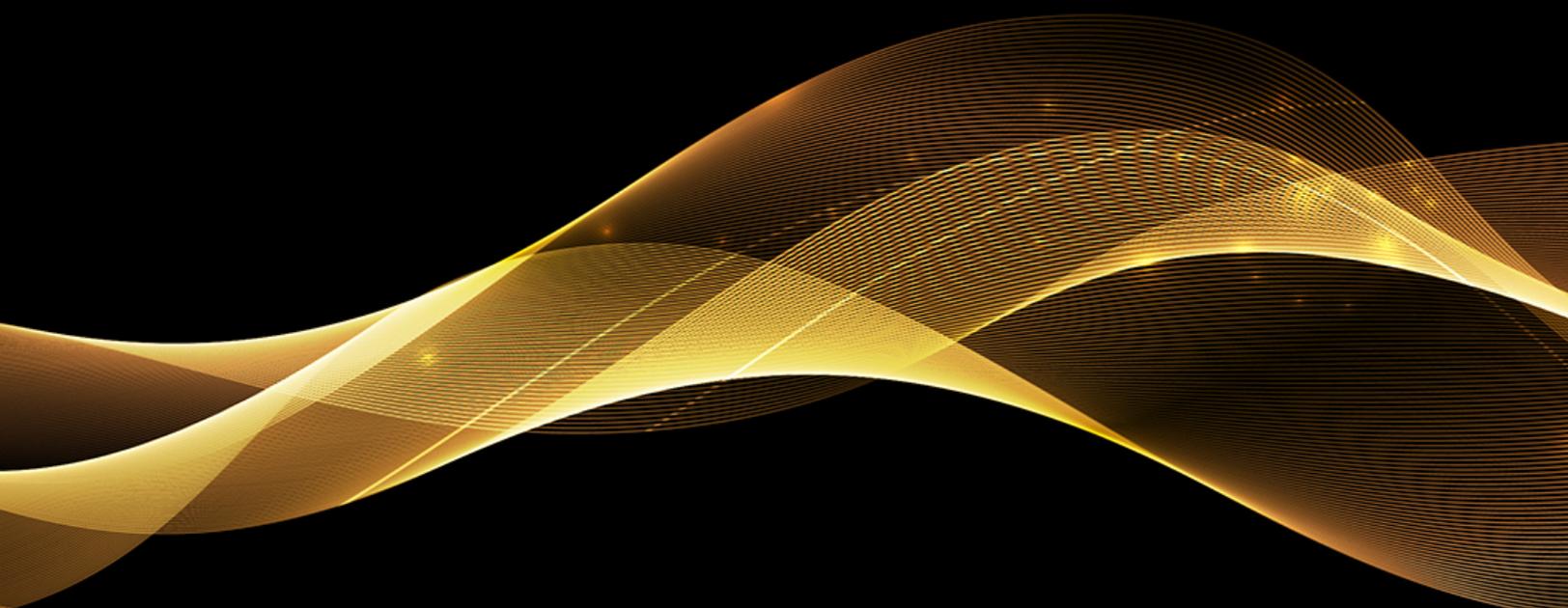




# ASH ELEMENTS



## Whitepaper v3.10

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December 2018

[www.ashelements.io](http://www.ashelements.io)

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## Commitment To Transparency

We are committed to being a fully regulated Asset Backed Token within the United States of America. This is our obligation to our token holders to embrace full transparency and accountability with a governing regulatory body. This commitment ensures accountability and viability of the coal ash backed asset token.

## Ash Elements Disclaimer

This version of the Ash Elements whitepaper is released as a working draft with the sole purpose of introducing the many value propositions of Rare Earth Elements (REE) found in coal ash and the benefits of the Ash Elements (AE) token. The objective of this draft release is to receive feedback from the blockchain and coal ash community. If you wish to contribute with comments or care to be a reviewer, please email us at [info@AshElements.io](mailto:info@AshElements.io)

This document does not constitute a prospectus of any kind. This document presents a description of the Ash Elements Token ecosystem and the functionality of the Ash Elements Tokens.

An Ash Elements Token represents physical title to one ton of coal ash at a specific basin. The token also clearly defines specifications of the ash, delivery mechanics, and other important contractual provisions. Ash Elements token does not represent ownership or equity in any company. Nothing herein constitutes an offer to sell, or the solicitation of an offer to buy, any tokens, nor shall there be any offer, solicitation or sale of Ash Elements tokens in any jurisdiction in which such offer, solicitation or sale would be unlawful. You should carefully read and fully understand this whitepaper and any updates.

In the future potential token purchasers will be required to undergo an on-boarding process that includes identity verification and certain other documentation, which you should read carefully and understand fully as it is legally binding. Please ensure you

consult with appropriate advisors. The Ash Elements token framework is committed to full Know Your Customer KYC compliance.

This whitepaper describes our current vision for the Ash Elements token. While we intend to attempt to realize this vision, please recognize that it is dependent on a number of factors and subject to a number of risks. It is possible that the Ash Elements vision will not be implemented or adopted, or that only a portion of our vision will be realized. We do not guarantee, represent or warrant any of the statements in this white paper, because they are based on our current beliefs, expectations and assumptions, about which there can be no assurance due to various anticipated and unanticipated events that may occur.

Please know that we plan to work hard in seeking to achieve the vision laid out in this white paper, but it may not come to fruition. Blockchain, cryptocurrencies and other aspects of this technology and related markets are in their infancy and will be subject to many challenges, competitors, and a changing environment. We will try to update our community as things evolve and change, but undertake no obligation or commit to do so.

## ASH Elements Mission Statement

The mission of ASH Elements is to turn a liability into an environmentally responsible asset, help create a domestic supply of rare earth elements, provide a store of value for investors, and support national security.

### ASH Elements Vision

ASH Elements believes that distributed ledgers have the ability to transform asset ownership by: increasing transparency, allowing for fractional ownership, creating unique ways to store value all at a very low cost. Ash Elements believes that creating a token for ash supports national security, creates positive environmental impacts, and unleashes technology for the domestic extraction of rare earth elements. Ash Elements is creating an asset backed token for coal ash to support our vision

The mission of ASH Elements is to encourage an environmentally sound process in which these elements can be extracted from the residual coal ash from coal-fired power plants.

### ASH Elements Values

1. The Environment – our ash tokens turns an existing environmental liability into an asset. Using ash from the coal combustion process helps reduce the negative environmental impacts of other conventional rare earth element mining methods. Additionally, the token may help advance more environmentally sound methods of processing REE.
2. National security- Over 90% of REE are controlled by China. These minerals are important in many military applications.
3. Free markets- Transparency and secure asset ownership are foundational to free markets. We believe that distributed ledger technology supports transparency, democratized ownership, increased security, and low cost compared to other methods of trading value.
4. Technology – Our token increases familiarity and broad adoption of distributed ledgers. We support the development of REE extraction technology by providing

price discovery for the value of domestic REE found in ash

### **What is coal ash?**

Coal Combustion Residuals (CCRs), more commonly known as coal ash, are created as a byproduct of electricity generation from coal-fired power plants. Coal ash is a hazardous waste material which contains many concentrated heavy metals, including arsenic, lead, and thallium. Approximately 80% of coal ash is composed of silicon, aluminum, iron, and calcium. While all of these elements exist naturally in coal, the combustion process refines and concentrates certain elements, including many rare earth elements, in the ash. Despite their name, rare-earth elements are – with the exception of promethium – relatively plentiful in Earth's crust. They are not especially rare, but because of their geochemical properties, rare-earth elements are typically dispersed and not often found concentrated as precious metals (such as gold, silver, or copper) in economically exploitable ore deposits. This makes the high concentrations of these elements contained in coal ash one of the anomalies on earth. Because of this, coal ash contains some of the most easily accessible and least costly concentrations of these elements on earth.

