INITIATION OF COVERAGE REPORT

CLIMATETECH & SUSTAINABLE INVESTING

WATER TOWER RESEARCH

Soluna Holdings, Inc. (NASDAQ: SLNH)

A Low-Cost Green Powered Data Center Operator with Multiple Paths to Grow

November 9, 2022

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KEY POINTS

- **Soluna is a leading provider of low-cost renewable energy powered data centers.** By bringing power demand to where electricity is generated, Soluna can purchase curtailed power that would have otherwise gone unsold.
- **Supporting growth in renewable electricity generation.** By purchasing electricity that would have otherwise been unsold, Soluna helps improve project economics for renewable power and further its growth on the grid. Moreover, data centers can easily ramp down their power use to help balance the grid in times of extreme power demand.
- **Near-term energization of its flagship project will be game-changing for Soluna.** Project Dorothy will more than double consolidated project cash flows and the installed base of megawatts under management when it receives final approval to begin operations in the coming months. The project will also be a replicable template that can be used in future data center projects.
- **A green play on the growth of Bitcoin mining.** Soluna's data centers are all powered by renewable power and have among the lowest electricity costs in the industry. The combination of green power and low cost makes the company's data centers attractive to third-party hosted miners and gives Soluna an advantage when it is mining its own Bitcoin to be sold or when it is hosting other miners through JVs.
- **Strong project-level economics.** Soluna targets a return on invested capital (ROIC) of three years or less on its projects and it achieved a 2x return in 16 months on its first project, Edith. The return profile of the projects has attracted outside infrastructure investors, notably Spring Lane Capital at Dorothy, and we expect to see additional investments to help accelerate growth and diversify future project risks.

KEY STATISTICS

Price	$0.96
52-Week Range	$0.86-17.02
Average Daily Trading Volume (30-Day)	120,614
Shares Outstanding (MM)	15.21
Market Capitalization ($MM)*	$13.64
Institutional Ownership (%)	12.59%
Enterprise Value ($MM)*	$32.92
Revenue TTM ($MM)	$26.70
Book Value ($MM)	$106.56
Fiscal Year-End	December

* Does not reflect October equity issuance.
Source: YCharts, as of November 8, 2022

OUR INSIGHTS

The Opportunities

Soluna is on the cusp of a major jump in its profitability and size with the start-up of its delayed flagship project Dorothy. Low energy costs and renewable power sources give the company a competitive advantage to grow the profitably of its cryptocurrency mining and expand its customer base into batchable, high-performance cloud computing.

The Obstacles

Soluna is subject to multiple factors that are outside of its control, mainly the timing of approvals from transmission operators, such as the Electric Reliability Council of Texas (ERCOT), and Bitcoin pricing/hash rate. The company has executed on what is in its control and has proved adept at reacting to these challenges, but they have slowed progress and forced Soluna to raise additional capital. As the company grows and brings on more projects, we expect portfolio diversification will help minimize the impact of individual project risk on corporate results.

COMPANY OVERVIEW

Soluna, through its operating subsidiaries, builds, owns, and operates flexible, modular data centers that are co-located with renewable energy projects that have excess energy. By bringing demand to the source of generation, the company takes advantage of low-cost energy to power its data centers, which can be used for energy-intensive computing applications such as cryptocurrency mining, artificial intelligence (AI), and machine learning (ML). Moreover, the flexibility and location of its data centers can help support renewable energy projects by helping them solve some of the challenges associated with intermittent energy generation such as curtailment, where the power plant can't monetize all the energy it produces.

Soluna has two operational data center projects in Kentucky (Sophie and Marie) and is in the final stages of energizing Project Dorothy, its flagship project co-located at a 150 MW wind farm in Texas. Phase 1 of Project Dorothy will be transformational for Soluna when it energizes in the coming months, with the potential to more than double the company's megawatts under management and annual cash flow contribution. Phase 2 of Project Dorothy will increase capacity and cash flow by another 50% when it comes online in late 2023. Soluna is engaged in discussions with multiple renewable energy projects companies for additional data center sites, having hired Truist Securities to accelerate project financing for its future pipeline.

How It Works

Soluna is able to source low-cost power for its data centers by bringing demand to where renewable electricity is generated. The intermittent nature of renewables and congestion on the grid result in significant amounts of electricity from renewable projects being unsold or curtailed. Soluna can purchase that power at a low fixed cost and in turn help improve the economics for developers and support growth.

The company's data centers are designed and purpose-built to work with the intermittent nature of renewable power. The data centers are a series of small modular prefabricated buildings that can easily be installed and linked together and flexibly scale energy consumption, unlike typical 24/7 large-scale warehouse-like data centers. Moreover, they are laid out so they can use ambient air for cooling and heating, eliminating the cost and environmental impact of climate systems and water usage.

The Market

To date, Soluna has been taking advantage of its low power costs to use its data centers to host cryptocurrency miners and mine for itself and then sell the cryptocurrency (primarily Bitcoin) for its own account. The profitability of Bitcoin mining is a function of power and computing costs, Bitcoin market price, and network difficulty. These factors have been very volatile in past years, which, along with leverage and fixed-price contracts, have led to several high-profile bankruptcies and business failures of cryptocurrency miners in recent months. Given its low power prices, Soluna has positioned its data centers to be profitable during this 'crypto-winter' and benefit as marginal/higher-cost miners drop out and industry conditions improve.

The company is also actively engaged in securing its first non-cryptocurrency customer in the batchable cloud computing market. This $100+ billion market is made up of universities, research institutions, and corporations in need of low-cost green computing power for compute-intensive cycles such as scientific research, AI, machine learning, and other compute-intensive tasks that are not on demand and can be paused if needed. This market is massively larger than the ~$6 billion digital currency computing market, but we note that customer ramp-up might be slow at first as Soluna establishes its solution and brand in the marketplace.

The Problem Soluna Solves

Soluna provides a solution to the problem of the intermittent nature of renewable energy projects. By bringing demand to the source of generation, the company's data centers can make renewable projects more attractive to developers (by buying curtailed power) as well as grid operators (by providing demand response), while at the same time supplying much needed green energy powered computing capacity.

KEY CONSIDERATIONS

A leading provider of low-cost renewable energy powered data centers. Soluna brings its power demand to the site of generation, allowing it to secure low electricity from renewable projects that would have otherwise gone unsold.

The growth of renewable projects creates a large target market for Soluna. The challenges of intermittent renewable power will increase as more projects are developed and tied to the power grid, and the recent passage of the Inflation Reduction Act of 2022 will only accelerate this growth. Battery storage and new/upgraded transmission capabilities will help, but we do not believe they will be sufficient to solve the problem. Demand for data centers, particularly those powered by renewable energy, is expected to continue to grow along with the proliferation of new technologies such as AI/ML and the amount of data associated with the 5G rollout.

Proven and replicable model for renewable projects. Soluna has successfully built, ramped, and operated three separate projects in different parts of the country, and Project Dorothy will be the fourth and largest. Through this experience, the company has developed a template, proprietary technology and project expertise that can be easily replicated at new renewable power sites. This should help Soluna secure new project sites as its track record and 'de-risked' model should make it an attractive partner for project developers, grid operators, and financial investors.

