

Fusion - The Mother Tree

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A Tribute to Unconditional Support and Sustenance on Mother's Day

In the depths of your pain, whom do you seek? Your anchor, your solace—*your Mother*. When life presents its array of challenges, whose comforting embrace do you yearn for? It's not a question but an instinctive response—*your Mother*. Picture this unwavering presence, an entity unyielding in its commitment. Regardless of the vast oceans that separate you, she stands resolute, ready to forsake her own world to be by your side, to unravel the intricacies of your problems, and offer solace—*your Mother*.

What more beautiful gift can we at Energy for the Common Good (E4CG) offer to our world on this **Mother's Day, May 12, 2024**, than introducing '**Fusion - The Mother Tree**'? Just as the unconditional support of a mother carries us through life's darkest moments, so too does the promise of fusion energy offer a ray of hope for our planet's future. It is a witness to humanity's resilience and our quest for solutions that nurture and protect, ensuring a sustainable world for generations to come.

'Fusion - The Mother Tree', a metaphor that encapsulates our mission to harness fusion energy for the betterment of humanity and the planet, with E4CG identifying and supporting the growing vital mycorrhizal network holding it all together. Dr. Suzanne Simard, in her groundbreaking work detailed in her book '***Finding the Mother Tree***', profoundly influences our understanding of nature's interconnected systems, revealing how trees in a forest symbiotically share resources and support each other, capturing E4CG's vision of the interconnected and complimentary capacity of our future energy systems empowered by fusion, renewables, and storage. This perspective forms the foundation of our approach, wherein Richard Powers' novel '***The Overstory***' also resonates, weaving a rich tapestry that further illustrates the inescapable nature of our interconnectedness. Together they beg us to accept the

patterns which have supported successful longevity and built resilience, rather than continuously attempting to circumvent that which binds us all as humans reliant on a living earth.

Finding the Mother Tree: A Fusion of Nature's Wisdom and Future Energy Solutions

In the heart of the forest, trees are not mere individuals but members of a complex, interconnected community, as elucidated by Dr. Simard. This intricate web of relationships, emphasized by the pivotal role of the Mother Tree, serves as a profound metaphor for human engagement and cooperation, particularly in the realm of energy. (See attached: 'The Fusion Mother Tree' — illustrating the interconnectedness and nurturing role of fusion energy within our ecosystem, mirroring these natural networks).

These trees, much like a nurturing mother, support and sustain the network of life around them, sharing resources, wisdom, and life itself with their kin. This revelation not only transforms our understanding of the natural world but also highlights the danger of ignoring the necessity of clean, sustainable technology like fusion energy, echoing Rachel Carson's critical insights into the impacts of pollution on the forests she described in ***Silent Spring***, vital for preserving the 'breath of life' for our planet.

Introducing 'Fusion - The Mother Tree'

As we stand on the precipice of a climate change fed diaspora, the concept of fusion energy emerges and offers hope, mirroring the nurturing essence of the Mother Tree. Fusion energy, with its promise of abundant, clean power, is our energy system's mother tree, a long sought endless renewing presence ready to address the global energy crisis once commercialized. Just as the Mother Tree supports its ecosystem, nourished by the chlorophyll it produces

from sunlight, fusion energy offers a sustainable solution to our energy needs from drops of sea water, fostering growth, development, and environmental stewardship.

The Essence of Fusion

Fusion energy, akin to the sun's power, is the process of combining two light atoms to form a heavier atom, releasing vast amounts of energy in the process. This clean and almost limitless source of power stands as a testament to human ingenuity

and the pursuit of harmony with nature's laws. It holds the key to addressing our most pressing global challenges, from climate change to energy security, without compromising the health of our planet.

