerSource** outer containment designed & guaranteed 10 yr by *Thyssenkrupp*! Triple charging with 6 MW recharge is 2 hrs, which hyper-extends range 3 x's to 7 x's with onboard thermal

battery-turbine charging, while *AHR 88L/min.* is running *Mazda Rx- 8* at 350 kW or newer small 112 kW *Rx - 30* onboard running induction 250 kW chargers, and regenerative braking charges thermal or electric chemical battery, or both- allowing retrofitting all vehicles!

I & trains plus much higher torque.

♣ Featuring 5.55 MW *Red Sun Power Block* onboard thermal battery-turbine nuclear hydrogen / steam charging, while *AHR 88L/min* biohydrogen is generated onboard to recharge, & regenerative braking charges *Red Sun* battery also.

♣ This is the thermoelectric platform mimicking the Earth and Sun- Thermoelectric molten Ni-Fe alloy transforms 98.6% electricity to core heat in metal battery with incredible energy density-a battery as big as suitcase powers turboprop 8 hours full power (180kW).

♣ *RED SUN* uses 150 year old *Inductotherm* using EMF crucible to heat Ni-alloy used in refining www.inductotherm.com to heat metals to white hot in seconds (1500°C) like an electric stove or wireless charger.

♣ Charging like *Sun-Earth* at 98.6% efficiency without inverter in real time

WIRELESS ~ Energy ~ Battery System
Distant plants can be connected
PowerSource Batteries



PowerSource - under the covers

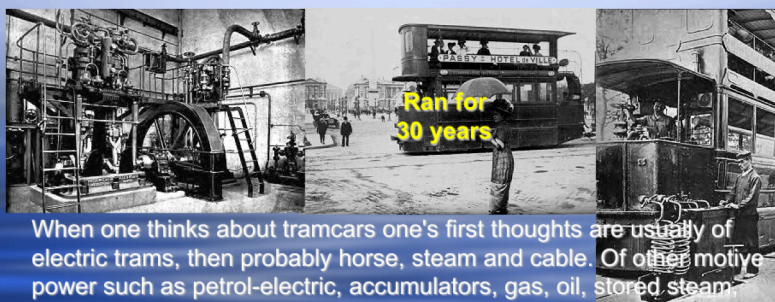
Under the skin, contained in attractive encasement, the basic PowerSource "Home" System includes the ceramic thermal cell, induction heater, controls, and steam turbine (with composite non-corroding pressure vessel, stainless steel expansion tank & return drive fluid container).

3.2MWp Energy Storage for 72 hrs to run desal, ice, steam & heat

High pressure tank w/ integrated boiler 5 kW steam turbine & alternator Expansion tank

♣ Cryo nitrogen added to all diesel rails give 3.5 x's torque and 20 kWh/L vs Diesel at 9.7 kWh/L and 700 bar hydrogen at 1.6 kWh/L. Thus, heating N₂ to 200°C gives 1500x's gas expansion triple gasoline at 1/3rd temperature! Plus, 300 x's less per L!

Compressed Air Trams/Buses



When one thinks about tramcars one's first thoughts are usually of electric trams, then probably horse, steam and cable. Of other motive power such as petrol-electric, accumulators, gas, oil, stored steam, clockwork, compressed air, etc., these we tend to dismiss as just experiments which lasted a few months at best. In the last case, compressed air trams, although we would be correct as far as the UK is concerned, we would be quite wrong if we look at France. There were six French cities and towns using compressed air, with Paris and Nantes having over 250 of these cars, which ran for more than 30 years. **RED SUN LINES** sets out to put the record straight and to give details of this perfected tramway system, the Compressed Air Tram.

Above- Nitrogen trains running 1842 to 1930s throughout Europe and parts of Americas, Africa and Switzerland ran coal N2 boiler. 150 years later coal boilette replaced by clean Red Sun Why Nitrogen

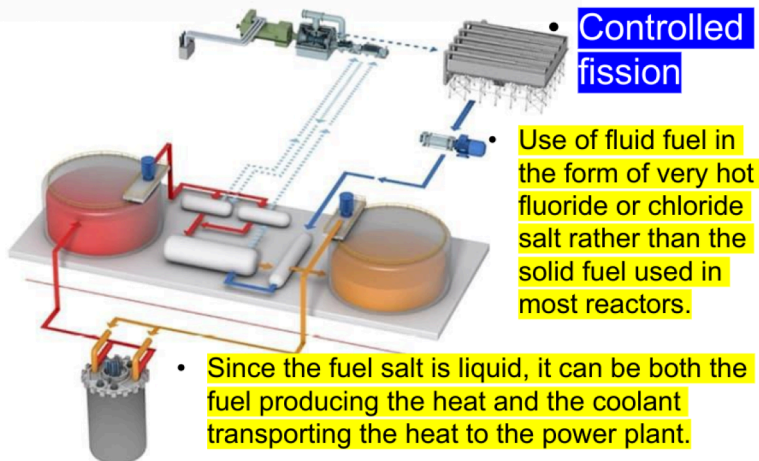
♣ All engines designed to use pure heat- Red Sun gives 1450°C pure heat non- intermittently and enables 50% longer life and half the maintenance + 25 db less noise!

♣ Thermal Nickel batteries are scalable at \$20 USD per 1 kWh capacity vs Tesla Panasonic at \$111 USD /1kWh capacity- while lithium battery 25 x's bigger vol vs Red Sun

♣ The Tesla battery is Li-ion that typically lasts 6 -8 years- vs 50 years.

♣ After the piston compresses the fuel-air mixture, the spark ignites it, causing combustion. The expansion of the combustion gases pushes the piston during the power stroke, which can be done with 3.5 x's more force or torque using cryo nitrogen at 1/11th \$\$

MSR = Radioactive waste removal + non-proliferation + safety



- **Since the MSR operates at atm. pressure it can't explode!**

The future of shipping is placing *Molten Salt Reactors* and *AHRs* on ships for propulsion and energy.

Current hydrogen regimes include costly fuel cells at \$60k, with only 25% full cycle efficiency when making green hydrogen vs Red Sun's 65% efficiency!

♣ Carbon fiber tanks are ten times more expensive than stainless steel cryo nitrogen tanks and bulky - 14 x's bigger than diesel tanks. On ships, compressed hydrogen is only allowed at 195 bar under *IMO* regulations, giving only 1/40th the energy density of heated cryo nitrogen (20 kWh/L), so tanks weigh 14 x's the weight of normal diesel ones containing equivalent energy. Plus, insurance becomes difficult and more expensive.