A commitment to transparency. Management has consistently been transparent and open about Soluna's position and operations in both good and difficult times, giving investors a clear picture of where it stands. The company publishes monthly flash updates that drill down into the operating history, current performance, and outlook for each project.

Return on capital focused. Soluna's key metric is ROIC. Projects need to see capital returned within three years as anything longer exposes it to too much uncertainty in management's view. The company's first project, Edith, returned 2x its capital in just 16 months. We expect Project Dorothy to have similarly attractive metrics, but we note that Bitcoin pricing and network hash rates may affect that timing.

Growth opportunities in addition to cryptocurrencies. Soluna's data centers are designed to be flexible and can support different computing applications at the same time. The company is engaged in securing its first non-crypto data center contract, which will open a new avenue for growth as the market for batchable cloud computing for scientific research or AI represents a considerably bigger market than crypto.

A green Bitcoin solution. By locating its data centers at renewable energy projects, the Bitcoin Soluna generates is 'green'. While there is much discussion about the environmental impact of Bitcoin in the media and from politicians, many of the criticisms are misinformed or cherry-pick facts and then fail to put those facts in perspective, including not acknowledging the impact of existing monetary systems, such as the carbon footprint of precious metal mining (to say nothing of its other environmental impacts) or the impact of security systems needed to protect and manage the world's existing money supply or ownership records and transactions of the various national central banks, credit card companies, and commercial banks. We note that the majority of Bitcoin mining utilizes renewable energy and that batchable computing can absorb excess renewable energy, which is one of the biggest challenges with renewable energy development and the green transition that is underway today. It will be central to stabilizing our energy infrastructure and achieving clean energy goals because it provides an additional load that offsets that disparity between generation and demand and helps strengthen the grid.

UPCOMING CATALYSTS

Energization date for Project Dorothy Phase 1. Soluna expects to have a 'line of sight' on a date that it can energize Phase 1 of Project Dorothy in the near future. Initially expected to be online in 2Q22, changes in the ERCOT connection process have pushed out the start date. Project Dorothy will be game changing for the company as it will more than double its annual cash flow contributions and its operating footprint of data centers. Moreover, it will lead to Phase 2 of the project and expand the possibilities for additional project funding and growth.

Announcing a batchable cloud computing contract. Soluna has been working to secure its first contract to use its data centers for batchable cloud computing applications, such as scientific computing, AI, and ML tasks. These are computer intensive but are not time sensitive, meaning they can be paused if needed. This contract will mark the beginning of the second phase of the company's growth and help diversify its customer base.

Updates on new project developments. Soluna has a strong project pipeline beyond Project Dorothy, with 275 MW in the design phase and more than 2 GW of projects in various phases of development. Moving forward on these projects will lead to additional growth opportunities and further market and geographic diversification.

Revenue from providing demand response in the ERCOT market. With the energization of Project Dorothy in Texas, Soluna will also be able to begin generating ancillary revenues from ERCOT for the flexibility to reduce its power consumption on demand.

Recent Events

Equity raise completed. Soluna raised $2 million through an underwritten public offering at $1.44 per share on October 26, 2022. The funds will be used to support the development of the company's data centers, including Project Dorothy. Soluna will also issue 593,065 shares of common stock to Spring Lane Capital upon conversion of its $850,000 promissory note and accrued and unpaid interest at the same price per share as the public offering.

Extending the maturity of convertible notes. On September 13, 2022, Soluna announced the extension of the maturity to April 2023 of its convertible notes, which were issued on October 25, 2021. The company was not required to make the $950,000 escrow deposit that would have been due on September 28, 2022, or redeem up to $2,200,000 of notes on September 29, 2022. In exchange for the extension of the maturity, the balance due will increase to $13,006,022, up from $12,485,781, and Soluna also issued 430,564 shares of common stock to the noteholders in exchange for the noteholders' existing Class B warrants and four new classes of warrants, each to purchase up to 1,000,000 shares of common stock, at exercise prices $3.50, $4.50, $5.50, and $7.50, respectively.

Renewed hosting contract. On September 9, 2022, Soluna renewed and extended the 10 MW hosting contract with its customer at Project Marie in Kentucky. The new contract enables Soluna to pass through power costs to the customer, but also enables the company to receive a meaningful profit share based on the potential upside of Bitcoin gains.

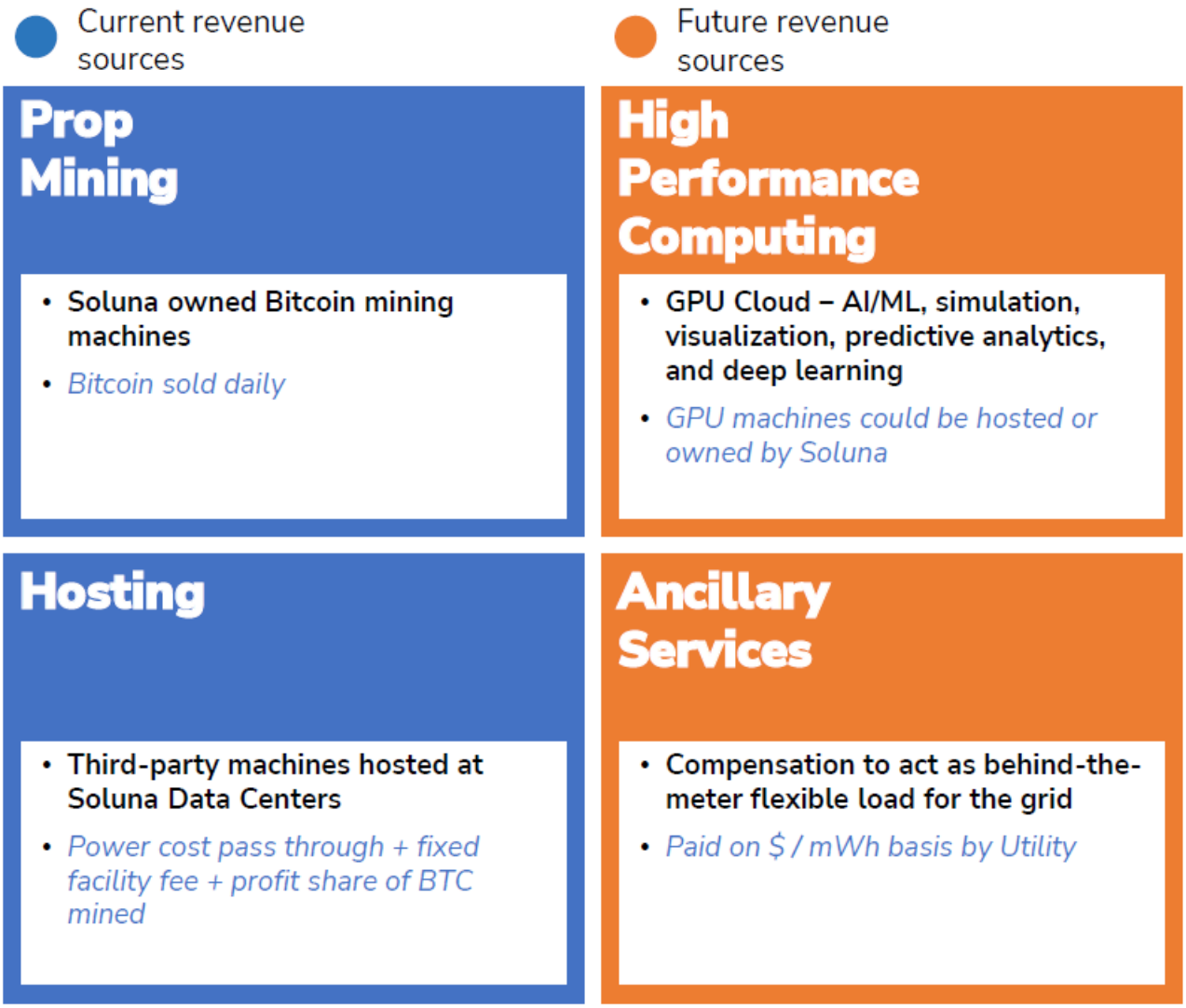
Project-level funding from Spring Lane Capital. In August, Soluna announced the initial funding of up to $12.5 million from private equity firm Spring Lane Capital, which is investing in a portion of Phase 1 of Project Dorothy. The funding is the first of up to $35 million in project financing committed by funds managed by Spring Lane Capital, originally announced on May 12, 2022.