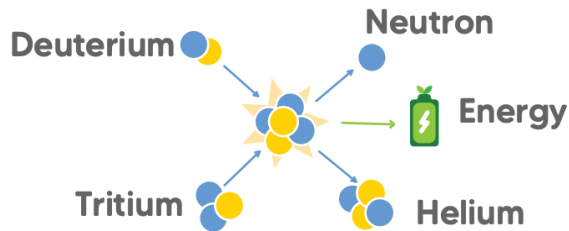


Figure 1: Fusion

The Roots of Fusion Energy: A Journey Through Time

The quest for fusion energy began around the mid-20th century ([EUROFusion](#)), inspired by the dream of harnessing the sun's limitless power. Today, there are over 37 private fusion company members of the Fusion Industry Alliance globally, developing fusion technologies to supply clean energy to balance grids, support transportation, and supply direct power for our industrial sector. The US has about 25 or more of these commercial fusion companies ([FIA 2023 industry report](#)) pioneering paths toward making fusion energy a reality, overcoming immense technical challenges to bring the physics of stars to power Earth.

Fusion: A Canopy of Benefits for Humanity's Common Good

Fusion energy extends its branches far and wide, promising a future where energy is clean, abundant, and accessible to all. Its potential to bring geopolitical peace, power cities, desalinate water, revolutionize transportation, and transform agriculture offers a comprehensive solution to the world's energy and environmental challenges.

Sheltering Branch: A Reliable and Abundant Source of Power

At the core of fusion's promise is its ability to produce reliable and abundant energy. It generates four times more energy per kilogram of fuel than nuclear fission ([IAEA](#)), tapping into a diverse array of fuel sources such as Deuterium and Tritium extracted from seawater and lithium. This sheltering branch not only supports the canopy of benefits fusion aims to provide, but also stands as a witness to fusion's scalability and potential to meet global energy demands.

Branch of Safety and Environmental Impact: Ensuring Public Safety and Promoting Environmental Stewardship

This branch of Fusion is characterized by its generation of short-lived radioactive material/waste, a containable and safe sustainable approach to energy generation. This aligns with the "Branch of Fresh Air," where fusion's role in combating climate change, and supporting clean air and healthier ecosystems is highlighted. With the potential for an inexhaustible fuel supply, fusion energy addresses the critical need for a cleaner environment.

Branch of Fresh Air: Combating Climate Change Through Reduced Carbon, NO_x, SO₂, and Particulate Matter (PM) Emissions

Fusion offers the best chance we have for reducing carbon emissions, methane along with SO₂, NO_x, particulate matter (PM) and halting climate change for future generations. Power generation accounts for a significant portion of these emissions, with a [December 2022 Congressional Budget Office Report](#) noting it at approximately 30 percent. Fusion promises to produce

electric power without these emissions or long-lasting nuclear waste, potentially generating vastly more energy than traditional methods. Its ability to provide dispatchable power positions it as an essential complement to renewables, which, despite their cost-efficiency, face limitations from natural conditions.

Branch of Energy Security: Strengthening Energy Security and Economic Growth

The "Branch of Energy Security" highlights fusion's capacity to enhance independence from geopolitical tensions and fossil fuel reliance, ensuring stable energy supplies.

Fusion energy is produced in facilities engineered with advanced safety mechanisms that inherently prevent any unintended consequences or misuse. The byproducts of the fusion process are inherently unsuitable for misappropriation, enhancing its appeal as a secure and peaceful energy source. Coupled with the "Growth-Enabling Branch," fusion energy supports economic development, fosters innovation, and creates job opportunities, promoting prosperity and improved livelihoods.

Outreach Branch: Bridging the Energy Divide

Fusion energy's 'Outreach Branch' extends its reach, its shade, and leafy understory to remote and underserved areas, ensuring equitable access to clean and affordable energy and fostering inclusivity. This branch can be seen as transforming the 'sucker' branches — elements that might initially seem destabilizing — into central, stabilizing roots. Like hidden roots that anchor and nourish, this branch secures the foundation for communal economic, political, and cultural growth, making clean energy a universally shared benefit. This branch is not just about spreading energy but also mirrors the vital role of chlorophyll in trees. Just as chlorophyll allows trees to convert sunlight into life-sustaining sugars, requiring essential nutrients like magnesium, iron, and nitrogen to function, fusion energy will transform high-tech resources into continuous, clean power that nurtures communities. Without adequate resources — similar to a tree deprived of nutrients — the potential of fusion energy cannot be fully realized.