♣ Hydrogen H2 Mobility refueling station costs €1.9 M.

<https://interestingengineering.com/transportation/russia-nuclear-powered-icebreaker-yakutia>

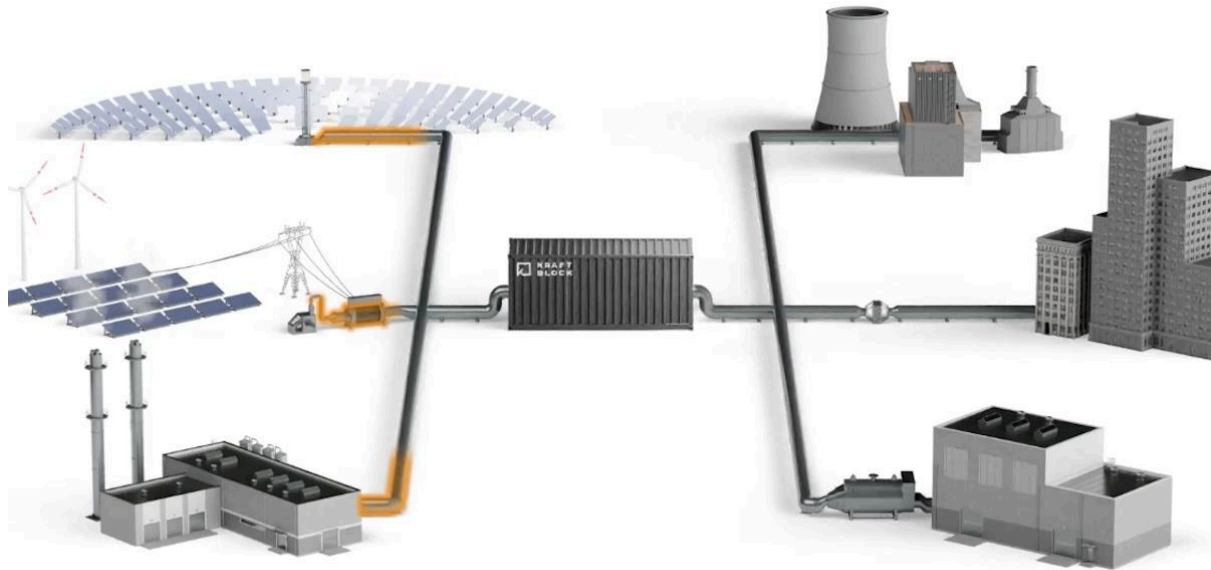
♣ **(Above link)** The future of shipping:

The future has to include the existing 27 trillion dollar transportation base and industrial engines, turbines and diesels to transition to 100% carbon free Red Sun propulsion, repowering diesels, turbines and steam with pure heat. Like the clean rating of EVs, there is no mention of the amount of CO2 created to produce the electricity to run this process. Red Sun retrofits transform all electricity And high heat to green, so that all manufacturing has a very low carbon footprint.



Retrofitting *GE Diesel Electric* locomotives and ship engine rooms, at only 18 m3, Red Sun mobile 32 MW combines existing engines with 1st mobile solid state high heat battery

that is 25 x's smaller and 10 times lighter and 5.5 x's less expensive at \$20/kWh vs. \$111/kWh for Li-ion. Only low-cost nuclear can make the *Hydrogen Economy* bloom!



Thermal storage beats hydrogen, electrification on industrial costs

<https://www.pv-magazine.com/2025/01/29/thermal-storage-beats-hydrogen-electrification-on-industrial-costs/>

Nitrogen Replaces Hydrogen for Directly Running Piston Engines with 700 x's more Power:

The element nitrogen shows extraordinary potential to transform multiple applications because it displays significant energy compared to hydrogen by 700 times, the nitrogen engine is the future. The search for renewable vehicle fuels revealed two major breakthroughs where nitrogen has proven a much more exciting option. The exceptionally potent option is 700 times stronger than hydrogen, so it can introduce a transformation to power plants and automotive manufacturing. Scientific researchers and private companies are investigating nitrogen energy technology since this old (they think its old) promises more efficient and cleaner power than standard fuels.

The renewable fuel sector has identified the abundant atmospheric element nitrogen as its new abundant power source. The production and storage of nitrogen prove easier than hydrogen because its needs neither complex nor expensive processes. The transformation of nitrogen from liquid to gas phase enables enormous expansion in engines that drive piston motion for power generation.

Using tiny amounts of heat, Red Sun thermal batteries with cryo nitrogen retrofit all diesel rail system in new format to drive diesels with expanding heated gas (1500 x's at 200°C vs gasoline at 432 x's at 600°C) as they were first originally designed to do- cleaner,, and with 3.5 x's more torque and power. The end products of nitrogen combustion mainly consist of nitrogen, making nitrogen a carbon-neutral option against fossil fuels.

The potential elimination of hydrogen fuel exists because of nitrogen technology. Hydrogen is a future fuel option, despite facing various problems with its use. The production process for hydrogen requires expensive energy and involves methods like water molecule splitting and hydrogen supercooling for liquid storage maintenance. Current hydrogen refuelling infrastructure remains poorly developed, resulting in lower convenience for broad market applications and use.

Storage and handling of nitrogen prove simpler than hydrogen execution. People can keep nitrogen in special tanks under low temperature without using 40% of the energy as required for hydrogen, thus proving better practicality and cost efficiency.

Nitrogen Powered Engines: The Actual Impact on the Environment.

The major advantage of nitrogen as a fuel stems from its negligible environmental consequences. Nitrogen based engine applications result in products based solely on oxygen and nitrogen gas emissions. The transport sector find nitrogens highly appealing (trains of 1940's to 1930's) because they help decrease carbon emissions.

Intense nitrogen emissions do cause environmental disturbance. And; scientists tackle nitrogen environmental impact issues by developing technologies that transform exhausted nitrogen emissions into safe components. Despite these challenges, the overall environmental benefits of nitrogen far outweigh its potential drawbacks.

The technological potential of nitrogen appears vast. Further advancement of nitrogen engine technology requires major investment to develop technology on a mass production scale. The widespread use of nitrogen vehicles requires developing an entire system to support their fuelling needs. Yet, the application of nitrogen technology has established itself as one of the best alternative fuel systems for the current era. The proven 80+ year track record running N2 trains becomes stronger thanks to high energy and torque capabilities and environmentally friendly properties. Plus, with Red Sun, nitrogen applications will extend to industrial and manufacturing applications, where it goes hand in glove with power applications.