### **Token Holder Benefits**

The rare-earth elements found in high grade coal ash price can be valued between \$100- \$500 USD a ton. The range is impacted by changing market prices and varying concentrations of REE in ash. There is a vast supply of this ash stockpiled in basins.

Rare earth elements are considered a strategic imperative for the United States of America. Many of these metals have no substitutes in electronics and technology manufacturing. China has a virtual monopoly on current production of rare earth elements, and alternate supplies are needed to ensure the world manufacturing base is not disrupted by price fluctuations for these materials. As such, using innovative extraction and financial technologies aligns the investor with the broader governmental organizations tasked with securing the nation's position in the broader geopolitical landscape.

The technology to extract these metals from coal ash is being developed in research laboratories all over the world. Most of the major national labs have initiatives and research focused on various portions of the REE value chain. Many US government agencies including the Department of Defense, Environmental Protection Agency, Department of Energy, and the Department of the Interior are involved. Once these processes are matured and commercially viable, coal ash may be in high demand. Those that own the rights to it will likely profit in this future world. The ASH Elements token

allows the future value of rare earth elements to be pursued today.

In the meantime, while these technologies mature, coal ash continues to be a controversial environmental problem and is considered a liability. The Ash Elements token addresses these issues by turning coal ash into an asset via the Ethereum blockchain. This makes money available for environmental remediation and preserves the asset for future use as a strategic minerals reserve. Tokenization allows individuals to take part in funding environmental projects that would not have been possible before. It is a part of a new wave of environmentally conscious projects that seek profit by solving today's environmental problems.

### ASH Elements Initial Business Model Canvas

 <p><b>KEY PARTNERS</b></p> <p>Charah Mirku MusalaSoft Camuso. CPA Token Fest Advisors</p>	 <p><b>KEY ACTIVITIES</b></p> <p>SEC Framework Website White Paper BMC Token Design Mineral Contracts Pilot Ash Reserves</p>	 <p><b>VALUE PROPOSITIONS</b></p> <p>The mission of Ash Elements is to turn an ugly liability into an attractive environmentally responsible asset. This asset will be made available to the blockchain community and in doing so add value in many dimensions to our collective future.</p> <p>Ash Elements Values</p> <p>Protect the Environment Secure Mineral Rights Unlock Asset Value Create a Stabilize Security Token</p>	 <p><b>CUSTOMER RELATIONSHIPS</b></p> <p>Customer relationship with the Ash Basin <u>land owners</u> will be VIA Charah</p> <p>Token holder relationship will be via website and exchanges</p> <p>Redeemer will be via Ash Elements holding company</p>	 <p><b>CUSTOMER SEGMENTS</b></p> <p>Ash Basin owner operator</p> <p>Ash Elements Holdings</p> <p>Token Holder</p> <p>Mineral refiner</p>
 <p><b>COST STRUCTURE</b></p> <p>Cost is market based Assets are added by basin Operating company receives a percentage of tokens</p>		 <p><b>REVENUE STREAMS</b></p> <p>Initial revenue of 7.6 million USD via ICO Additional revenue 7% of ash reserves added under contract.</p>		

We are using many tools and principles in lean start up to help build our business. We have adjusted this and will continue to adjust and pivot.

## Phases of ASH Elements Product Development

Our Timeline:



## Social Media / Connect with us

Website: [www.AshElements.io](http://www.AshElements.io)

LinkedIn <https://www.linkedin.com/company/ash-elements-inc/>

Twitter: <https://twitter.com/AshElements>

Facebook: <https://www.facebook.com/ash.elements>

Instagram: <https://www.instagram.com/ashelements/>

Telegram Updates <https://t.me/joinchat/AAAAAEMPw02o86mJ6X6EtQ>

Telegram Group <https://t.me/joinchat/Gisg7BFSgOd5joiSvRM60w>

Slack Group <https://ash-elements.slack.com/>

## The Team And Partners

PRINCIPALS

		
<b>Thomas Friend</b>	<b>Chuck Whitlock</b>	<b>Kevin Paley</b>
Founder / Managing Partner	Managing Partner	Managing Partner

DEVELOPMENT TEAM

		
<b>Viktor Gabaj</b>	<b>Ivan Maretic</b>	<b>Thomas Friend</b>
Designer	Web Developer	Communications Strategist

MEET THE ADVISORS

			
<b>Ryan Colby</b>	<b>Nathaniel Miller</b>	<b>Pedro Fong</b>	<b>Nic Sementa</b>
Serial entrepreneur & CEO Token Fest	NASA Aerospace Engineer	Business Architect & Senior Executive Leader	Social Media adviser & Director of Business Development

		
<b>Rob Ellerman</b>	<b>Steve Stava</b>	<b>Rod Hatt</b>
Serial Startup Adviser & Alterer of business configurations	CIO & Entrepreneurial Ecosystem Builder	Adviser

## Partner Companies



### Musala Soft

Musala Soft is a software services company specialized in complex geographically distributed enterprise projects. We believe in excellence and growth inspired by partnership, personal success and team spirit. Musala Soft is a leading Bulgarian software services company. Our young and ambitious team consists of more than two hundred professionals in the area of software development, quality assurance, enterprise integration, project infrastructure, database optimization and many others. Our specialists work on a variety of projects using diverse technologies.



### Mirku Marketing

With a combined 30 years in PR, Marketing, Leadgen, and financial sales, Nic Sementa and Robert Ellerman have each taken companies in the financial space to the INK 500 list. Both were early adopters to the crypto trading movement and have been consulting on various ICO projects for the last year. The pair hold a strong shared belief that education is the key component to any successful marketing effort. After a year of working on joint projects Nic Officially joined the management team of Rob's technology and consulting company. Co-founder of the agile marketing academy Nic has pioneered methods for rapid growth and education based marketing.



### Token Fest

Token Fest is an exclusive, two day networking event focused on the business and technology of tokenization. Attendees will gain a wealth of insights and information about the state of the token-based economy while networking with over 2,500 senior level decision makers.

## Cryptocurrency Problem Statement And Solution

Just over a decade ago, Satoshi Nakamoto, a pseudonymous cryptographer, introduced Bitcoin as a digital cryptocurrency. The offering was limited in supply to drive scarcity, but secured by modern cryptography, and made for the internet age. Following in Satoshi's footsteps, many tried to improve upon his original vision.

Despite technological developments and innovation, the market for cryptocurrencies remains a niche market. The reason for this is that current cryptocurrency implementations and strategies still have shortcomings that discourage mainstream use. Questions surrounding volatility, legitimacy, underlying value, and ease of use are just a few barriers to mass adoption.

The Ash Elements token hopes to address all of these shortcomings with a value-based solution, grounded in real world assets. ASH Elements aims to solve these issues by using blockchain technology to create an asset backed token. From launch, each coin is backed by one ton of coal ash containing high REE content.