HOW SOLUNA MAKES MONEY

To date, all Soluna's revenues have come from cryptocurrency mining, both proprietary mining and hosting for third-party miners. Bitcoin generated by the proprietary mining is sold daily and the company has stated it does not plan to mine and hold Bitcoin on its balance sheet. In 1H22, hosting accounted for ~15% of total revenues, but we note that the recently renewed hosting contract will be reported differently as power costs will be passed through and not part of GAAP revenues.

With the energization of Project Dorothy in Texas, Soluna will also be able to pursue ancillary revenues from ERCOT for the flexibility to reduce its power consumption on demand.

Figure 1: Soluna Revenue Sources



Source: Company reports, WTR

COMPANY OPERATIONS

Modular Data Centers

The company builds and operates modular data centers located at the site of a renewable energy generation project. In contrast to typical data centers that use warehouse-like buildings with a large footprint, extensive cooling systems, and are geared for 24/7 operations, Soluna's data centers are a series of small high-density modular prefabricated buildings that can be easily scaled to fit the project.

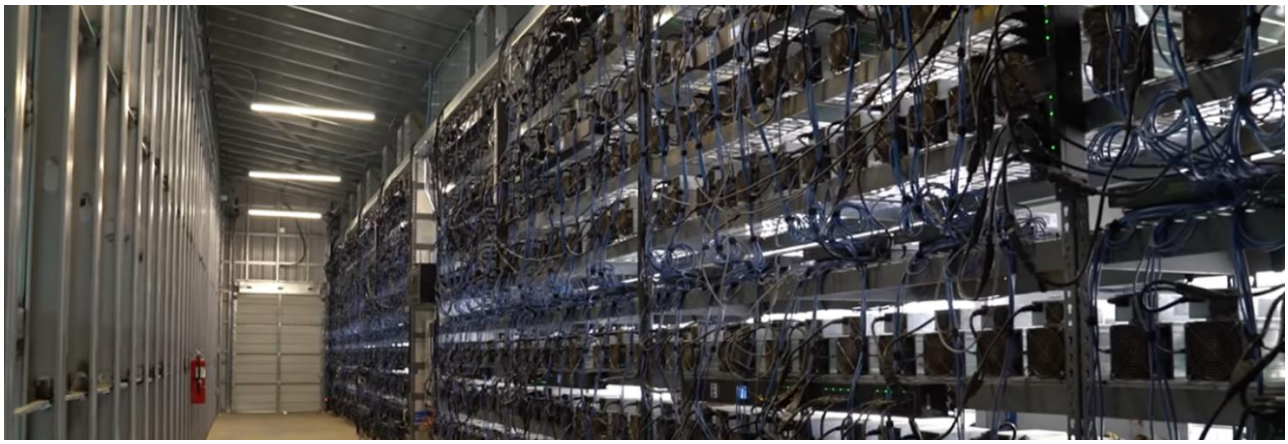
Figure 2: Soluna Data Center Construction Underway at Dorothy

Source: Company reports, WTR

Soluna's data centers are compact in their layout but are designed to have very efficient thermodynamics and can manage their climate with only ambient air. The buildings use low-speed fans and extended louvers for cooling, and the arrangement of the building in the shape of a diamond helps to optimize airflows and wind impact. Not only does this avoid the costs and environmental impact of typical climate systems or water, but it also allows for more power to be available for computing as none needs to be diverted to climate systems.

The systems are purpose-built for batchable computing applications and are capable of shutting down in as little as 15 to 90 seconds (depending on the processor configurations) and booting up in 90 seconds. This is made possible by Soluna's proprietary data center operating system called MaestroOS™. The data center systems and electrical design are agnostic in terms of the type of processors used and can support multiple systems within the same building. The sites are remotely monitored by technician-level personnel who use a combination of AI-driven testing as well as on-site diagnostics and maintenance.

Figure 3: Server Racks Inside a Soluna Data Center



Source: Company reports, WTR

Further, Soluna's projects benefit the local communities by creating several local jobs from construction and maintenance to technical management. The company also offers on-site training.

SOLUNA'S MARKETS

A Very Simple Overview of Electricity Generation and the Grid

Most people in the US and developed nations take for granted that electric power is available when they want, in whatever quantity they want—just put a plug into the outlet in the wall. However, behind the scenes, it's a very complex system with several moving parts.

Broadly, there are two types of electric power generation systems: (1) distributed generation (DG) where the power is generated and consumed on or very close to the site of generation; and (2) centralized power, which accounts for most of US electricity, whereby the electricity is generated by large and efficient plants that are typically located away from where the electricity is consumed. To get power to consumers, it is sent out over a network of high-voltage transmission lines before the voltage is 'stepped down' and distributed to the end-users. The network is referred to as "The Grid".