Research indicates that nitrogen will gain industrial applications extending past transportation. Researchers investigate nitrogen-based applications extending into power generation systems, industrial machinery, and aerospace equipment. The constant advancement will transform nitrogen-based systems into industry-redefining entities that minimize our reliance on fossil fuels. Companies' advancement of this technology will substantially boost their ability to create a sustainable future.

19. Redstar AHR New Design Features & Material Upgrades Patent- Pending:

Design optimized every single facet of a 21st Century AHR with a perfect mix of low power electricity, isotope production physics and its latest computational method of chemical management of the multiple inorganic chemistries that need to be simultaneously tracked.

First - exploring the latent RK-4 algorithm (an industry standard), micromolar- scale filtration adjustments can initially be made 30 x's a second to both the primary core and breeder blanket chemistries.

Second - the modest pH of bith core (~3) and blanket (~4.75) are less acidic than common household balsamic vinegar.

Third - what was once a liability, AHR's small size ($r = 32.5$ cm) can be turned i to a literal gold mine. Euler's famous surface area volume formula for spheres in a fissile context equates to 'leaky' neutrons. We capitalizr on this seeming disadvantage; our design has already demonstrated (MCNP-7 neutronics software suite) less than 0.5% leakage. The reason is that we put every neutron to task.

●Twenty 1 kg (1.065 kg) slugs of pure U239 protrude radially into the core. ● The highly valuable molybdenum -99 isotope (Mo99), normally lost in all Gen III and Gen - IV reactors, can be easily harvested with our proprietary, patentable inline cartridges. ● Although low in overall

market volume, we will produce enough Po209 and Po210 to satisfy North America and Western Global markets. • The interesting gamma and neutronics behavior that Hg196 offers belies an additional bonus; transmutation into homoisotopic Au193. • The aqueous Th(NO3)4 blanket combined with some proprietary physics generates a positive breeding coefficient (1.13). This empowers us to produce pure U233 (Pa233), as either the nitrate salt or metal. The volumes are substantially enhanced in our larger ~ 1 MW design. • our LOI with Delaware- registered C- Corp called Stargena has provisionally placed our 1st order for 1 MT of the highly valuable isotope, Americum- 241 (Am241) by 2030. We have provisionally given **Stargena** a highly discounted (90%) price for Am241 of \$1500/gm, given the substantial size of the order.

Fourth - decades of research have demonstrated that certain fluoropolymers actually moderate neutron flux and increase the tensile strength while resisting embrittlement, due to polymeric cross-linking among the molecular polymeric chains themselves. Our design capitalizes upon this, using fluoropolymers as primary reactor vessel materials.

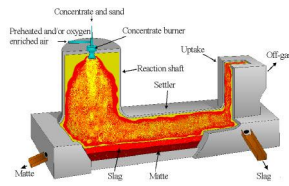
Fifth - the U233 fuel has long been known to demonstrate a positive burn profile superior to U235, while simultaneously offering the inherent, robust, non- proliferation properties of paracidic U232 co-production. Using MCNP-7, our breeder design demonstrates a positive breeding coefficient of 1.13.

Sixth - all reactor designs produce some amount of hydrogen through a radiolysis of water, a well-understood phenomenon that occurs in all fissioning environments. With our aqueous fissile core and blanket however, copious amounts of hydrogen are maximally, naturally generated. By optimizing gas management for this simple aqueous lysis, all gases produced are easily captured via their normal boiling points. When hydrogen is not needed, our “duel mode” configuration recombines the hydrogen and oxygen back into water, releasing a substantial amount of energy (285.8 MJ/mol), in a well known reaction. We recapture the energy, transforming it into electrical energy/ power, using slightly modified COTS turbines.

Seventh - Our tiny 112 kW, and near future 1 MW, reactors are deliberately designed to be in arrays. We want to have 10 - 15 (or more) reactors operating at a single location. In fact, several projects with several clients have aligned for 1000 reactors in multiple locations.

Finally- Redstar AHR reactors are both fuel and breeding agnostic. We can burn and breed whatever we choose, without any modifications to the primary design. SLOI with Am241 for \$1,500/gm as our first focus.

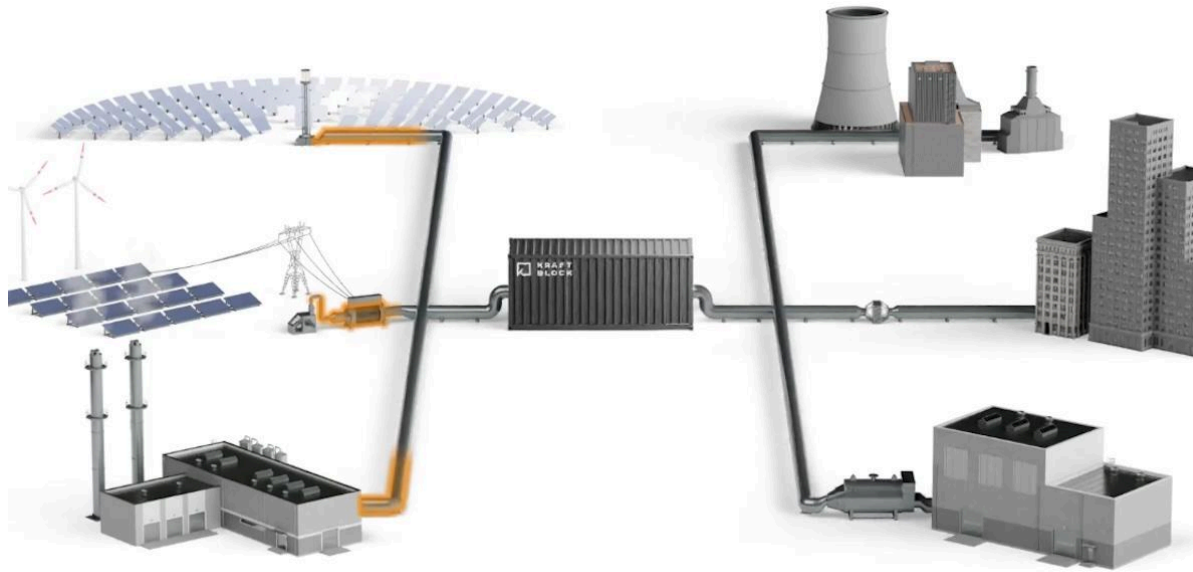
Preliminary Fuel - Isotopes for 112 kW ☆ Isotope. Price/ unit Daily Gen Unit. Mo99. \$47k/g.							
2.	mg Am241.	\$1500.	10.	mg Po210.	\$2000.	3500.	mg. Po209.
\$81.	25.	mg Np237.	\$825.	7.85.	mg H2.	\$5.	2885. gm
Power.			mode 1 & 2	-0.105.	528.	kWh_e Heat.	
2885.	kWh						



Above - Outotec flash furnace



20. Nickel & Copper Flash Smelting Run by AHR: Giving Heat and Reducing H₂ to separate out iron & impurities + electric to charge Red Sun batteries to 1850°- providing 25% of heat to smelter at 650°C to ignite metal sulfidic oxides~with exothermic sulfidic nickel and copper ores providing other 75%- to 1650°C: AHR and flash smelting furnaces are two advanced technologies that have the potential to significantly improve the efficiency and sustainability of industrial processes and together they are new home run hit- increasing efficiency by reducing energy and time requirements from 4 hours melting to 6 seconds. However, flash smelting is not known in Asia, even though it's 100 years old...used in Baltics and Scandinavia- Finland mainly.



