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VALAR ATOMICS

INTRODUCTION TO VALAR ATOMICS

Why Valar Exists

Where we started

To understand the story of Valar Atomics, we must look over our shoulders into history, and understand the fundamentals that lead to the advancement of humanity.

There are three pillars that support human prosperity and economic development: Intelligence, Dexterity, and Energy. Intelligence is the ability to understand reality, and what actions need to be taken to manipulate reality to mankind's benefit. Dexterity is the physical ability to execute those actions. Energy is the ultimate cost that reality charges for making changes in the scheduled program of dissipation and disorder.

A few millennia ago, very little leverage was available to move the needle on those three pillars. Some humans knew that wheels could increase the amount of grain livestock could move by pulling carts rather than having sacks slung over their backs, but overall, man's intelligence was limited to the knowledge that survival required food, and food could be produced by physically placing seeds in the ground and tending livestock for slaughter.

The Romans made advancements in their ability to transport water to urban centers and build a network of roadways to ease travel, but the hockey stick of progress only went skyward when the industrial revolution took place. We discovered that there was energy trapped in these black rocks called coal, and that if we harnessed this energy we could move ships across the sea without relying on wind, or even create rudimentary robots to mimic some of the less complex forms of dexterity that humans alone were capable of previously.

Where we are today

Fast forward to the 21st century: Intelligence is experiencing a revolution, with many low-value labor sets being rapidly replaced by LLMs. Dexterity is experiencing a similar revolution: there are a host of highly detailed and repeatable tasks in which robots far outstrip the finest craftsman's ability. But what happened to energy?

Oil came in the late 19th century. At first, we harvested oil nearly exclusively from whales, and both the supply and the products available from whale oil were extremely limited. The discovery of coal and coal slurries fueled the industrial revolution, but we quickly discovered that drilling for and refining numerous grades of crude oil directly from the earth's crust provided the holy grail of energy: a liquid fuel.

Each change in the source of energy brought with it a rapid decrease in the cost per joule and an increase in the utility of the fuel. But in the last 50 years, that decreasing cost has come grinding to a halt. For the first time in the history of humanity, the cost of a joule *increased* from one generation to the next. The reason for this stall? We've already made the system of extracting and processing hydrocarbons from the crust of the earth as efficient as we can. The technology is as mass-scale and mature as it can get.

It is time for the next fundamental source to take its place as the primary generator of energy for mankind. The solution has eluded us for decades, but it is now time. **We believe that finally, after 80 years of waiting, Valar Atomics will usher in the Atomic Age of mankind.**

Why keep producing hydrocarbons? Aren't they bad?

At this point in the story, you may be asking - but hydrocarbons are bad, right? We stopped using coal (sort of), so aren't we going to stop using gasoline, diesel, jet fuel, propane, and methane as well? Aren't we making everything electric?

Many things will be electrified, but most will not! It turns out that hydrocarbons are irreplaceable. Allow me to illustrate with a few examples.

1. Next time you're fueling up your car, think for a moment about the energy flowing into your vehicle's fuel tank. The continuous transference of energy from the gas station into your vehicle is equivalent to roughly **half** of the average US city's electrical grid capacity.
2. Try to imagine modern jet transportation without hydrocarbons. In order to generate the continuous energy required for an Airbus A330 to cruise, you would need approximately **360,000 square meters** of solar panels. Even if you could afford that many solar panels (and 90 acres of land) to provide the energy for your jet, storing that energy onboard the aircraft is its own problem. The amount of lithium ion batteries to store the energy required for an international flight would weigh 12,250,000 lbs; more than 27x the maximum weight of the aircraft. In other words, it's impossible. Luckily, thanks to Jet A hydrocarbon fuel, Airbus A-330's do this incredible feat every day, easily storing all the energy needed in its thin wings!

There is nothing that comes close to hydrocarbon fuels on several fronts: liquid fuels such as gasoline can be transported easily, for far less cost than the value of the energy stored in their weight. For example, jet fuel is **sixty-five times** more energy dense than the most advanced lithium ion batteries.

So, how can we continue to use this incredible fuel source? The answer is not drilling, transporting crude oil to refineries, refining various grades of crude, and transporting that final product to its end user. This model has gotten as cheap as it can. We must break out of that technology paradigm if we want to make energy ten times cheaper again, like our ancestors before us. **The answer is Valar Atomics.**

Nuclear Energy is the Solution

Next time you encounter a piece of gravel, pick it up, and take a good look. The average piece of gravel is 3 parts per million uranium, 7 parts per million thorium. Overall, it is 0.001% fissionable material.

Let's rewind to the moment that we, as humans, discovered that coal burned at scale could power the next stage of human advancement. Imagine now that you are holding that piece of coal in one hand, and the piece of gravel (seriously, any piece of gravel) in the other.

One of the most shocking things about the discovery of atomic energy is that it implies *the piece of gravel you're holding in your hand has more potential energy than the coal you're holding in the other.* Imagine if someone from 1920 were told that in a few years, they would discover that *the entire world is essentially coal, except even better*.