### Tokenization Benefits

Leveraging the Blockchain architecture will allow Ash Elements to use an ecosystem that allows full trust and transparency across the entire transaction process. Blockchain tokenization will offer the participants a clear view of transaction and the entities participating in the transaction process including:

- Benefits of affordable fractional ownership
- Access via various exchanges
- Liquidity via a simple commodity tied to tokens
- Commitment to full accountability and transparency
- Stability of value through a real physical asset
- The inherent security and transparency of the Blockchain



## Coal Ash Problem Statement

Coal Combustion Residuals (CCRs), more commonly known as coal ash, are created as a byproduct of electricity generation from coal-fired power plants. In a coal-fired power plant, coal is burned in boilers to heat water to steam, and the byproducts are released as ash. Coal ash is best described as “a slurry of fly and bottom ash produced by burning coal for power production” according to the US Department of Transportation. It is a very dangerous, hazardous waste material, which contains many concentrated heavy metals, including arsenic, lead, and thallium. Approximately 80% of coal ash is actually composed of silicon, aluminum, iron, and calcium. While all of these elements exist naturally in coal, the burning process refines and concentrates certain elements, (including many heavy metals of value) while burning away the carbon making up the coal.

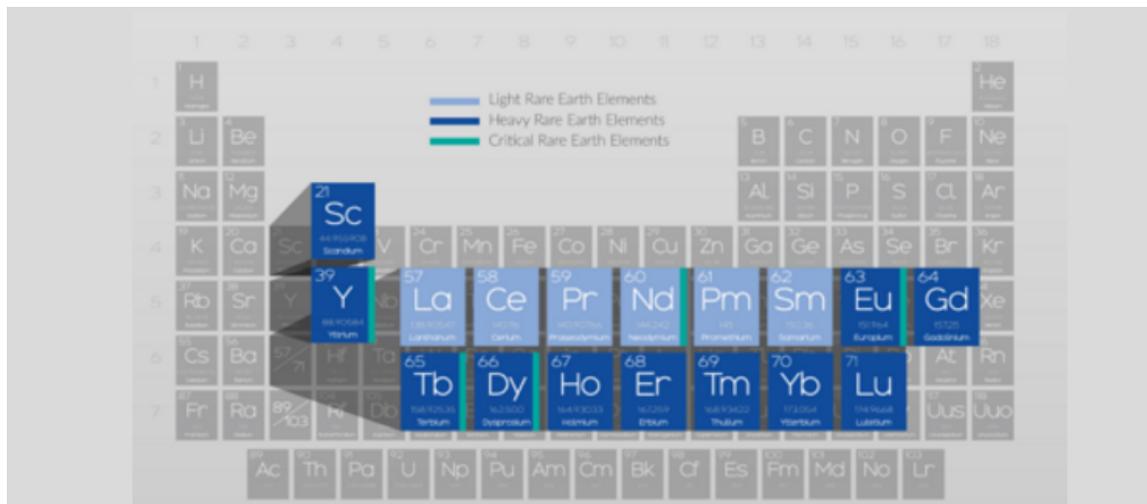
CCRs are released in three forms: Bottom Ash, Boiler Slag and Fly Ash. The fly ash and bottom ash both have the potential to be radioactive, due to the presence of thorium and uranium in coal, which are both highly radioactive elements, yet relatively light particles.

Of the CCRs released, approximately 75% is fly ash. These are the lightest residual particles and are trapped by coal stack filters. Bottom ash, which is composed of residual particles too large or heavy to be lifted, settles to the bottom of the boilers, and accounts for roughly 20% of ash generated. Boiler slag accounts for the remaining 5%, and is formed when the bottom ash melts under heat and pressure, and hardens in larger chunks than the other forms of ash. Overall, approximately 98% of coal ash is retained post combustion.

Once the coal plant has completed a burn, all three forms of ash are collected, sluiced, and then refined to a sludge, which drains into either a dry landfill, or (more commonly) a coal ash pond. As most coal-fired power plants are on a river, creating retention ponds is a simple task for the coal industry. These ponds are used with the hopes that the waste will be contained underwater, and kept from both the air and water ecosystems and groundwater systems. As the rare-earth elements have been refined and condensed in this leftover ash, there is an extremely high concentration of not only valuable elements and metals, but also toxic and radioactive elements.

## What are Rare-Earth Elements (REE) & Rare-Earth Metals (REM)?

Rare-earth elements and rare-earth metals (REM) are one of a set of seventeen chemical elements in the periodic table. The rare-earth elements are cerium (Ce), dysprosium (Dy), erbium (Er), europium (Eu), gadolinium (Gd), holmium (Ho), lanthanum (La), lutetium (Lu), neodymium (Nd), praseodymium (Pr), promethium (Pm), samarium (Sm), scandium (Sc), terbium (Tb), thulium (Tm), ytterbium (Yb) and yttrium (Y).



Name (Symbol)	Selected applications
Scandium(Sc)	Light aluminium-scandium alloys for aerospace components, additives in halide and mercury-vapor lamps, radioactive tracing agent in oil refineries
Yttrium (Y)	YAG laser, yttrium vanadate (YVO <sub>4</sub> ) as host in television red phosphor, YBCO high-temperature superconductors, yttria zirconia, microwave filters, energy-efficient light bulbs, spark plugs, gas mantles, steel additive, cancer treatments
Lanthanum (La)	High refractive index and alkali-resistant glass, flint, hydrogen storage, battery-electrodes, camera lenses, fluid catalytic cracking catalyst for oil refineries
Cerium (Ce)	Chemical oxidizing agent, polishing powder, yellow colors in glass and ceramics, catalyst for self-cleaning ovens, fluid catalytic cracking catalyst for oil refineries, ferrocerium flints for lighters

Praseodymium (Pr)	Rare-earth magnets, lasers, core material for carbon arc lighting, colorant in glasses and enamels, additive in didymium glass used in welding goggles, ferrocerium firesteel (flint) products.
Neodymium (Nd)	Rare-earth magnets, lasers, violet colors in glass and ceramics, didymium glass, ceramic capacitors, electric motors of electric automobiles
Promethium (Pm)	Nuclear batteries, luminous paint
Samarium (Sm)	Rare-earth magnets, lasers, neutron capture, masers, control rods of nuclear reactors
Europium (Eu)	Red and blue phosphors, lasers, mercury-vapor lamps, fluorescent lamps, NMR relaxation agent
Gadolinium (Gd)	High refractive index glass or garnets, lasers, X-ray tubes, computer memories, neutron capture, MRI contrast agent, NMR relaxation agent, magnetostrictive alloys such as Galfenol, steel additive
Terbium (Tb)	Additive in Neodymium based magnets, green phosphors, lasers, fluorescent lamps, magnetostrictive alloys such as terfenol-D, naval sonar systems, stabilizer of fuel cells
Dysprosium (Dy)	Additive in Neodymium based magnets, lasers, magnetostrictive alloys such as terfenol-D, hard disk drives
Holmium (Ho)	Lasers, wavelength calibration standards for optical spectrophotometers, magnets
Erbium (Er)	Infrared lasers, vanadium steel, fiber-optic technology
Thulium (Tm)	Portable X-ray machines, metal-halide lamps, lasers
Ytterbium (Yb)	Infrared lasers, chemical reducing agent, decoy flares, stainless steel, stress gauges, nuclear medicine, monitoring earthquakes
Lutetium (Lu)	Positron emission tomography – PET scan detectors, high-refractive-index glass, lutetium tantalate hosts for phosphors, catalyst used in refineries, LED light bulb

Despite their name, rare-earth elements are relatively plentiful in Earth's crust, with cerium being the 25th most abundant element at 68 parts per million making it as abundant as copper. They are not especially rare, but they tend to occur together in nature and are difficult to separate one from another. Due to their geochemical properties, rare-earth elements are typically dispersed and not often found concentrated in economically exploitable ore deposits.