The analogy highlights that our energy solutions, much like ecosystems, rely on a balanced input of essential materials to thrive. This is where humanity's pursuit of

calculable economics has overlooked the flowering of communal economic, political, and cultural opportunities possible when clean energy is a universal common. This central branch supports new growth and heals the wounds suffered through inequity. The benefits of fusion are similar to chlorophyll — an inexhaustible, renewing energy source accessible to all corners of the globe, pivotal in bridging the energy divide.

Branch of Unity: Fostering Global Collaboration

At the heart of fusion's development is the "Branch of Unity," embodying international cooperation and bringing nations together in a shared effort to address global energy challenges. This collaborative spirit is essential for the pursuit of sustainability and peace through technological advancement. It is what the UN has captured in its 17 spoke wheel, that all on earth share one atmosphere, already reacting to historic pollutants, its ability to shield and sustain life can only be healed by unified and collaborative actions.

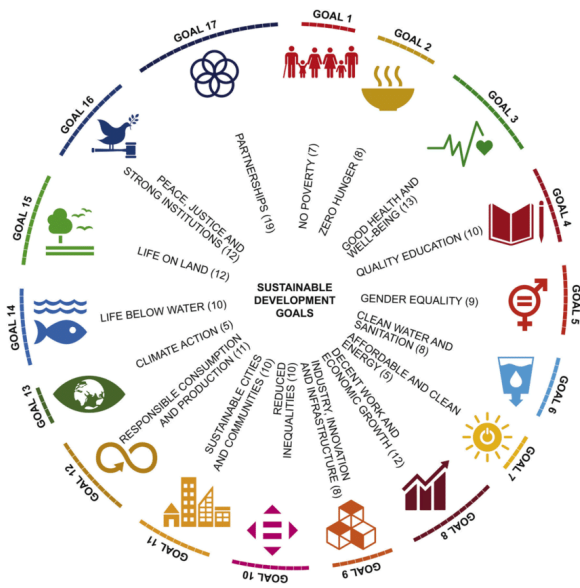


Figure 2: The 17 UN Sustainable Development Goals (SDGs)

Source: Carr, J. A., Petrokofsky, G., Spracklen, D. V., Lewis, S. L., Roe, D., Trull, N., Vidal, A., Wicander, S., Worthington-Hill, J., & Sallu, S. M. (2021). [Anticipated impacts of achieving SDG targets on forests - a review.](#)

**Sustainable Solution Branch:
Revolutionizing Data Center,
Desalination, Railroads and many
others with Fusion Energy**

Fusion energy, positioned at the forefront of technological innovation, offers a sustainable solution to some of the most pressing global challenges, including the high energy demands of data centers and the critical issue of water scarcity exacerbated by traditional desalination processes.

Data centers: Infrastructure safeguarding humanities growing¹ storage of crypto digital information, accounted for about 1-1.5% of the world's electricity use in 2023 (EIA), highlighting the sector's significant energy requirements. Assuming a 38% global share of activity in the United States, Leading Crypto currency Bitcoin mining's electricity usage ranged from 25 TWh to 91 TWh in 2023², constituting 0.6% to 2.3% of the U.S. electricity demand (3,900 TWh). This usage could power over three to six million homes annually. Globally, Bitcoin mining consumed 67 TWh to 240 TWh in 2023, representing approximately 0.2% to 0.9% of total electricity demand (EIA, bloomberg), equivalent to the energy consumption of Greece or Australia (EIA). When considering Bitcoin and the rest of crypto together, their energy consumption is estimated to be significant, potentially surpassing our current and planned capacity additions.