Final Conclusions & Use In Flash Smelting:

With Redstar's focus on the lucrative Cu and Ni smelting of raw concentrates in new super- efficient 6 second flash smelting as opposed to 4.5 hour norm to produce 100 kt metal/ year for manufacturing nickel- iron alloy thermal batteries directly from concentrates for 3500/ Mt, or one-fifth retail nickel's price! Also, Redstar is the first to put together nuclear low- cost heat and electricity, and flash nickel and copper smelting. And featuring proprietary AHR and pyrolysis reactors that produce copious amounts of hydrogen and oxygen (and CO from pyrolysis syngas) to provide turnkey reducing and oxidizing gases to separate metals and slag with flash furnace and **Pierce Smith Converters** as reducers and oxidizers, making blister copper- 96% pur from concentrates in continuous process up to 1 to 10 million tons per year in large smelters. Wes ground to fine powder to be injected into **Outotec Flash Furnace** using and Red Sun to run roasting, dehydrating and initial furnace heat to oxidize sulphides that exothermically provide 3/4ths of flash furnace 1300°C heat to smelt concentrates to matte; with AHR steam electricity or ORC charging Red Sun thermal battery(ies) that run all diesel or turbine/ steam gensets to provide hydrogen and oxygen plus operational power for additional electric furnaces to recycle copper and steel and heat operations. With all inputs provided in house, Redstar's FULL VERTICAL MATERIAL AND ENERGY INTEGRATION SAVES \$180,000 per battery in nickel and metal alloy costs! This very inexpensive AHR nuclear battery charger makes electricity for only \$40/MWh in dual energy/isotope production, with 80% income from isotopes production. Moreover; Redstar will capitalize directly on AHRs high hydrogen output for reducing Cu and Ni alloy concentrates in smelters. And; low energy costs and high power greatly lower costs of smelting green metals- with 70% of the costs representing energy. Thus, the highest and best use of both AHR and Red Sun *is synergistically running Ni and Cu Flash smelter reduction furnaces together- injecting hydrogen and oxygen directly produced by AHRs radiolytic water splitting while giving 2.8c/kg hydrogen (turned into hydrogen plasma in next gen flash smelters)*. Flash smelting of copper sulphide concentrates is a modern pyrometallurgical copper making process, where the sulphide concentrates are firstly smelted to copper matte in a flash furnace, and then the matte is further converted or oxidised into metallic copper either through a Pierce Smith (PS)-converter () blowing compressed 95% oxygen through smelted Cu while still in molten state, or more recently through a flash converter. Flash smelting combines roasting and melting in one furnace with reducing and oxidizing in one step. Most of its heat comes from oxidizing Fe and S in the concentrate feed. It requires very little hydrocarbon fuel. It accounts for ~ 3/4 of Ni sulfide smelting energy to run furnaces at 1300°C through highly exothermic sulfide oxidation. Cost of 1500 ton per day **Outotec** smelter €30 million, to make 550,000 tons of blister copper per year. Blister copper made from Cu matte is 98.5% pure with black blistered surface, worth \$8,753 per ton. Thus, 500 kt is valued at \$4.4 bn USD.

are severely delayed. The degrading quality of available ores emphasizes the need for improved smelter plant operation.



Floating 70 MW Nuclear Power Plant - with 50 Gcal/hr. The plant's length is 120 meters. Ship is 140 x 30 meters.



Am241 sells for \$1500/ gm to a big nuclear battery manufacturer - **Stargen**.

China Leads world with first, Thorium Molten Salt Reactor -TMSR:

<https://youtu.be/sml7NdmQ7gc?si=Bfb-wUGUWLxsAhO3> **Why China Dominates Nuclear Power Space:**

<https://oilprice.com/Alternative-Energy/Nuclear-Power/Why-China-is-Winning-the-Nuclear-Energy-Race.html>

Nuclear plants could use three times more water than current coal plants (with exception of AHRs & MSRs, which don't use water - see above TMSR):

<https://docs.google.com/document/d/14glh-cdQcNxcMDBIhnUA0RP37MbJ6rVVT9OfCwOzuLo/edit?usp=drivesdk>

No industrial deal without power sector:

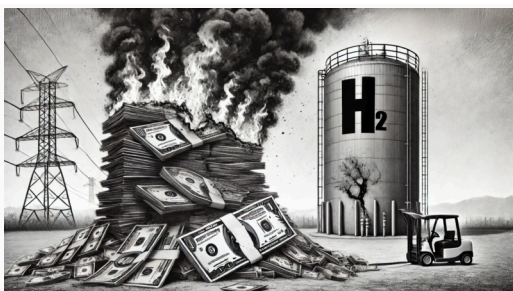
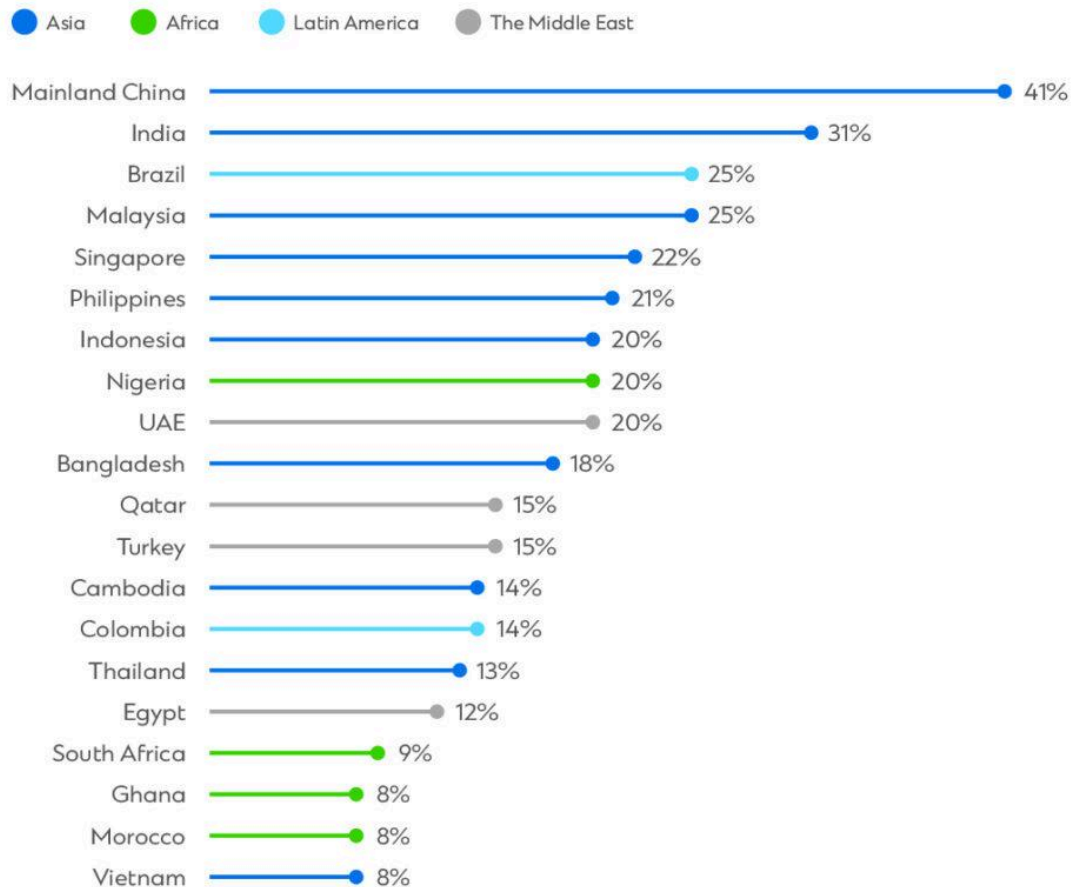
<https://www.euractiv.com/section/eet/opinion/no-industrial-deal-without-power-sector/> **Study finds health risks in switching ships from diesel to ammonia fuel**

But even the greenest ammonia generates nitrous oxide (N₂O), nitrogen oxides (NO_x) when combusted, and some of the ammonia may slip out, unburnt. This nitrous oxide would escape into the atmosphere, where the greenhouse gas would remain for more than 100 years. At the same time, the nitrogen emitted as NO_x and ammonia would fall to Earth, damaging fragile ecosystems. As these emissions are digested by bacteria, additional N₂O is produced. NO_x and ammonia also mix with gases in the air to form fine particulate matter. A primary contributor to air pollution, fine particulate matter kills an estimated 4 million people each year. "Saying that ammonia is a 'clean' fuel is a bit of an overstretch. Just because it is carbon-free doesn't necessarily mean it is clean and good for public health," Wong says.

<https://news.mit.edu/2024/study-finds-health-risks-switching-ships-to-ammonia-fuel-0711>

Philippines is one of top destinations for foreign investment:

Top 20 markets cited by western financial institutions as a priority destination for investment or business development



Debunking H2 Myths:

<https://cleantechnica.com/2025/03/11/debunking-the-myth-electrolyzing-hydrogen-for-energy-is-waste-ful-higher-emissions/>

21. Red Sun Power Block FINANCIAL PRO FORMA:

5.55 MW	
6 MW RED	
SUN + 4x	
AHR + 3 x	
Opra 16	5.55 MW POWER BLOCK FOR SHIPS

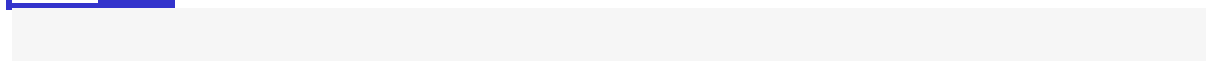
Year	0	1	2	3	4	5	6	7	8
	2025	2026	2027	2028	2029	2030	2031	2032	2033
CAPITAL EXPENDITURES (\$1000 USD)									
Equity Investment Capex	-6230								
REVENUES (\$USD)									
MWh/yr	36600	36600	36600	36600	36600	36600	36600	36600	36600
PPA Rate (\$/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Am241 + Po208,209 210 + Mo99 + Sr89 350d/yr8g/d=(g/yr)	2800	2800	2800	2800	2800	2800	2800	2800	2800
Radioisotope Sales Revenue\$2k/g(\$/yr)	5600000	5600000	5600000	5600000	5600000	5600000	5600000	5600000	5600000
Electricity Sales (\$) Revenue per PPA	3772000	3772000	3772000	3672000	3672000	3672000	3672000	3672000	3
	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Carbon Credits (t) 0.553 tCO2/MWh	20,240	20240	20240	20240	20240	20240	20240	20240	20240
Carbon Credits (\$) \$24/tCO2 Ave. 2024	485,700	485700	485700	485700	485700	485700	485700	485700	485700
Production Incentive Payments	0	0	0	0					
TOTAL REVENUE	9858000	9858000	9858000	9858000	9858000	9858000	9858000	9858000	9858000
EXPENSES (\$1000)									
Operations & Maintenance	445	446.35	447.741	449,173	450,648	452,167	453,732	455,344	
Contingency Fund	25	25,5	26,01	26,53	27,061	27,602	28,154	28,717	
Project Management Fee	70	71,4	72.828	74.29	75.77	77.29	78.83	80.41	
Insurance	21	21.42	22	22.3	22.7	23.2	23.65	24.12	
Property Tax	99	99	99	99	99	99	99	99	
Leaseholder Payments 48 mo	248	248	248	248	248	248	248	248	
Admin/Financial/Leg al Management	5	5,1	5,202	5.31	5.41	5.55	5.63	5.74	

Production Tax Expense	12.1	12.2	12.5	12.8	12.9	13.0	13.2	13.3
Warranty Expense	20	20.4	20.81	21.22	21.65	22.3	22.87	23.47
Shipping costs of radioisotopes	35	35	35	35	35	35	35	35
Personnel	320	320	320	320	320	320	320	320
purchasing night hydroelec	900	900	900	900	900	900	900	900
Annual total Opex	2204	2204	2204	2204	2204	2204	2204	2204

EBITDA & Taxable Income (\$1000 USD)