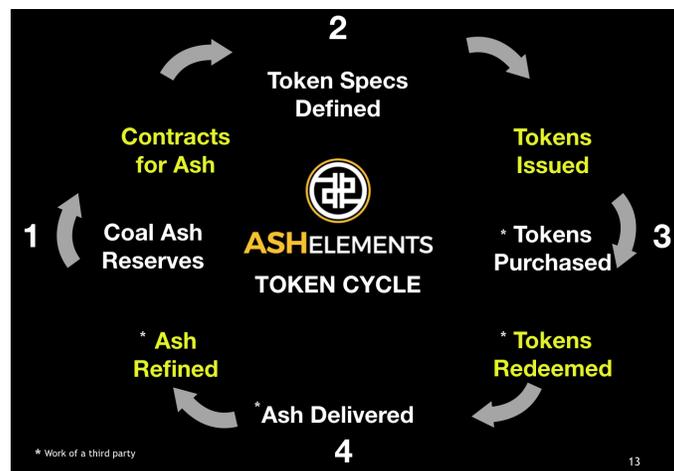
## Who benefits from Ash Elements Fractional Mineral Rights For Coal Ash?

Who benefits:

1. Ash basin owners: receive value for coal ash today for profit, remediation and clean up.
2. Token holders: can purchase and redeem ownership of coal ash and increased liquidity will jumpstart the coal ash REE market.
3. Ash basin owners: compensated for being a steward of ash until token holder physically delivers ash.
4. Mineral extractors processors: purchase high grade coal ash easily at market price
5. Environment; provides funding for coal ash clean up and stabilization.
6. United States National Security: Builds rare earth element stockpiles for the future of the United States vs today putting high grade REE ash in concrete and roads.

The Token cycle

1. Ash Elements identifies high value ash basins.
2. Ash Elements contracts for ash with basin owner
3. Ash Elements defines token specifications and issues tokens.
4. Token holders purchase these asset backed tokens on exchanges and trade them freely.
5. Ash basin owners receive money or tokens for ash for profit or remediation.
6. Token holder redeems token for physical ash and Ash Elements burns the token
7. Refining companies refine ash into REE.



## The Environmental Problems Ash Elements solves

The desired outcome of the ASH Elements token is to be a part of the solution to the coal ash problem. Ash Elements Token will provide funding for Ash Reserve stabilization, environmental remediation and maintenance. This is good for both the long term stability of the digital currency via Ash Reserves and the Environment at large. This is not a small problem as coal ash waste continues to be created and old ash basins lie dormant and unmonitored.

The problem with coal ash begins when it is created. Coal ash is the solid waste generated during coal combustion and includes fly ash, bottom ash, and sludge from flue gas desulfurization units. In the United States, the combustion of coal generates more than 100 million tons of coal ash each year. Almost half of this waste is reused for beneficial purposes such as the manufacture of concrete and other construction materials.

Coal ash contaminants are concentrated during combustion and compounds such as arsenic and selenium that can be harmful to ecosystems near coal ash disposal sites. The practice of disposing coal ash in holding ponds has recently received much attention after the catastrophic failures of ash ponds in Tennessee (2008) and in North Carolina and Virginia (2014). The magnitude of these spills and the uncertain environmental costs have renewed efforts to improve policies for coal ash disposal and identify beneficial reuse opportunities.

How big is this problem? The Environmental Protection Agency estimates that 72 percent of all toxic water pollution in the country comes from coal-fired power plants. The toxic coal ash pollution flowing into lakes, rivers, streams, groundwater and bays results in death and mutation of fish and wildlife. Some well-known examples of large-scale destruction of fish and wildlife are:

1967: A coal ash dam breaks, spilling coal ash slurry into the Clinch River, VA killing 217,000 fish and poisoning invertebrates for 77 miles downstream.

1976: Releases from an ash pond to Belews Lake, NC, permitted by the National Pollutant Discharge Elimination System, caused massive fish kills and completely eliminated 19 species of fish from the almost 4,000 acre lake.

2008: Coal ash spill at Kingston Fossil Plant, TN, released over one billion gallons of toxic coal ash, inundating the Emory river and causing massive fish kills.

2014: Dan River coal ash spill, causing fish kills and damage to groundwater system

Coal ash doesn't only harm fish and wildlife during large releases of the hazardous waste. Most coal ash impoundments are little more than unlined pits; toxic substances leach into ground and surface water, enter waterways through unpermitted seeps, and poorly regulated "end of pipe" discharges. The U.S. EPA and environmental groups have already documented over 200 coal ash "damage cases" where levels of toxic coal ash pollutants in waterways exceed state or federal standards. The concentrated pollutants in coal ash, such as lead, mercury, arsenic, chromium, and selenium, cause life-threatening deformities in fish, amphibians, birds, invertebrates, and other organisms living in polluted waters.

## **How Ash Basins will be selected**

In order to provide the best value and greatest positive impact to the environment ASH Elements has developed a selection criteria framework to choose the basins.

The criteria are as follows:

1. Quality: Is there a premium to the value of the rare earth elements in the coal ash basin?
2. Location: Is the basin in a location where removal will not be hindered?
3. Delivery: how flexible is the method of delivery
4. Size: Is the basin large enough be commercially desirable?
5. Type of Ash: Certain ash types have undesirable contaminants that have liability in disposal.
6. State location: State regulations differ regarding ash remediation

Sites selected from the above will undergo an overview which will include:

- a. Site Survey
- b. Bore hole core drilling, to determine REE and contaminate content.
- c. Review of Plant Records, including types of coal burned.
- d. Drone aerial mapping for basin configuration.
- e. Lab testing and independent verification of REE content.

## Why Tokenization of Coal Ash is a Win-Win

### For the token owner

- Store of Value
- Fractional ownership
- Price appreciation
- Secure ownership

### For the United States of America

- Strategic Rare Earth Element Reserve
- Safeguarding coal ash from other reuse which will remove potential REE from supply
- Incentivize REE extraction methods

### For the Environment

- Environmental clean up
- Stabilization of ash ponds
- Raise awareness
- Fund research

## Blockchain and Distributed Ledgers

Blockchain as a technology is beginning to experience widespread adoption. The main innovation behind cryptocurrencies is that instead of relying on a trusted third party, transactions are recorded and propagated in a distributed ledger known as blockchain. This allows transactions to be trustless, censorship-resistant, permission less and private. Once a transaction is confirmed by the blockchain network, it becomes irreversible: it cannot be charged back through a dispute process like other forms of money transfer.

Blockchain, and more broadly distributed ledgers, promises to radically change many areas of our lives. Ash Elements believes that how physical assets are owned and transferred is one such area. Our participation in this burgeoning innovation led us to creating a token for coal ash. Distributed ledgers allow for:

- Fractional ownership
- High levels of security
- Low transaction costs

- True peer-to-peer transfers
- Near instant transaction speed

## What is an Ethereum Blockchain Smart Contract?

Ethereum is based on the Blockchain architecture principles. It uses PKI and one-way hashing, not encryption. It is a write once, and append only process, offering full transparency throughout the transaction process. All transactions are recorded for everyone to examine and cannot be erased. The Ethereum Smart Contract is basically Business Process Automation that are recorded in the Ash Elements Agreement.