Meanwhile, desalination processes, though crucial for mitigating global water

¹ [With the growing demands of AI, data center storage capacity is expected to grow from 10.1 zettabytes \(ZB\) in 2023 to 21.0 ZB in 2027, for a five-year compound annual growth rate of 18.5%.](#) Jan 31, 2024

²<https://rmi.org/cryptocurrencys-energy-consumption-problem/#:~:text=Bitcoin%20alone%20is%20estimated%20to,fuel%20used%20by%20US%20railroads>.

scarcity, remain energy-intensive. Yet, technological advancements are gradually reducing their energy footprint, signaling a shift towards more sustainable water production methods.

Addressing the Global Water Crisis: The urgency of tackling water scarcity is paramount, with nearly two-thirds of the world's population experiencing severe shortages for at least one month each year. Projections indicate that by 2025, half of the global population may face water stress, potentially displacing approximately 700 million people due to intense scarcity by 2030 ([UNICEF](#)). By 2040, the specter of extremely high water stress looms over one in four children worldwide ([UNICEF](#)). These stark [statistics](#) highlight the necessity for innovative solutions like fusion energy in desalination to ensure a future where clean water is accessible to all.

In the United States, the industrial sector's energy consumption accounted for about 35% of the total in 2022 ([EIA](#)), emphasizing the substantial energy demands of manufacturing and production. The necessity for proximity to high-wattage transmission lines and the significant transportation costs associated with current energy supply methods further complicate the energy landscape. Moreover, the

growing adoption of electric vehicles highlights the escalating demand for clean, sustainable energy sources to support this green transition ([Center for Sustainable Energy](#)).

Fusion energy offers hope, capable of providing safe, direct, scalable power with minimal land use, making it an ideal candidate for sitting close to any community while powering industrial energy needs such as, data centers and desalination plants. Additionally, it can directly electrify the railroads, now in demand as part of our clean energy infrastructure ([EESI](#)), transportation priorities.

Fusion not only promises to efficiently meet the energy requirements of these sectors but also significantly reduces their environmental impact. For desalination, fusion energy's potential to power plants more sustainably and efficiently could play a pivotal role in addressing water scarcity. By generating clean, abundant energy without need of water for cooling and without long-lasting high level nuclear waste, fusion energy stands as an ideal power source for desalination, promising a future where clean water is more accessible and affordable globally. Fusion energy's ability to efficiently power desalination plants presents a transformative approach to ensuring clean

water access, promising to alleviate the global water crisis and support sustainable agriculture, improve public health, and foster economic development.

As the narrative progresses towards making fusion energy a practical reality once deployed, its potential to significantly reduce the carbon footprint of energy-intensive industries and address the urgent need for sustainable water supply systems becomes increasingly apparent. This vision of a fusion-powered future, aligning with global sustainability goals ([UN](#)), heralds a new era of environmental stewardship, supports new technological breakthroughs, and promises a healthier, more prosperous world for future generations.

Community Engagement and Technology Adoption

The successful implementation of fusion-powered solutions will hinge on robust community engagement and the collaboration of stakeholders across the spectrum. And this is where with resources and outreach E4CG works with local communities, their policymakers, scientists and industry leaders. This

collective effort is essential to identify and overcome the barriers to adoption and

realizing the full benefits of fusion energy for sustainable solutions to climate change.

A Future Powered by Fusion:

As scientists and engineers edge closer to making fusion energy a practical reality, the anticipation for a fusion-powered future grows. This energy source, capable of powering our industries, cities, and infrastructures safely and with minimal environmental impact, promises a world where energy insecurities are obsolete.

The Fusion Mother Tree with its interconnected benefits, beautifully captures the vision of fusion energy intertwined with our lives, signaling a healthier, more prosperous future for all.