EBITDA	7654	7654	7654	7654	7654	7654	7654	7654
Depreciation	625	625	625	625	625	625	625	625
Debt Interest Payment	253	253	253	253	253	253	253	253
Total Annual Expenses	3082	3082	3082	3082	3082	3082	3082	3082
Income								
Accumulated	6776	13552	20328	27040	33880	40660	47432	54208
Taxable Income	6776	6776	6776	6776	6776	6776	6776	6776
Return on Investment %108%	216%	325%	434%	542%	650%	759%	867%	

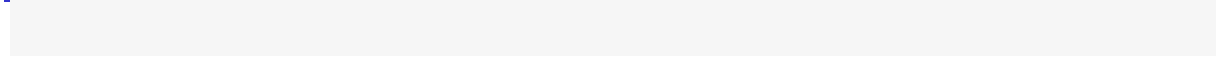
TAXES



22. Appendix 1.
MAERSK Turning
To Nuclear to power
cargo ships with
 custom \$8M H2
 engines

UCLEAR
 TO
 POWER
 cargo

H2
engines



Updated: August 16, 2024

Can Nuclear Power Propel Maritime into a **Zero-Emission** Era? Maersk to Explore Nuclear for Ships

Nuclear energy is emerging as a potential game-changer for the maritime shipping industry, which currently relies heavily on fossil fuels. With global shipping responsible for nearly 3% of greenhouse gas emissions, there's a pressing need to explore cleaner energy alternatives. And the integration of nuclear power into the maritime shipping industry is gaining momentum as a promising solution to achieve zero-emission shipping.

Danish shipping giant Maersk has joined forces with Lloyd's Register (LR) and UK-based Core Power to explore the potential for nuclear-powered container shipping in Europe. This collaboration represents a significant step in the maritime industry's efforts to decarbonize.

Teaming Up for Nuclear-Powered Shipping

The study will focus on the feasibility of using a fourth-generation nuclear reactor for powering container ships. Unlike traditional nuclear reactors, these small and mass-produced reactors are designed to consume less nuclear fuel while being less powerful. The partnership will evaluate the necessary regulatory frameworks and safety requirements to operate nuclear-powered vessels in European waters.

Maersk's head of fleet technology, Ole Graa Jakobsen, acknowledged the challenges associated with nuclear power while also noting that if these challenges can be overcome, nuclear power could become a viable decarbonization option for the logistics industry within the next 10 to 15 years.

Nick Brown, CEO, Lloyd's Register, remarkably highlighted the role of nuclear in the maritime industry saying that: *"A multi-fuel pathway to decarbonising the maritime industry is crucial to ensuring we as an industry meet the IMO's emission reduction targets and nuclear propulsion shows signs of playing a key role in this energy transition."*

Core Power's CEO, Mikal Bøe, echoed Brown's sentiment noting that "there's no net zero without nuclear." The maritime sector has been increasingly considering nuclear fuel as a potential solution to reduce its carbon footprint. A survey conducted by the International Chamber of Shipping in May 2022 highlighted growing interest in nuclear-powered commercial ships, with some experts predicting their viability within the next decade.

The collaboration between Maersk, LR, and Core Power signals a forward-looking approach to addressing the environmental impact of shipping.

Advanced Nuclear Reactors: The Next Frontier in Maritime Decarbonization:

Nuclear power has a long history of use in naval vessels since the 1950s, and its application in commercial maritime shipping is being revisited due to the urgent need for decarbonization. The U.S. is exploring the potential of marinized nuclear reactors to replace aging fleets and meet the International Maritime Organization's (IMO) target of a 50% reduction in CO2 emissions by 2050.

Among various types of nuclear energy technologies available, SMRs (small modular reactors) are particularly appealing for maritime applications due to their compact size and enhanced safety features.

SMRs are smaller and more flexible than traditional nuclear reactors, making them suitable for installation on ships. SMRs could provide ships with a steady supply of power, enabling them to travel long distances without the need for frequent refueling stops. This could be especially beneficial for large cargo ships and icebreakers operating in remote areas.

MSRs, a type of SMR, offer even greater potential with their ability to operate on various fuel cycles, including thorium, and provide extended refueling intervals.

Countries like the U.S., South Korea, and Denmark are at the forefront of developing these reactors.

Why Nuclear Power Could be the Key:

One of the most compelling reasons to consider nuclear energy for maritime shipping is its potential to reduce GHG emissions. Nuclear-powered ships do not emit carbon dioxide during operation, unlike conventional ships that burn fossil fuels. More notably, nuclear generates 4x less carbon emission than solar farms.

Additionally, nuclear energy produces minimal waste compared to fossil fuels, and advances in waste management have made it safer and more manageable.

Moreover, nuclear energy offers a high level of energy security and independence for ships. Unlike fossil fuels, which are subject to price fluctuations and geopolitical tensions, nuclear fuel is abundant and can be sourced from multiple countries.

However, while the potential of nuclear-powered ships is significant, there are challenges related to regulatory approval, public perception, and the high initial costs of reactor development. Still, countries like Russia, China, and the U.S. are making strides in overcoming these hurdles.

Russia, for example, already operates nuclear-powered icebreakers and floating power plants, demonstrating the feasibility of nuclear technology in harsh marine environments.

In the U.S., the adoption of nuclear power in maritime shipping could revitalize the domestic fleet, particularly under the Jones Act. The regulation mandates that goods transported between U.S. ports must be carried on U.S.-built and operated ships.

Could Nuclear Power Revolutionize Shipping?

The development of SMRs and advances in nuclear technology are making it increasingly feasible for commercial vessels to be powered by nuclear energy. However, careful consideration of safety, regulatory, and public perception issues will be crucial as the industry moves forward.

In conclusion, nuclear energy presents a promising opportunity for the maritime shipping industry to reduce its environmental impact and increase energy security. While there are still many challenges to overcome, the potential benefits make it an option worth exploring. With continued research and development, as well as the establishment of appropriate regulatory frameworks, nuclear-powered commercial shipping could become a reality in the coming decades.

74.61	-0.07%
78.50	0.