In the blockchain space a general confusion shrouds so called 'smart contracts'. Smart Contracts are a new solution made possible by public blockchains.

### How smart contracts work

It's worth noting that bitcoin was the first to support basic smart contracts in the sense that the network can transfer value from one person to another. The network of nodes will only validate transactions if certain conditions are met. Bitcoin is limited to the currency use case.

By contrast, ethereum replaces bitcoin's more restrictive language (a scripting language of a hundred or so scripts) and replaces it with a language that allows developers to write their own programs.

Ethereum allows developers to program their own smart contracts, or 'autonomous agents', as the ethereum white paper calls them. The language is 'Turing-complete', meaning it supports a broader set of computational instructions.

### Smart contracts are many things:

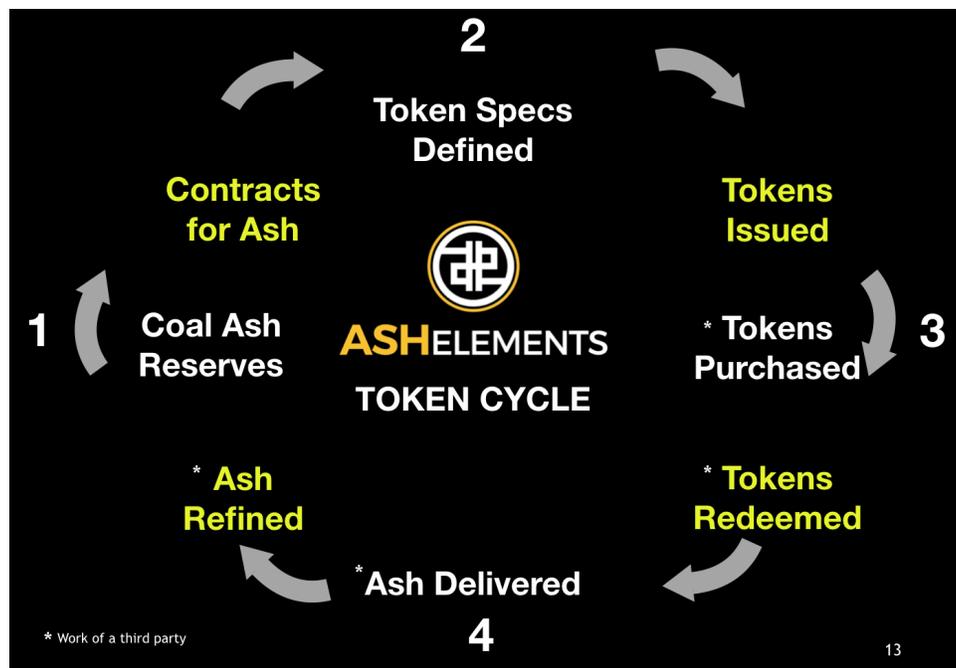
Function as 'multi-signature' accounts, so that funds are spent only when a required percentage of people agree.

Manage agreements between users, say, if one buys insurance from the other  
Provide utility to other contracts (similar to how a software library works).

## How these technologies will be used

These core blockchain technologies will make up the building blocks of the Ash Elements Ecosystem. These blockchain technologies are important, however we need to look at the business process as a whole to understand the technology. We focus on key parts of the Token Cycle to see how technology helps.

The first question is obvious: **What do we need to complete the Token Cycle?**



There are two areas that need to be addressed:

1. The trading of the asset on an open market

CONFIDENTIAL //////////////

## How do I buy and sell my Ash token?

Various exchanges allow you to buy or sell your  token.

You can also buy or sell your  token with other market participants directly.






The trading of ash token on the open market will be enabled by blockchain technologies on an open distributed ledger.

Function:

- This is a space for traders and users to acquire and trade Ash Element tokens. Ideally this blockchain would already be a public blockchain like Ethereum to increase transparency.

Advantages:

- This could be an already established public blockchain with exchanges and tools for managing digital assets. An advantage would be the lower barrier to entry for experienced users and the wealth of common knowledge known by the already active user base of said blockchain.
- Separates the technical concerns to focus on only the trade and origination of the token. These aspects of digital assets are already well known and developers have already developed standards to make this process easy. One example would be the ERC-20 token standard On the Ethereum Blockchain.

## 2. The Delivery of the physical ash



For the delivery of the ash, token owners will register their wallet that holds tokens on the Ash Elements website in a separate web interface that will provide the following:

- a. Notices to the ash holders
- b. Scheduling delivery or pickup
- c. Outages
- d. New additions of ash
- e. corporate communications

Function:

- Facilitate the delivery of ash once it's recovered from the ash basin. This blockchain would be a service ran by Ash Elements for the express purpose of facilitating the physical delivery of ash to the token holder
- This contains the Entities responsible for delivering the coal ash. These would include Company's that would be responsible for removal of the ash from a specific basin.

Advantages:

- Since we can run this system on our own system we can control the experience better and worry not about the volume and speed problems of public blockchains. All while keeping the origination data and tracking of the asset from the original blockchain.

We can also integrate legacy servers and databases to speedup data lookup. This will be invaluable when we want to notify users of changes to an order or some scheduled or unscheduled outage. (Think: mobile apps, text alerts, emails, etc.)

Using the blend of both public blockchain and private delivery notification system Ash Elements LLC will be able to better control the experience for users depending on their intentions in the process. This becomes very useful when considering the system as it works together to complete the Token Cycle.

## Valuation of the REE/REO in Coal Ash

Price discovery for rare-earth elements is complicated. The markets have varying delivery points, purity, and can be for either oxides or the elemental form. Ash Elements objective is to focus on the top 10% of coal ash sources. Researchers from Duke University measured the content of rare earth elements in samples of coal ash representing every major coal source in the United States. The results of the Duke University study were published in the journal Environmental Science and Technology. It concluded that coal from the Appalachian Mountains contains the highest amounts of rare earth elements. REE concentrations vary even within the Appalachian Mountains. Ash Elements is trying to contract for ash with the highest concentrations of REE.

## Extraction of Rare Earth Elements from Coal Ash

The [Department of Energy 2016 Rare Earth Elements from Coal and Coal By-Products Program](#) consists of five core technology areas that are focused on development of REE separation from coal ash and recovery technologies, addressing the current global REE separations market and process economics, and demonstrating the generation of environmentally benign REE separation processing capabilities. The program's objective is to demonstrate the techno-economic feasibility of domestic REE separation technologies by 2025. This will be accomplished through conduct of laboratory REE separation projects and demonstration of concept feasibility at bench- scale through pilot-scale facilities, ultimately realizing REE separations technology for commercial deployment. Co-production of materials and/or critical elements, successful demonstration of environmentally benign processing, and competitive economics are key critical areas for success of this program. The program consists of the following five core technology areas:



1. Resource Sampling and Characterization
2. Separation Technology Development
3. REE Sensor Development
4. Process and Systems Modeling
5. Techno-Economic Analysis

Their goal is to help leverage our nation's vast coal resources that contain quantities of REEs that offer the potential to reduce our dependence on others for these critical materials, and create new industries in regions where coal plays an important economic role. The objective is to develop an economically competitive supply of REEs, which will secure and maintain our nation's economic growth and national security.

ASH Elements' focus is strictly on creating a token for the ownership of coal ash. The simple creation of that token and the resulting awareness and price discovery should lead to further development of other areas of the REE value chain including refining.