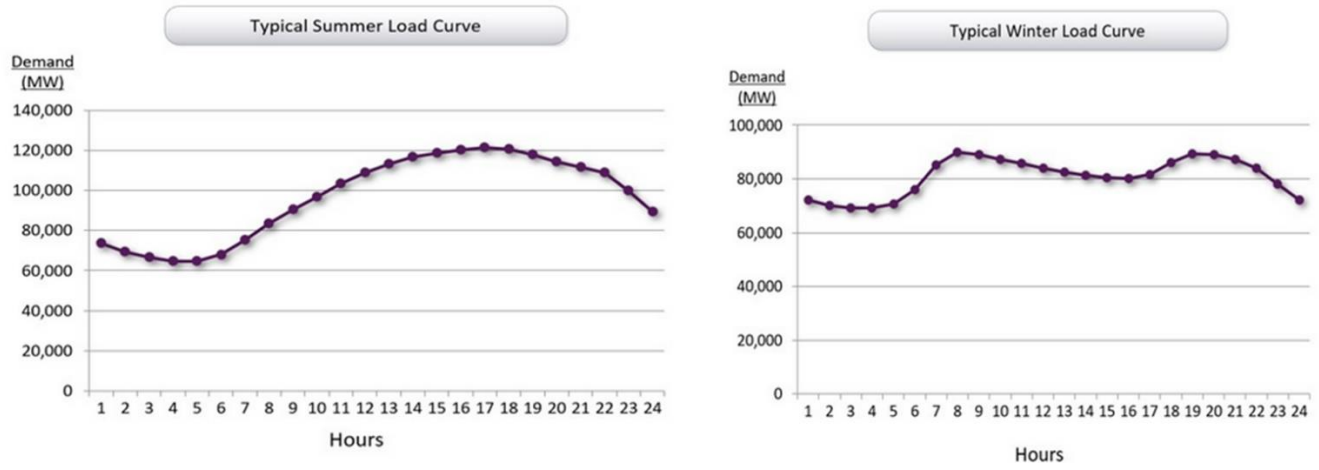
Figure 4: Centralized Electricity Generation

Source: Institute for Energy Research, WTR

The grid needs to be balanced, meaning that the supply of electricity is matched with the demand for electricity; otherwise localized or widespread blackouts can occur. Operators of the grid face the dual challenges of variable supply and constantly shifting demand. Demand from end-users fluctuates throughout the day based on general living habits and also the weather. The amount of available electricity generated also varies. Plants are sometimes offline for maintenance, renewable power is a function of the elements, and there are challenges of transmitting power to demand centers as well as changing commodity prices that impact the price of available power.

Figure 5 shows a typical demand curve. Electricity demand ramps up as people start waking up and turning on lights. It then wanes as the sun provides more lighting and people go to work but then increases into the evening as people turn on lights, cook dinner, and watch TV, leading to a decline in demand as people go to sleep. Summer loads are typically higher than winter loads and the amount of total demand will also fluctuate based on the weather; during the hotter days, fans and air conditioners will drive 'peak demand'.

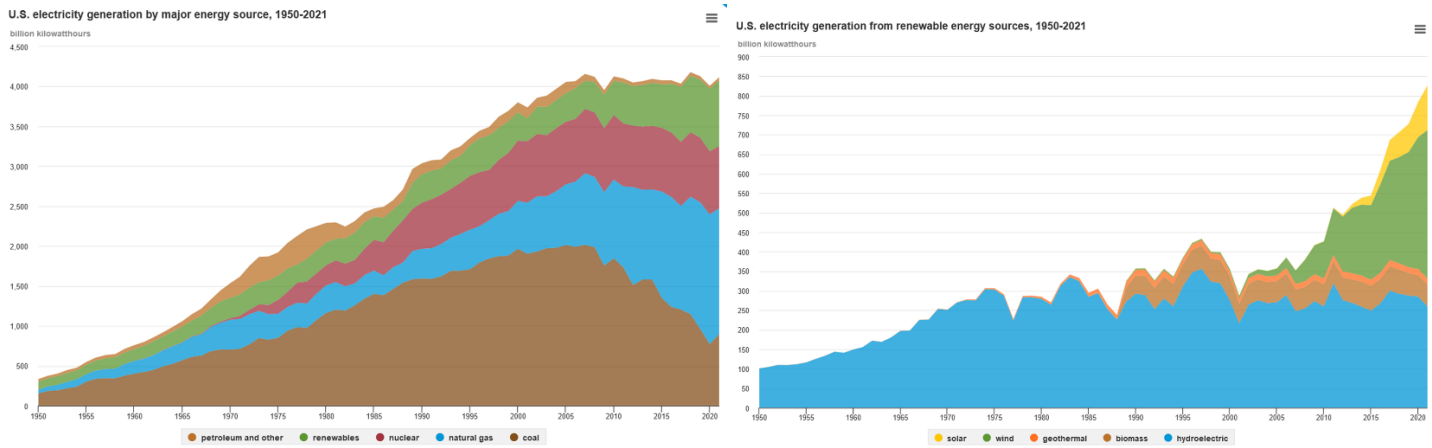
Figure 5: Electricity Demand Curves



Source: Enerdynamics, WTR

Twenty years ago, electricity generation mainly consisted of 'baseload' large coal and nuclear plants as well as natural gas plants that could be ramped up and down with demand as it moved. By 2021, renewables (led by wind) accounted for 21% of US electricity generation and are forecast to reach 42% by 2050 according to the EIA 2021 Annual Energy Outlook.

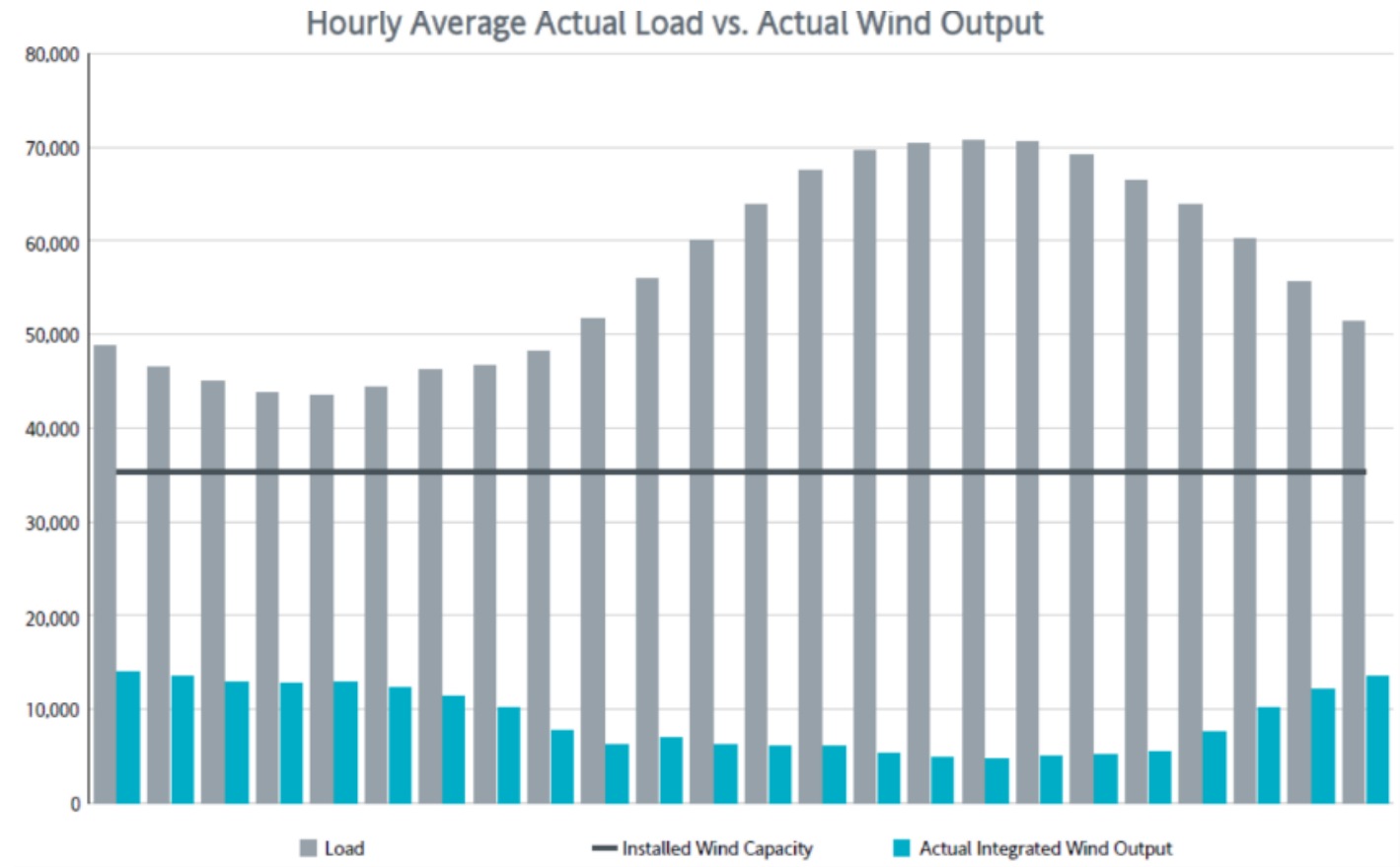
Figure 6: US Electricity Generation by Source