Global nuclear energy production is set to reach a record high in 2025, driven by increased investment and growing demand. The resurgence of nuclear power is by factors such as the need for reliable, baseload power and the growing concerns about climate change. However, the concentration of nuclear technology supply chains in China and Russia poses risks to global energy security and could undermine Western sanctions against Russia. The world will generate more nuclear energy in

2025 than it ever has before. A brand new report from the International Energy Agency (IEA) says that “the market, technology and policy foundations are in place for a new era of growth in nuclear energy over the coming decades.” The public and private sectors alike are realigning in support of nuclear energy expansion for the first time in decades as nuclear presents an increasingly tempting solution to satisfying ever-expanding energy needs while also meeting decarbonization targets. “It’s clear today that the strong comeback for nuclear energy that the IEA predicted several years ago is well underway, with nuclear set to generate a record level of electricity in 2025,” stated IEA Executive Director Fatih Birol in relation to the publication of last week’s report. “In addition to this, more than 70 gigawatts of new nuclear capacity is under construction globally, one of the highest levels in the last 30 years, and more than 40 countries around the world have plans to expand nuclear’s role in their energy systems.”

While the drawbacks of nuclear energy are well-known and multiple – the million-year challenge of nuclear waste management, high up-front costs, and a handful of high-profile nuclear disasters – its backers argue that these downsides do not come close to eclipsing nuclear energy’s many benefits. As solving the global energy trilemma – providing, sufficient, clean, and affordable energy – becomes increasingly difficult as well as dire, nuclear energy advocates say that we can no longer afford to ignore the solutions that nuclear energy offers. Critically, nuclear fission is a proven zero-carbon technology that can produce ‘clean’ electricity around the clock and according to demand, unlike variable renewable energies such as wind and solar.

As a result, global investment in nuclear power is sharply on the rise. Annual investments in the revitalized sector are projected to reach a whopping \$75 billion by 2030, and 63 reactors are currently being constructed. When they’re finished, they will bring an additional 70 gigawatts of added capacity

“That growth can partly be attributed to rising private sector interest, in particular to meet the round-the-clock energy needs of data centers,” the news outlet Semafor reported last week. Indeed, the tech sector has thrown its weight behind nuclear expansion, research, and development in a big way in recent years as Silicon Valley’s energy demands explode.

Oil Executives Fume as Trump Shakes Up Climate Rules Again Coal Continues to Dominate China's Energy Landscape <https://www.euronuclear.org/glossary/boiling-water-reactor/> GE Hitachi Nuclear Energy’s BWRX-300 features an innovative and simplified configuration.



Appendix II - Why China Is Building a *Molten-Salt Reactor*. REDSTAR IS MAKING NEW neutron-proof neutron collector blankets, for Thorium and *all reactors*, out of fluorine crystal that is corrosion-proof.. This reactor and blanket is neutron, acid and heat proof up to 1800°C and last 100 years.

EnergyFeature

Why China Is Building a Thorium Molten-Salt Reactor

China’s demo reactor could breed nuclear fuel from rare earth waste

After a half-century hiatus, thorium has returned to the front lines of nuclear power research as a source of fuel. In 2025, China plans to start building a demonstration thorium-based molten-salt reactor in the Gobi Desert. The 10-megawatt reactor project, managed by the Chinese Academy of Sciences’ Shanghai Institute of Applied Physics (SINAP), is scheduled to be operational by 2030, according to an environmental-impact report released by the Academy in October. The project follows a 2-MW experimental version completed in 2021 and operated since then. China’s efforts put it at the forefront of both thorium-based fuel breeding and molten-salt reactors. Several companies elsewhere in the world are developing plans for this kind of fuel or reactor, but none has yet operated one. Prior to China’s pilot project, the last operating molten-salt reactor was Oak Ridge National Laboratory’s Molten Salt Reactor Experiment, which ran on uranium. It shut down in 1969.

Green steel & Ammonia investments dropped by over 50% in 2024 (because the costs of green hydrogen and renewable electricity makes them untenable and uneconomic)<https://cleantechnica.com/2025/02/18/investments-in-green-steel-ammonia-plummeted-in-2024/>

Appendix III - 5.55 MW Red Sun POWER BLOCK pro forma 16 gm Am241/Po208, 209, 210 per day...yearly total 5600 gm - total income \$15.5 M/ yr

5.55 MW
6 MW RED
SUN + 4x
AHR + 3 x
Opra 16 5.55 MW POWER BLOCK FOR SHIPS

Year	0	1	2	3	4	5	6	7	8
	2025	2026	2027	2028	2029	2030	2031	2032	2033
CAPITAL EXPENDITURES (\$1000 USD)									
Equity Investment Capex	-6230								
REVENUES (\$USD)									
MWh/yr		36600	36600	36600	36600	36600	36600	36600	36600
PPA Rate (\$/kWh)		0.12	0.12	0.12	0.12	0.12	0.12	0.121	0.12
Am241 + Po211 350d/yx8g/d=(g/yr)		5600	5600	5600	5600	5600	5600	5600	5600
Radioisotope Sales			1120000					1120000	
Revenu\$2k/16g(\$/y)		11200000	0	1120000	1120000	1120000	1120000	0	11200000
Electricity Sales (\$)									
Revenue per PPA		3772000	3772000	3772000	3672000	3672000	3672000	3672000	3672000
Green Tag Rate		0	0	0	0	0	0	0	0

Green Tag Sales Revenue	0	0	0	0	0	0	0	0
Carbon Credits (t) 0.553 tCO2/MWh	20,240	20240	20240	20240	20240	20240	20240	20240
Carbon Credits (\$) \$24/tCO2 Ave. 2024	485,700	485700	485700	485700	485700	485700	485700	485700
Production Incentive Payments	0	0	0	0				
TOTAL REVENUE	15458	15458	15458	15458	154458	15458	15458	15458
EXPENSES (\$1000)								
Operations & Maintenance	445	446.35	447.741	449,173	450,648	452,167	453,732	455,344
Contingency Fund	25	25,5	26,01	26,53	27,061	27,602	28,154	28,717
Project Management Fee	70	71,4	72.828	74.29	75.77	77.29	78.83	80.41
Insurance	21	21.42	22	22.3	22.7	23.2	23.65	24.12
Property Tax	99	99	99	99	99	99	99	99
Leaseholder Payments 48 mo	248	248	248	248	248	248	248	248
Admin/Financial/Legal Management	5	5,1	5,202	5.31	5.41	5.55	5.63	5.74
Production Tax Expense	12.1	12.2	12.5	12.8	12.9	13.0	13.2	13.3
Warranty Expense	20	20.4	20.81	21.22	21.65	22.3	22.87	23.47
Shipping costs of radioisotopes	35	35	35	35	35	35	35	35
Personnel	320	320	320	320	320	320	320	320
purchasing night hydroelec	900	900	900	900	900	900	900	900
Annual total Opex	2204	2204	2204	2204	2204	2204	2204	2204
EBITDA & Taxable Income (\$1000 USD)								
EBITDA	13254	13254	13254	13254	13254	13254	7654	7654
Depreciation	625	625	625	625	625	625	625	625
Debt Interest Payment	253	253	253	253	253	253	253	253
Total Annual Expenses	3082	3082	3082	3082	3082	3082	3082	3082
Income								
Accumulated	10252	20504	30756	41000	51260	61512	71764	82016
Taxable Income	10252	10252	10252	10252	10252			