## Rare Earth Elements – Pilot-Scale Test Facilities

### **Physical Sciences, Inc.**

Physical Sciences, Inc. is building a pilot-scale plant to economically produce high-yield rare earth element concentrates and commercially viable co-products from coal ash using environmentally safe physical and chemical enrichment processes. The team will develop a detailed techno-economic model of the continuous process, including ash feedstock and reagent inputs, REE concentrate, and co-product outputs of commercial value, taking into account capital and operating expenses. The proposed work, if successful, will demonstrate an environmentally benign and economically feasible method of providing a reliable and cost- competitive domestic source of rare earth elements and water recovery.

### **Southern Research Institute**

Southern Research Institute (SRI) has developed an alternating current graphite electrode plasma arc technology for coal fly ash that will be utilized to concentrate REEs in fly ash. The technology has two options: a plasma smelting process and a plasma smelting process plus volatilization and sequential condensation. In option one the molten metal is collected and then tapped for further processing to concentrate the REEs. In option two, the molten metal pool is vaporized to apply sequential condensation to refine the concentration of the REEs into groups. The team will conduct

bench-scale experiments utilizing a plasma furnace to evaluate the fate of REEs in the separation between the top slag layer and the bottom molten metal layer. Evaluation of potential enhancements to promote the partitioning of REEs to the molten metal layer will be made and the plasma volatilization of the molten metal layer will be modeled, including sequential condensation of enriched REE material from the gas.

#### **University of Kentucky Research Foundation**

The University of Kentucky Research Foundation is proposing innovative separation technology including an advanced froth flotation process and a novel hydrophobic-hydrophilic separation process. The team proposes to use the hydrophobic-hydrophilic separation (HHS) process to recover the coal due to its demonstrated ability to produce low-ash, low- moisture products from ultrafine refuse. The reject stream from the HHS process will be conditioned with a hydrophobizing agent and subsequently treated by flotation and/or the HHS process to recover rare earth metals (REMs). The reject stream, consisting mostly of clay minerals and fine clay rocks, will be treated with ammonium sulfate to extract rare earth ions from the surface of the clay by an ion-exchange mechanism.

#### **Battelle Memorial Institute**

Battelle Memorial Institute has created a Closed Loop Leaching Process for REE separation. Battelle's closed-loop Acid Digestion Process (ADP) will attempt to demonstrate the economic viability of Battelle's patented closed-loop ADP to extract REEs by identifying a promising ash source to produce a pozzolan material, and model/validate the economics for commercial- scale systems based on bench- scale operations. The proposed technology offers a breakthrough for the economic recovery of REEs from coal products on several levels including limiting waste streams and optimizing recycling opportunities, producing a concentrated solid form rare earth oxide for easy delivery to a purification facility and finally identifying coal sources containing higher availability of REEs thus improving the techno- economics of the operation.

#### **Duke University**

Duke University's project focuses on electrodeposition and semipermeable membrane separators. Their Membrane & Electrodeposition-Based Separation & Recovery of Rare Earth Elements from Coal Combustion Residues is a project developed around REE extraction from CCRs. NETL is partnering with Duke University to develop a hydrometallurgical-based technology to extract and concentrate rare earth elements (REEs) from coal fly ash and other coal combustion residues (CCRs). The recovered REEs leached from CCRs will be further separated from the leachates by membrane filtration

and electrochemical deposition. This project will develop technologies to recover REEs from CCR rivaling production tonnage and quality from current operational mine, it will also utilize advanced separation technologies to enable environmentally benign processes relative to conventional approaches that use hazardous chemicals for separations of REEs, and will achieve at least 75% REE recovery from ash.

There are many more demonstrators and technologies that have been proposed for REE extraction and refinement based on the elements being extracted and the quality of the coal ash it is being mined from. These technologies are a few years away from being commercially viable. The objective of Ash Elements is to identify and secure the reserves with the highest REE concentrations and identify the most promising extraction technology so when the time comes that the technology is perfected, the ash under contract will be ready for profitable extraction.

## US Federal Agencies That Align with Ash Elements

1. General Accounting Office. [GAO-16-161](#) Report: RARE EARTH MATERIALS Developing a Comprehensive Approach Could Help DOD Better Manage National Security Risks in the Supply Chain, Feb 2016
  - a. The US Department of Defense DOD depends on rare earths that contain one or more of 17 similar metals which have unique properties, such as magnetism at high temperatures, to provide functionality in weapon system components. Many steps in the rare earths supply chain, such as mining, are conducted in China, a situation that may pose risks to the continued availability of these materials. The Joint Explanatory Statement accompanying the Carl Levin and Howard P. “Buck” McKeon National Defense Authorization Act for 2015 included a provision for GAO to review DOD efforts to identify and mitigate risks in its rare earths supply chain. This report assesses the extent that DOD
    - i. “determined which rare earths, if any, are critical to national security; and
    - ii. has identified and mitigated risks associated with rare earths, including the effects of a potential supply disruption”

GAO reviewed DOD reports from 2011-2015 and relevant legislation; and collected information from DOD, the military departments, and industry

organizations.

- b. What GAO Recommends GAO recommends that DOD designate which rare earths are critical to national security, and develop a comprehensive approach to help ensure a secure supply by identifying risk metrics, among other activities. DOD concurred with all the recommendations in this report and provided timeframes for action.
2. Strategic Materials Defense Logistics Agency (DLA) -Strategic Materials
    - a. DLA Strategic Materials is the leading U.S. agency for the analysis, planning, procurement and management of materials critical to national security. We serve our clients through a unique combination of technical expertise, global/geopolitical material supply analysis, and management & tracking of a broad range of existing & future critical materials.
    - b. DLA Strategic Materials Mission: DLA Strategic Materials administers the implementation and execution of Strategic and Critical Materials (S&CM) policies as set forth by the National Defense Stockpile (NDS) Manager. Strategic Materials is responsible for acquiring, upgrading, rotating, and disposing of stockpile materials as provided by the Annual Materials Plan (AMP).
    - c. DLA Strategic Materials duties include storage, security, testing, contracting, quality studies, and maintenance and replacement of materials in the NDS. Strategic Materials directs the development of new or revised specifications and special instructions for existing and proposed S&CM to be stockpiled. Along with overseeing the NDS we administer and implement policies and procedures for the DLA Strategic Materials environmental program. We also administer the financial and property accounting systems to include the NDS Transaction Fund.
    - d. Materials that are Stockpiled
    - e. DLA Strategic Plan 2015-2022
  3. TITLE 50, UNITED STATES CODE THE STRATEGIC AND CRITICAL MATERIALS STOCK PILING ACT 50 U.S.C. §98 et seq. (As amended through Public Law 114-328, the National Defense Authorization Act for Fiscal Year 2017)
    - a. This Act may be cited as the “Strategic and Critical Materials Stockpiling

Act". FINDINGS AND PURPOSE SEC. 2. [50 U.S.C. §98a]

- b. The Congress finds that the natural resources of the United States in certain strategic and critical materials are deficient or insufficiently developed to supply the military, industrial, and essential civilian needs of the United States for national defense.
  - c. It is the purpose of this Act to provide for the acquisition and retention of stocks of certain strategic and critical materials and to encourage the conservation and development of sources of such materials within the United States and thereby to decrease and to preclude, when possible, a dangerous and costly dependence by the United States upon foreign sources or a single point of failure for supplies of such materials in times of national emergency.
  - d. The purpose of the National Defense Stockpile is to serve the interest of national defense only. The National Defense Stockpile is not to be used for economic or budgetary purposes.
4. Defense National Stockpile Center: This was established after world war I.
- a. The National Stockpile is a physical reserve of definite quantities of materials, owned by the United States government, stored mostly on government-owned property and in government warehouses. Currently, there are 40 different commodities stockpiled nationwide.
  - b. The Stockpile is an inventory of raw materials with a cash value. Today, that market value is approximately \$1.5 billion (2005 value). These are recoverable assets owned by the people of the United States. In this sense, the Stockpile acts like an insurance policy with an outlay return of many-folds over the original costs should the stockpile be used, and yet until used, it retains indefinite value (at current market value).
  - c. DNSC is a basic element and an integral part of the national defense structure. However, it is not solely a military element: it is intended for all essential civilian and military uses in times of emergencies. This function is closely linked to military and civilian national security requirements, of course while taking into account the formulation of DNSC objectives. There is a direct relationship with industrial mobilization planning and the disposition of the Stockpile in time of national emergency.