One vial of uranium that you can hold in the palm of your hand and hardly feel any weight, contains enough energy to power the average US home for 12 years. The cost of that vial is around $50 on today's uranium market.

This fundamental paradigm shift is impossible to overstate. Compared to current energy costs, the discovery of atomic energy is like finding the Cave of Wonders in mankind's backyard.

So why is nuclear so expensive, and how are you different?

This is a very long question to answer. In a separate document, we have detailed the cost structure from beginning to end of existing nuclear construction, its failure points, and how Valar Atomics is orders of magnitude different. Please, feel free to pause here, and request this document if you have not already read it. For now, I'll summarize as follows:

By searching on YouTube, you can find some old clips of Elon Musk in the early 2000s explaining why SpaceX was going to be able to get payload to orbit in a mere fraction of the cost that NASA was doing it. These videos are interesting because he struggles to

explain why SpaceX will be so different from the rest. It turns out that it's actually harder to explain the technological irrationalities of a system with broken incentives and bad market dynamics than it is to simply stand at the correct starting point and design within the constraints of physics. 15 years later, his stuttering does not matter. The Falcon 9 is putting kilograms into orbit for approximately 25x less cost than the space shuttle – retail!

Valar Atomics is in a similar position. The existing nuclear industry is a basket case of bad incentives, cost plus contracting, unscalable and unrepeatable expenditures, and of course unconscionable delays. It is harder to unravel the mess than it is to build a new model from scratch.

In short, we believe that a single company building many small reactors in a factory and then installing them quickly, side by side, *on the same physical site* will create far cheaper energy than many companies site-building huge reactors very slowly across many different sites. The differences seem subtle, but we believe these changes would amount to a 32x reduction in cost per output power, relative to recent attempts at building nuclear power generation. This is perhaps the greatest physics gap in history; energy is worth about $8T per year, and we can make it so much cheaper.

	Traditional Nuclear	Valar Atomics
Supply chain structure	Many integrators + thousands of suppliers	Valar Atomics verticalizing 80%
Reactor count	Tens	Thousands
Reactor size	Very large (thousands of MW)	Small (tens to hundreds of MW)
Production method	Site-built	Factory-built
Time-to-criticality of each reactor	86 months	1 month
Number of sites	Hundreds	1-3

But there's a hidden flaw in the above formulation for cheap atomic energy: it assumes that you can install *massive amounts* of nuclear power in a single location and sell the product *globally*. This is a vitally important piece of the puzzle. One of the primary causes for the stratospheric costs of atomic energy has been its distributed nature. **You must be able to install many gigawatts of power to a single site in order to unlock the order-of-magnitude cost decreases.**

The problem with this is that **electricity is not a commodity.** Without massive, complex, and politically prohibited projects, there is no way today to produce massive amounts of electricity in a single location and sell it all over the world. The largest nuclear sites in the world cap out at around 8 gigawatts. To reach 30x lower cost of energy, Valar Atomics will construct sites with more than 100 gigawatts of installed power. But if electricity cannot be globally distributed, how do we sell the power?

We do it by converting the heat energy of atomic reactions directly into chemical energy in the form of hydrocarbons. This distinction – the goal and capability of using the existing multi-trillion dollar hydrocarbon industry to distribute and sell our cheap energy – is the deepest secret of Valar Atomics' eventual success.

Bringing Nuclear and Hydrocarbons Together

Hydrocarbons are consumed all over the world: transporting us on land and through the air, generating electricity for use in our homes and electric vehicles, powering everything from our military's tanks and APC's to our sedans, from the Boeing 787 Dreamliner to the Cessna 172 flying in to your local airport.

How does the marriage between these incredibly valuable fuels and nuclear energy generation happen?

Every engine fueled by hydrocarbons generates useful work by burning the fuel, i.e., by bonding the carbon and hydrogen contained in the fuel with oxygen, producing carbon dioxide and water. Valar Atomics is in the business of reversing this process. We simply need an energy source cheap enough that we can continuously regenerate the fuel from its byproducts.

Fortunately, nuclear energy is that source!. We have already discussed the incredible amount of energy contained in fissionable materials - the only task left is to create Ward One: a mass-produced system splits uranium atoms and harnesses the heat energy to split hydrogen from water ($\mathbf{H}_2O$) and combines it with carbon in carbon dioxide ($\mathbf{C}O_2$) to create valuable and energy dense hydrocarbons.

By reversing combustion, we turn hydrocarbon fuels into a battery – the transportation rails for atomic energy. We also turn them into an infinitely renewable resource.

Rather than geographically-bound electricity, Valar Atomics is making a product that can be transported to any market in the world from our energy generation site. Thanks to nuclear fission, that fuel will be generated from thin air at 35% the cost of hydrocarbons procured by traditional methods.

Essentially, we convert the abundant energy from low cost nuclear fuel (uranium and thorium) into high-density hydrocarbon fuels which the world already consumes; but at a far lower cost than they can be drilled and refined.

This work must be completed. It is crucial to the advancement of mankind. By accomplishing this mission, we will reshape the energy map of the globe and eventually the solar system, enabling the next step in mankind's economic development and prosperity.