Source: Energy Information Agency, WTR

The challenge with renewables is that there is no control over when or how much the wind blows or the sun shines and they typically do not line up with times of peak demand. In Figure 7, we show that most wind energy is generated at night when demand for electricity is lowest, while peak solar generation occurs in the middle of the day when electricity demand dips.

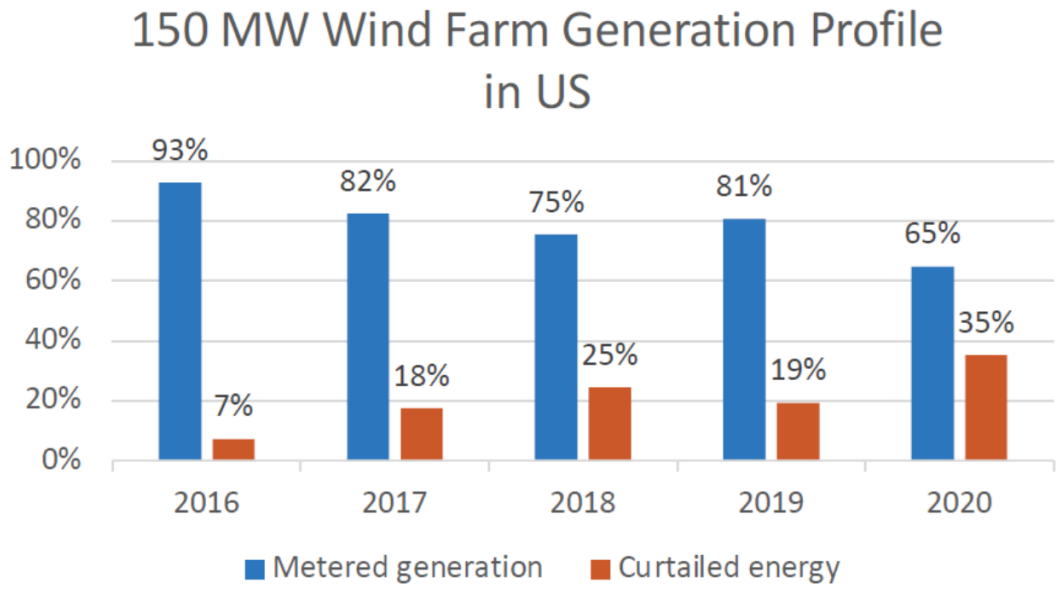
Figure 7: Wind and Load



Source: ERCOT, WTR

Traditional energy power plants can reduce fuel inputs to lower the amount of power they generate but wind, solar, and hydro plants cannot. Further, as more renewable plants connect to the grid, the transmission network becomes congested (exacerbated at times of high generation), making it challenging for renewable power generated to reach the demand center. This causes renewable plants to 'curtail' or 'spill' the electricity that could be sold (and production tax credits earned). As more intermittent power generation joins the grid, this problem will likely grow. Using data from regional transmission organizations and independent system operators, Soluna estimates that at the end of 2021, there were 14.9 TWh of wind and solar generation curtailed, an increase from 7.9 TWh in 2017. Figure 8 shows the amount of curtailed power at a Texas wind farm between 2016 and 2020.

Figure 8: Curtailed Energy Production at a Wind Farm



Source: Company reports, WTR

Another challenge is that large-scale renewable projects are typically located away from demand centers. A good example is in Texas, where the best winds are in the western part of the state, but most demand is in the southeastern part of the state.

The Curtailment Problem

A solution to the curtailment problem is to add energy storage to intermittent projects or the grid, and to upgrade and build new transmission capabilities.

Transmission

The challenges with adding transmission are time, cost, and permitting/land acquisitions rather than technology.