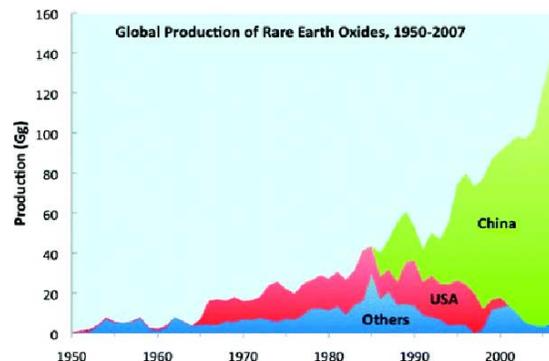
- d. DNSC provides a tremendous reserve of commodities for use during a national emergency. In the final analysis, materials are stockpiled on the basis not of the manpower required to produce them, but of the manpower that is required in wartime if these materials are not available.
5. Department of Defense (DOD)
    - a. Three Department of Defense (DOD) offices have identified certain rare earth materials (rare earths) as critical for some defense applications, such as lasers, but DOD has not taken a comprehensive, department-wide approach to identifying which rare earths, if any, are critical to national security. Specifically, DOD offices have not yet agreed on what constitutes “critical” rare earths. Using different statutorily-based definitions, these offices have identified [15 of the 17 rare earths as critical over the last 5 years](#).
  6. Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy
    - a. [The Manufacturing and Industrial Base Policy \(MIBP\)](#) office supports the Under Secretary of Defense for Acquisition, Technology and Logistics by providing detailed analyses and in-depth understanding of the increasingly global, commercial, and financially complex industrial supply chain essential to our national defense.
  7. Office of the Undersecretary of Defense for Acquisition, Technology and Logistics
  8. SMPB Strategic Materials Protection Board  
<https://www.law.cornell.edu/uscode/text/10/187>
  9. CENRS [Subcommittee on Critical and Strategic mineral supply chains committee on environment](#), natural resources and sustainability national science and technology council.
  10. Environmental Protection Agency
    - a. [Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues](#)
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- c. U.S. Environmental Protection Agency. (2012) [“Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues”](#)
- d. U.S. Department of Energy. (2011) [“Critical Materials Strategy”](#)
- e. U.S. Geological Survey. (2011) [“Rare Earth Elements - End Use and Recyclability”](#)
- f. U.S. Geological Survey. (2010) [“The Principal Rare Earth Elements Deposits of the United States - A Summary of Domestic Deposits and a Global Perspective”](#)

## Strategic Considerations

In 1984, the Mountain Pass mine in California supplied nearly all of U.S. demand and a third of the world’s demand for REEs. Since that time, China has become the world’s leading producer of REEs, with approximately 95 percent of worldwide production. Due to rising demand and the reduction in supply, the cost of REEs has increased dramatically in recent years.

Mining companies around the world have responded by taking steps to increase production. Though China doesn’t have a monopoly on deposits of any particular rare-earth element they control much of the world’s supply of REE. The U.S. Geological Survey recently estimated that China has about half the world’s 110 million metric tons of rare-earth deposits.



Mining in the U.S. and elsewhere fell off several years ago, in part because of environmental concerns. Australia’s Lynas Corp.. and other companies are ramping up operations. However, a new mine can take a decade to develop, and processing of rare-

earth elements will remain concentrated in China for years to come. Further limits on Chinese exports of rare-earth elements also threaten to raise costs for companies in an array of industries, including cellphones, oil refining and high-technology batteries.

Three U.S. Federal organizations have related statutory requirements to manage risks from the DOD's use of "critical" and "strategic and critical" materials, such as rare earths. The three organizations are DLA-Strategic Materials, and the Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (MIBP), both in the Office of the Undersecretary of Defense for Acquisition, Technology and Logistics (OUSD(AT&L)), and the Strategic Materials Protection Board (SMPB).

## **Ash Elements legal structure:**

Ash Elements LLC is registered in the state of North Carolina as a sub-chapter S limited liability corporation. The company has owners, managing members, and advisors. A current listing of our managing members and owners can be found at [www.ashelements.com](http://www.ashelements.com).

## **Our current plan for the initial token sale:**

Ash Elements tokens will be sold to initial investors directly. We call this getting the tokens "into the wild". After the initial sale the tokens will be bought and sold as defined below. We think some of the following are likely participants in our first, and subsequent, initial token sales.



### How do token holders buy and sell:

It is important for the Ash Elements token to have the attributes of liquidity, transparency, and clearly defined specifications to create a successful market. Ash Elements will work to create those elements as part of our design. The Ash Elements token will be listed on various exchanges to allow for easy, low-cost, and secure transactions between token owners and interested owners. For illustration purposes here is a picture:

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## How do I buy and sell my Ash token?

Various exchanges allow you to buy or sell your Ash token.

You can also buy or sell your Ash token with other market participants directly.



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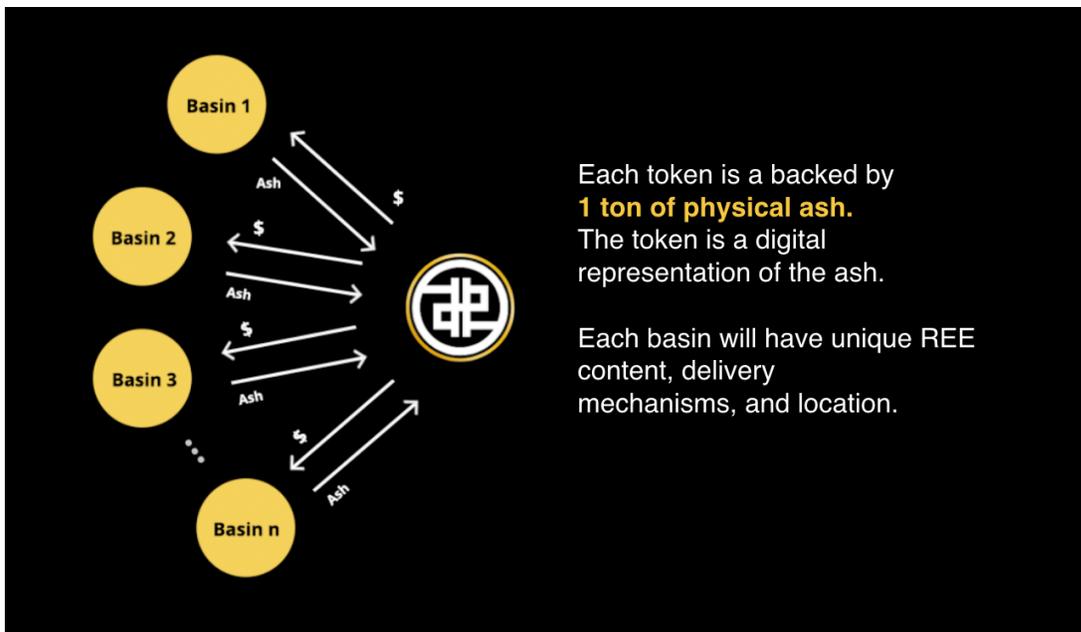