73.61 -0.22%

77.29



Red Sun Power Block FINANCIAL PRO FORMA:

5.55 MW
6 MW RED
SUN + 4x
AHR + 3 x
Opra 16 5.55 MW POWER BLOCK FOR SHIPS

Year	0	1	2	3	4	5	6	7	8
	2025	2026	2027	2028	2029	2030	2031	2032	2033

CAPITAL EXPENDITURES (\$1000 USD)

Equity
Investment
Capex -6230

REVENUES (\$USD)

MWh/yr	36600	36600	36600	36600	36600	36600	36600	36600	36600
PPA Rate (\$/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Am241 + Po211 350d/yr8g/d=(g/yr)	2800	2800	2800	2800	2800	2800	2800	2800	2800
Radioisotope Sales Revenue\$2k/g(\$/yr)	5600000	5600000	5600000	5600000	5600000	5600000	5600000	5600000	5600000
Electricity Sales (\$) Revenue per PPA	3772000	3772000	3772000	3672000	3672000	3672000	3672000	3672000	3672000
Green Tag Rate	0	0	0	0	0	0	0	0	0
Green Tag Sales Revenue	0	0	0	0	0	0	0	0	0
Carbon Credits (t) 0.553 tCO2/MWh	20,240	20240	20240	20240	20240	20240	20240	20240	20240
Carbon Credits (\$) \$24/tCO2 Ave. 2024	485,700	485700	485700	485700	485700	485700	485700	485700	485700
Production Incentive Payments	0	0	0	0					

TOTAL REVENUE	9858000	9858000	9858000	9858000	9858000	9858000	9858000	9858000
EXPENSES (\$1000)								
Operations & Maintenance	445	446.35	447.741	449,173	450,648	452,167	453,732	455,344
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Insurance	21	21.42	22	22.3	22.7	23.2	23.65	24.12
Property Tax	99	99	99	99	99	99	99	99
Leaseholder Payments 48 mo	248	248	248	248	248	248	248	248
Admin/Financial/Legal Management	5	5,1	5,202	5.31	5.41	5.55	5.63	5.74
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Shipping costs of radioisotopes	35	35	35	35	35	35	35	35
Personnel	320	320	320	320	320	320	320	320
purchasing night hydroelec	900	900	900	900	900	900	900	900
Annual total Opex	2204	2204	2204	2204	2204	2204	2204	2204
EBITDA & Taxable Income (\$1000 USD)								
EBITDA	7654	7654	7654	7654	7654	7654	7654	7654
Depreciation	625	625	625	625	625	625	625	625
Debt Interest Payment	253	253	253	253	253	253	253	253
Total Annual Expenses	3082	3082	3082	3082	3082	3082	3082	3082
Income								
Accumulated	6776	13552	20328	27040	33880	40660	47432	54208
Taxable Income	6776	6776	6776	6776	6776	6776		

74.61	-0.07%
78.50	

Appendix III - 5.55 MW Red Sun POWER BLOCK pro forma 16 gm Am241/Po208, 209, 210 per day...yearly total 5600 gm - total income \$15.5 M/ yr

5.55 MW	
6 MW RED	
SUN + 4x	
AHR + 3 x	
Opra 16	5.55 MW POWER BLOCK FOR SHIPS

Year	0	1	2	3	4	5	6	7	8
	2025	2026	2027	2028	2029	2030	2031	2032	2033
CAPITAL EXPENDITURES (\$1000 USD)									
Equity Investment Capex	-6230								
REVENUES (\$USD)									
MWh/yr	36600	36600	36600	36600	36600	36600	36600	36600	36600
PPA Rate (\$/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Am241 + Po211 350d/yr8g/d=(g/yr)	5600	5600	5600	5600	5600	5600	5600	5600	5600
Radioisotope Sales Revenue\$2k/16g(\$/y)	11200000	11200000	11200000	11200000	11200000	11200000	11200000	11200000	11200000
Electricity Sales (\$)									
Revenue per PPA	3772000	3772000	3772000	3772000	3772000	3772000	3772000	3772000	3772000
Green Tag Rate	0	0	0	0	0	0	0	0	0
Green Tag Sales Revenue	0	0	0	0	0	0	0	0	0
Carbon Credits (t) 0.553 tCO2/MWh	20,240	20240	20240	20240	20240	20240	20240	20240	20240
Carbon Credits (\$) \$24/tCO2 Ave. 2024	485,700	485700	485700	485700	485700	485700	485700	485700	485700
Production Incentive Payments	0	0	0	0					
TOTAL REVENUE	15458	15458	15458	15458	15458	154458	15458	15458	15458

EXPENSES (\$1000)

Operations & Maintenance	445	446.35	447.741	449,173	450,648	452,167	453,732	455,344
Contingency Fund	25	25,5	26,01	26,53	27,061	27,602	28,154	28,717
Project Management Fee	70	71,4	72.828	74.29	75.77	77.29	78.83	80.41
Insurance	21	21.42	22	22.3	22.7	23.2	23.65	24.12
Property Tax	99	99	99	99	99	99	99	99
Leaseholder Payments 48 mo	248	248	248	248	248	248	248	248
Admin/Financial/Legal Management	5	5,1	5,202	5.31	5.41	5.55	5.63	5.74
Production Tax Expense	12.1	12.2	12.5	12.8	12.9	13.0	13.2	13.3
Warranty Expense	20	20.4	20.81	21.22	21.65	22.3	22.87	23.47
Shipping costs of radioisotopes	35	35	35	35	35	35	35	35
Personnel	320	320	320	320	320	320	320	320
purchasing night hydroelec	900	900	900	900	900	900	900	900
Annual total Opex	2204	2204	2204	2204	2204	2204	2204	2204

EBITDA & Taxable Income (\$1000 USD)

EBITDA	13254	13254	13254	13254	13254	13254	7654	7654
Depreciation	625	625	625	625	625	625	625	625
Debt Interest Payment	253	253	253	253	253	253	253	253
Total Annual Expenses	3082	3082	3082	3082	3082	3082	3082	3082
Income								
Accumulated	10252	20504	30756	41000	51260	61512	71764	82016
Taxable Income	10252	10252	10252	10252	10252	10252		