Figure 9: High Power Transmission Lines

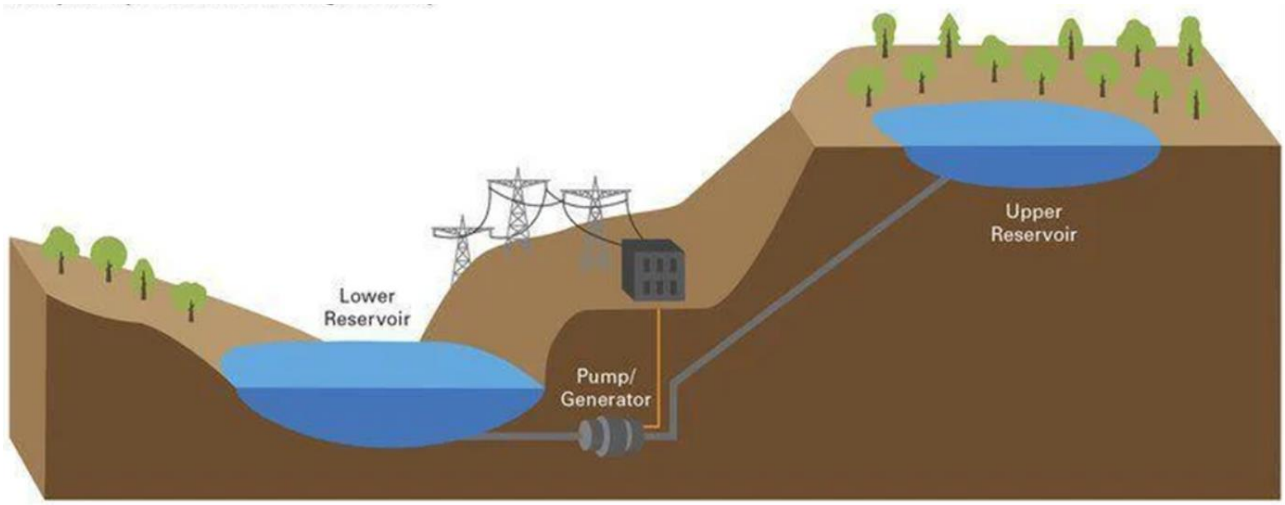
Source: Transmission World, WTR

A standard industry cost metric is approximately $1 million per mile of transmission, however, that number can be considerably higher depending on the terrain and labor availability. A transmission project can be derailed at many points in its decade-long timeframe from conception to completion. Failure to gain regulatory approval at the federal/state/local level, opposition from environmental groups and communities worried about their negative impacts, or the refusal of any landowner to cooperate are ever-present risks and have led to several high-profile project failures. A notable example of this is the Northern Pass transmission project that sought to build a 192-mile transmission line to bring renewable energy from Quebec into New Hampshire. Initially proposed in 2008, following years of local, state, and federal challenges, the utility trying to build the project abandoned it in mid-2019 after spending $318 million over the 10+ years.

ENERGY STORAGE SOLUTIONS

The primary method of energy storage is pumped hydropower—a producer uses off-peak (and low-cost) energy to pump water into an elevated reservoir that could then generate hydropower when needed.

Figure 10: Pumped Hydroelectric Storage Facility



Source: Dominion Energy, BDTonline, WTR

Using batteries for grid-scale energy storage has seen significant growth in recent years, driven by advances in technology and a sharp decline in price. Battery storage has the advantages of a small footprint, the ability to scale with the project, and a quick response time. However, there are drawbacks, including battery degradation over time, lost electricity in the charge/discharge cycle, and limited storage duration. Further, the costs and availability of batteries have been negatively affected by competition from electric vehicle demand. In some cases, utilities are rethinking their plans to deploy renewables with battery storage, as seen with the AES Indiana citing $381 million in cost savings over 20 years in its decision to re-power an existing coal plant with natural gas rather than build renewable generation with storage.

Computing is a Better Battery

Simply, a battery is a way to concentrate streams of energy that can be released as one on demand. The term for a battery is thought to have come from Benjamin Franklin, who called his collection of connected charged plates an 'electrical battery', a play on the military term for multiple cannons functioning together to form a battery.

Soluna has created a solution better than a battery; it uses renewable power to make a product (Bitcoin or AI calculations) and then the product can be used anywhere. We view it in the same way as an energy-intensive industry like aluminum locating its production near low-cost power sources and then shipping finished goods around the world.

BITCOIN BASICS

Bitcoin is a digital technology that serves the function of money. It is a store of value that is exchanged between trading partners.

What is Money?

The simplest form of trade is a direct exchange—a farmer trading eggs with a tailor for clothes. However, direct exchange is limited by location (the goods need to be brought to the site of exchange), scale (a suit of clothes is worth more eggs than the tailor can use?) and time preference (the amount of eggs needed to exchange for suit of clothes will rot and become worthless in time). The solution has been the use of indirect exchange—using an unrelated item or good that both parties agree will match the value of the goods traded. A medium of exchange can be anything the trading parties agree upon. Humans have used colored seashells, beads, large stones, precious metals, and paper notes as mediums of exchange over the centuries. The quality of the medium of exchange is its ability to store value over time, which is a function of the supply of the medium in circulation. History is full of examples of a medium of exchange losing value and failing due to an increase in the supply of the medium of exchange. When more of the medium of exchange is created (though discovery or production), the value of those already in circulation declines. If the dilution is large enough, people will stop using it as a medium of exchange.

Precious metals, such as gold, silver, and copper, have long served as effective mediums of exchange around the world. Gold is considered one of the best stores of economic value and it has stood the test of time over the centuries for several reasons. Gold has excellent chemical stability and does not degrade over time, and most of the gold mined is still in existence. Further, the mining of new stocks of gold is very difficult, which limits the amount in circulation. The proportion of gold mined annually to the total stock is typically less than 2% per year, far lower than other precious metals. Even in periods where the price of gold jumped significantly, there was not a corresponding jump in supply as we have seen in other commodities such as oil. For an excellent discussion of money, gold, and Bitcoin, we would recommend *The Bitcoin Standard* by Saifedean Ammous.

What is Bitcoin and Blockchain?

Bitcoin was created in 2008, when a pseudonymous programmer named Satoshi Nakamoto published a nine-page document on a cryptography site outlining a new decentralized, digital currency. The first Bitcoin was 'mined' in 2009 and by March 2022, there were about 19 million Bitcoins in circulation. The important attributes are that the number of Bitcoins is capped at 21 million and the ledgers recording who own it are decentralized. The distributed ledger technology is called "blockchain," which contains a record of every Bitcoin transaction ever processed. To be confirmed, transactions must be packed in a block that fits very strict cryptographic rules that will be verified by the network.

No one government, bank, or company controls the ledgers of accounts, rather there are thousands of copies of the same ledger distributed on computers around the world. A government cannot 'run the printing press' to pay for its spending or shut down the accounts of its political enemies. The open network prevents previous blocks from being modified because doing so would invalidate all the subsequent blocks. To hack it or steal it, you would need to hack 51% of the network, but in doing so, you would destroy the value of what you are hacking. Moreover, as the network and use of Bitcoin grows, it becomes more secure as hacking the 51% becomes that much harder to accomplish. It is said that Bitcoin is 100% verification and 0% trust.

BITCOIN MINING AND THE HASH RATE

Bitcoin mining is a computing process that solves cryptographic hash puzzles to verify the blocks of transactions that are updated on the decentralized blockchain ledger. For successfully solving mathematical problems and providing computing power to the network, miners are rewarded with Bitcoins, both in the form of newly created Bitcoins and fees in Bitcoin. The fees are like an audit fee for the integrity of the network.