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### Sample token specifications:



The following is a framework for the data for Token based on the ERC20 Protocol:

Token Size: 1 Ton

Token Issuer: Ash Elements

Ash Supplier: based on party Ash Elements contracts with for physical supply

Delivery point: based on specific location of ash from each basin

Clearly defined and guaranteed specs: source, moisture content, and limited non-ash materials

Flexible delivery terms

Force Majeure provisions

Term: up to May 1, 2039

## **Liability:**

In no event shall the Ash Elements LLC, or any current or former employees, officers, directors, partners, trustees, representative, agents, advisers, contractors, or volunteers of the Ash Elements LLC be liable for: (a) damages, arising out of your use or inability to use the services or Tokens offered by the Company or the breach of any of the terms by you or by any third party; (b) any security risk such as hacker attacks, loss of password, loss of private key, or such; (c) mistakes or errors in code, text, or images involved in the token Sale; (d) any losses resulting from the volatility in pricing of tokens in any countries and on any exchange or market (regulated, unregulated, primary, secondary or otherwise); (e) arising out of or in any way connected to your failure to properly secure any private key to a wallet containing tokens. Ash Elements is not liable for damages or loss occurring due to change in environmental laws or regulations. If applicable law does not allow all or any part of the above limitation of liability to apply to you, the limitations will apply to you only to the maximum extent permitted by applicable law.

## **Representations and Warranties**

The Company does not make and hereby disclaims, any representation, warranty or undertaking in any form to any entity or person, including any representation, warranty or undertaking in relation to the truth, accuracy and completeness of any of the information set out in this White Paper, or provided on our website. Some statements in our White Paper, or provided on our website, may include forward-looking statements which reflect the Company's and its management's current views with respect to the market situation, environmental regulations, technological advances and the company's future plans. There may be important factors that could have an adverse effect on the token and company.

There will be no obligation to update or review any statements as a result of new information, future developments, etc. We do not accept any liability for accuracy of forward-looking statements. The White Paper is not legally binding and is provided for informational purposes only.

### **Risk Factors:**

Purchasing of Ash Elements tokens. Any purchase of Ash Elements Tokens carries significant risk; and, when used herein, the term risk includes, but is not limited to, a material risk. Prior to participation, you should carefully consider the non-exhaustive list of risks set forth below and, to the extent necessary, consult a lawyer, accountant, and/or tax professionals.

Cryptocurrencies and financing through cryptocurrencies have been the subject of regulatory scrutiny by various regulatory bodies around the world. The Ash Elements Token Community of Interest and Ash Elements LLC may need to change its operations in order to comply with applicable regulation and may become subject to regulatory requirements. Ash Elements and the related tokens could be impacted by one or more regulatory actions or regulatory enforcement, which could impede or limit the ability to continue to issue Ash Elements tokens. This uncertainty significantly adds to the risks connected with the purchase and sale of Ask Elements tokens. Ash Elements LLC will make every effort to accommodate regulatory requirements and changes.

The Ash Elements Token relies on third-party platforms. There is a risk that, as an open source project, any changes to the Ethereum blockchain could introduce weaknesses or bugs into the technologies utilized, which may cause loss of tokens. Ash Elements LLC reserves the right to be vendor agnostic in this regard, and use other blockchain providers where feasible, practical, or necessary.

The field of digital cryptography is not mature and there is a risk of unforeseen attacks, both in terms of the underlying cryptographic protocol that underpins the token's functionality, as well as 'game theory' related vectors which have not all been documented to date. Both these vectors represent a risk that could lead to the loss of Ash Elements tokens.

Ash Elements LLC does not give any warranties in regard to any exchange services providers nor does it warranty that Ash Elements tokens will be exchangeable for fiat currency or other tokens or crypto-currency.

Ash Elements tokens may not have an active or liquid market.

The price of the token may fluctuate may be highly volatile and no representations are given of a minimum price.

The technology to refine the RRE from the coal ash may never become commercially viable.

Ash Elements tokens are subject to current laws. Changes to those laws, including environmental laws, creates risks for token holders.

The risks identified and discussed herein comprise a non-exhaustive list of known or unknown risks.

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## Glossary of Terms

**Ash Elements:** The organization itself.

**Asset Backed Token:** A token which holds claims on an underlying asset, from a specific issuer.

**Blockchain:** A digital ledger in which transactions made in a cryptocurrency are recorded chronologically and publicly.

**Bottom Ash:** The portion of coal ash which comprises traces of combustibles embedded in forming clinkers and sticking to hot side walls of a coal-burning furnace during its operation. Contains the heavier particles in coal ash. Around 10% of coal ash is bottom ash.

**Bottom Slag:** The melted form of coal ash that can be found both in the filters of exhaust stacks and the boiler at the bottom. Around 20% of coal ash is bottom slag.

**CCR:** Coal Combustion Residuals. The leftover, noncombustible byproduct from coal fired power plants. Commonly known as coal ash.

**Coal ash:** The byproduct of burning coal in power plants. The leftover, noncombustible byproduct from coal fired power plants. Also known as Coal Combustion Residuals. Can be broken down into three distinct components: Fly Ash, Bottom Ash, and Bottom Slag.

**Coal Ash basin:** An excavated basin for the disposal of coal ash to prevent its release into the atmosphere. Although the use of basins decreases the amount of airborne pollutants, basins pose serious health risks for the surrounding environment.



**Cryptocurrency:** A digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.

**Environmental Remediation:** Environmental Remediation deals with the removal of pollution or contaminants from environmental media such as soil, sediment, groundwater, or surface water. This would mean that once requested by the government or a land remediation authority, immediate action should be taken as this can impact negatively on human health and the environment.

**Ethereum:** An open-source, public, blockchain-based distributed computing platform and operating system featuring smart contract (scripting) functionality.

**Fiat Currency:** Paper money or coins of little or no intrinsic value in themselves and not convertible into gold or silver, but made legal tender by fiat(order) of the government.

**Fly Ash:** The lightest particles in coal ash, which floats into the exhaust stacks and chimneys of the plant. It is collected by filters. Around 70% of coal ash is fly ash.

**REE:** Rare Earth Elements are the following elements listed on the Periodic table of elements. Sc, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Y, Ho, Er, Tm, Yb, and Lu.

**REO:** The oxide form of the rare earth element.

**SEC:** The Securities and Exchange Commission of the United States

**Token:** Tokens are a representation of a particular asset or utility, that usually resides on top of another blockchain. Tokens can represent basically any assets that are fungible and tradeable, from commodities to loyalty points to other cryptocurrencies.

**Tokenization:** The process of substituting a sensitive data element with a non-sensitive equivalent, referred to as a token, that has no extrinsic or exploitable meaning or value.