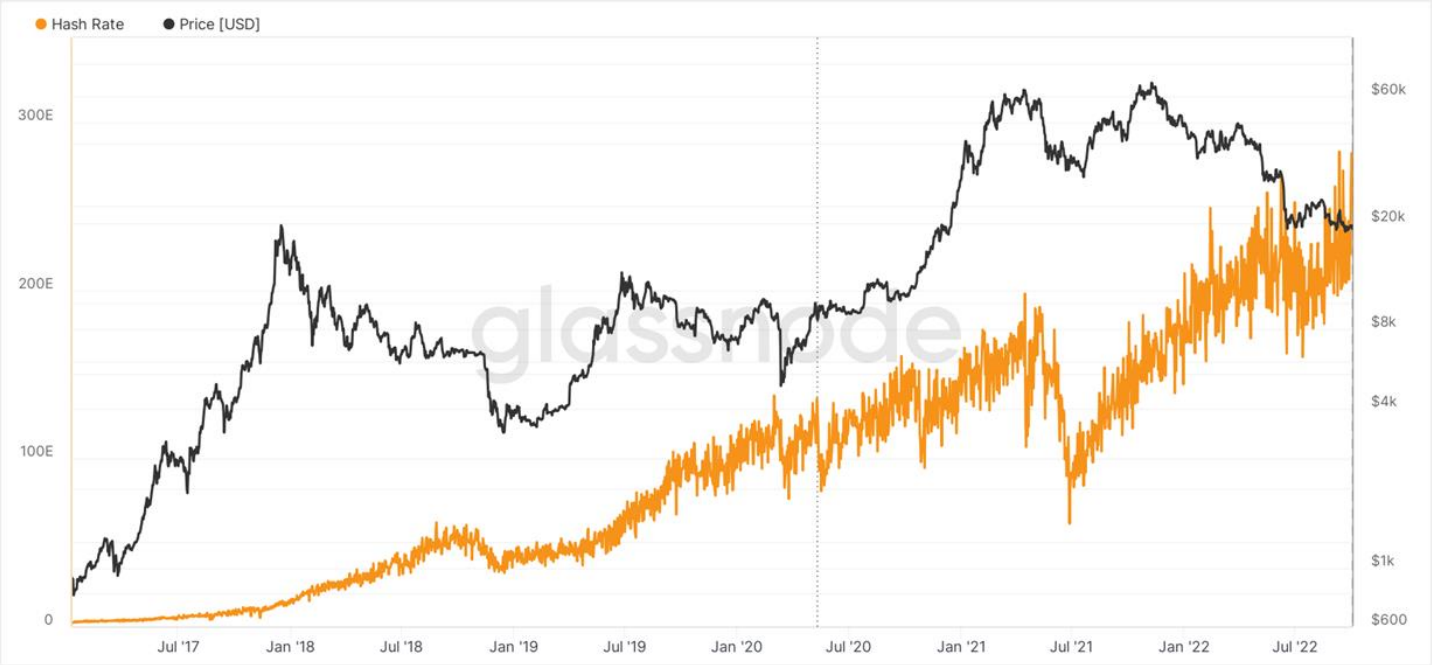
With Bitcoin, the proof of work algorithm is automatically adjusted with the goal of keeping the mining of new blocks constant at 10 minutes per block. As computing power is added to the network to solve the puzzles, the difficulty is increased, making mining more difficult for everyone. If computing power is removed, the difficulty is reduced, making mining easier. Another feature of Bitcoin is that the number of coins a miner receives 'halfs' every 210,000 blocks or roughly four years. In 2009, a miner received 50 Bitcoin per block as a reward; it is now 6.25 Bitcoin and the next halving is expected to take place sometime in 2024, which will reduce the reward to 3.125. This process will continue until all 21 million Bitcoins are mined by 2140.

Hash Rate

Bitcoin miners use the SHA-256 Cryptographic Hash Algorithm and the hash rate is a unit of measurement used to gauge the processing power of the Bitcoin network. It is the number of times per second that computers on the Bitcoin network are hashing data to verify transactions and perform the encryption that secures the network.

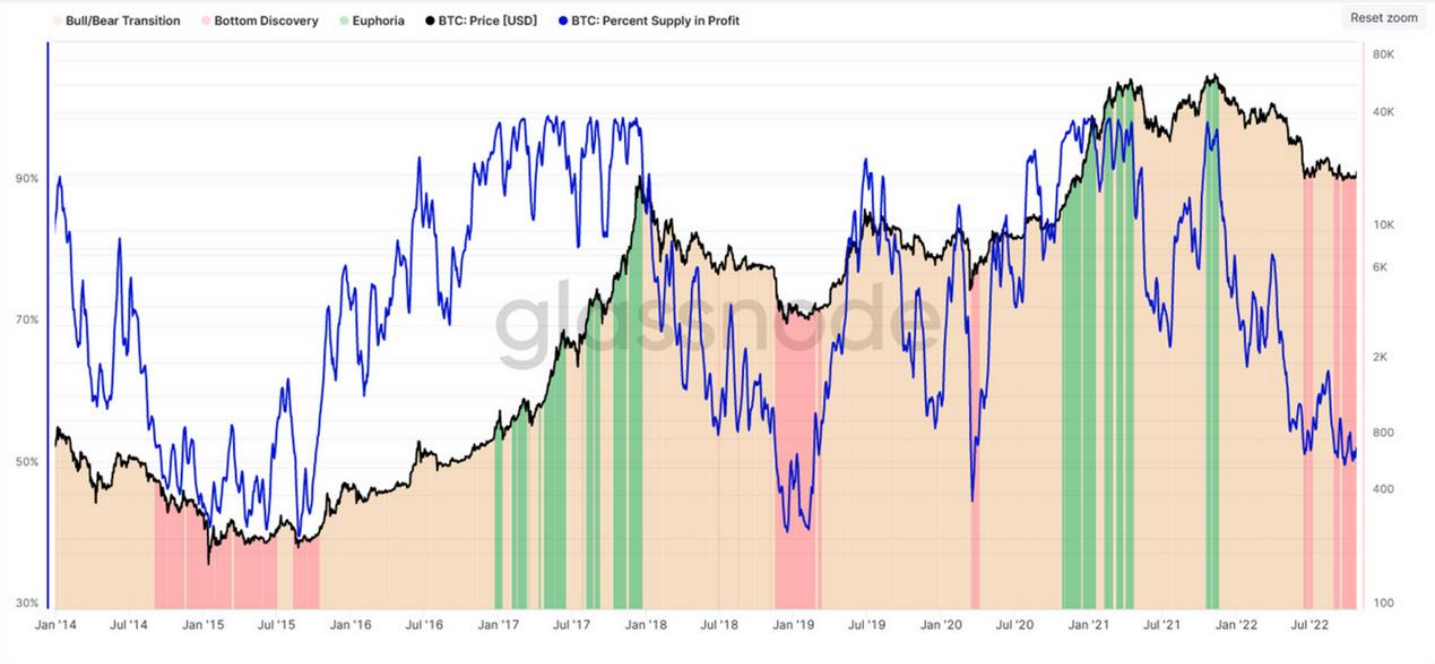
A higher network hash rate can be seen as healthy as more miners increase the overall security of the network and it is indicative of the popularity of a cryptocurrency (increasing in growth and adoption) however, it reduces profitability for miners. Higher hash rates should push marginal (higher power costs, inferior processors) miners off the network and in time the price of Bitcoin should increase in relation to the hash rate. However, we note the market remains very volatile and given its immaturity relative to other markets, this is likely to continue in the near term.

Figure 11: Bitcoin Mean Hash Rate



Source: Glassnode, WTR

Figure 12: Bitcoin Supply Profitability Cycle

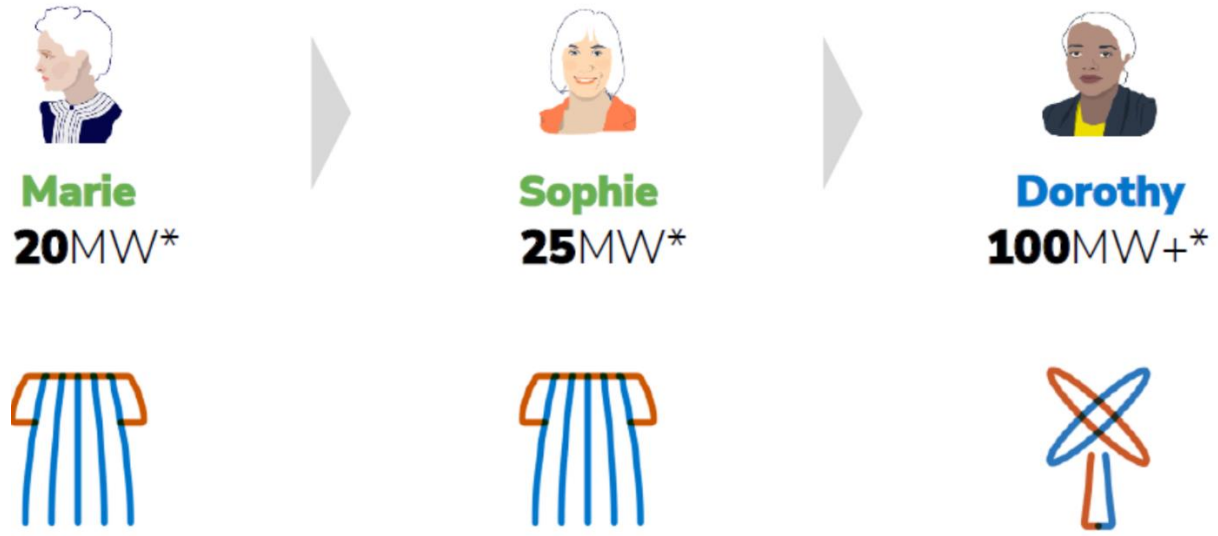


Source: Glassnode, WTR

OPERATING PROJECTS

As of October 2022, Soluna had approximately 45 MW of capacity at data centers across two projects located in Kentucky that rely on hydropower. Its flagship project, Dorothy, is in the final stages of getting approval for energizing following interconnection delays due to changes in ERCOT's policy earlier this year. Phase 1 of Project Dorothy will more than double the company's capacity and will be followed by an additional 50 MW in Phase 2. The company's 2.6 MW beta test site, Project Edith, recently stopped operations and sold its miners after serving as a proof of concept and returning a total of 3.5x capital in less than three years.

Figure 13: Soluna Existing Projects

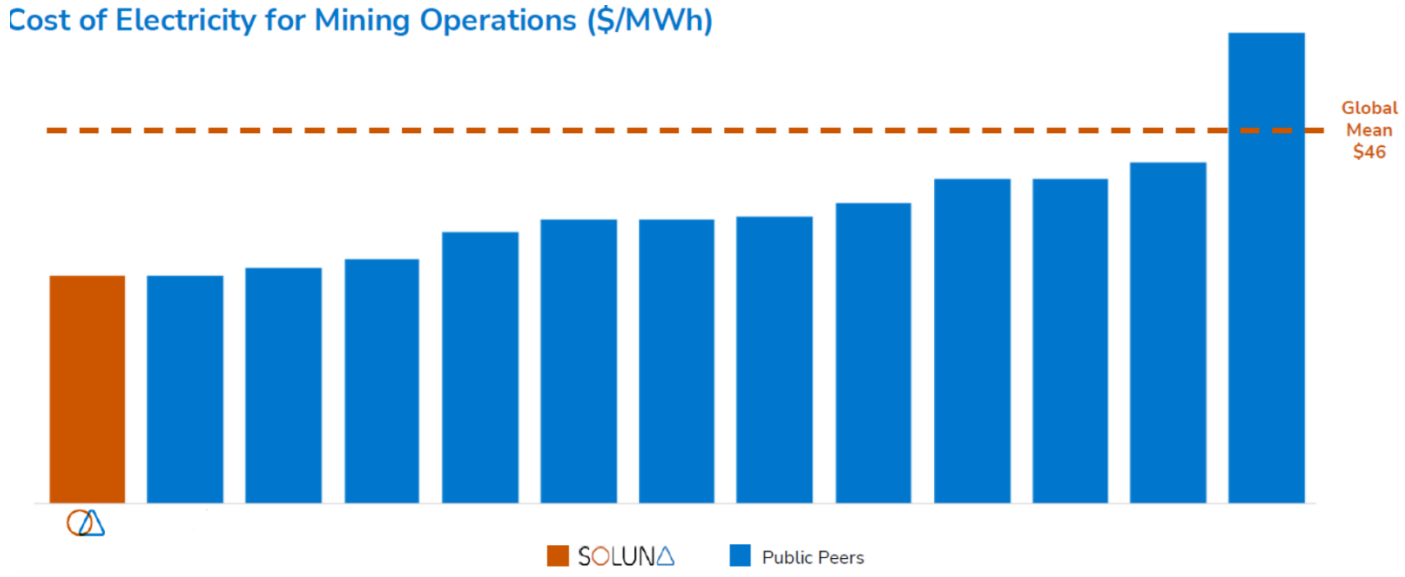


*Data center capacity

Source: Company reports, WTR

Power costs have an outsized impact on Bitcoin mining profitability and Soluna has secured some of the lowest energy costs in the industry as seen below.

Figure 14: Soluna's Electricity Cost vs Peers



Source: Company reports, WTR

Project Dorothy

Project Dorothy, named after famed NASA mathematician Dorothy Vaughan, is a 100 MW capacity data center at a 150 MW wind farm in Texas. The project is being developed in two 50 MW phases, the first of which is waiting for ERCOT approval to connect to the grid. We expect it to be energized in the coming months.

This project is game changing for Soluna. The company expects Phase 1 to generate an additional $27 million to $38 million of annual cash flows as well as double the MW deployed. Figure 15 shows the company's illustrative project P&L from the September Flash report.

Figure 15: Project Dorothy Illustrative Monthly P&L

Illustrative Monthly P&L
($ In '000s)

	Dorothy 1A 25MW Spring Lane (32% Owner)			Dorothy 1B 25MW 100% Owner		
	100% Hosting	50% / 50%	100% Prop	100% Hosting	50% / 50%	100% Prop
Cash Inflows	1,139	1,364	1,588	1,139	1,364	1,588
(-) Power Costs	(630)	(630)	(630)	(630)	(630)	(630)
Cash Contribution Margin	509	734	958	509	734	958
% Contribution Margin	*45%*	*54%*	*60%*	*45%*	*54%*	*60%*
Cash Contribution Margin to Soluna	346	499	652	509	734	958

Intended to illustrate cash economics to Soluna, NOT representative of GAAP accounting representation.

Note: Assumes $20k BTC price, 225 EH / s network hash rate, 93% capacity factor, 95% availability factor, and $35 / kWh average annual power costs (includes assumed seasonal demand fees and taxes). Hosting contract includes power cost pass-through, $146k fixed fee per 10 MW, and 15% profit share. Assumes that hosted machines are 95 Th/s S19s. Cash inflows not referred to as revenue due to pending GAAP treatment of power cost pass-through for hosting contracts.

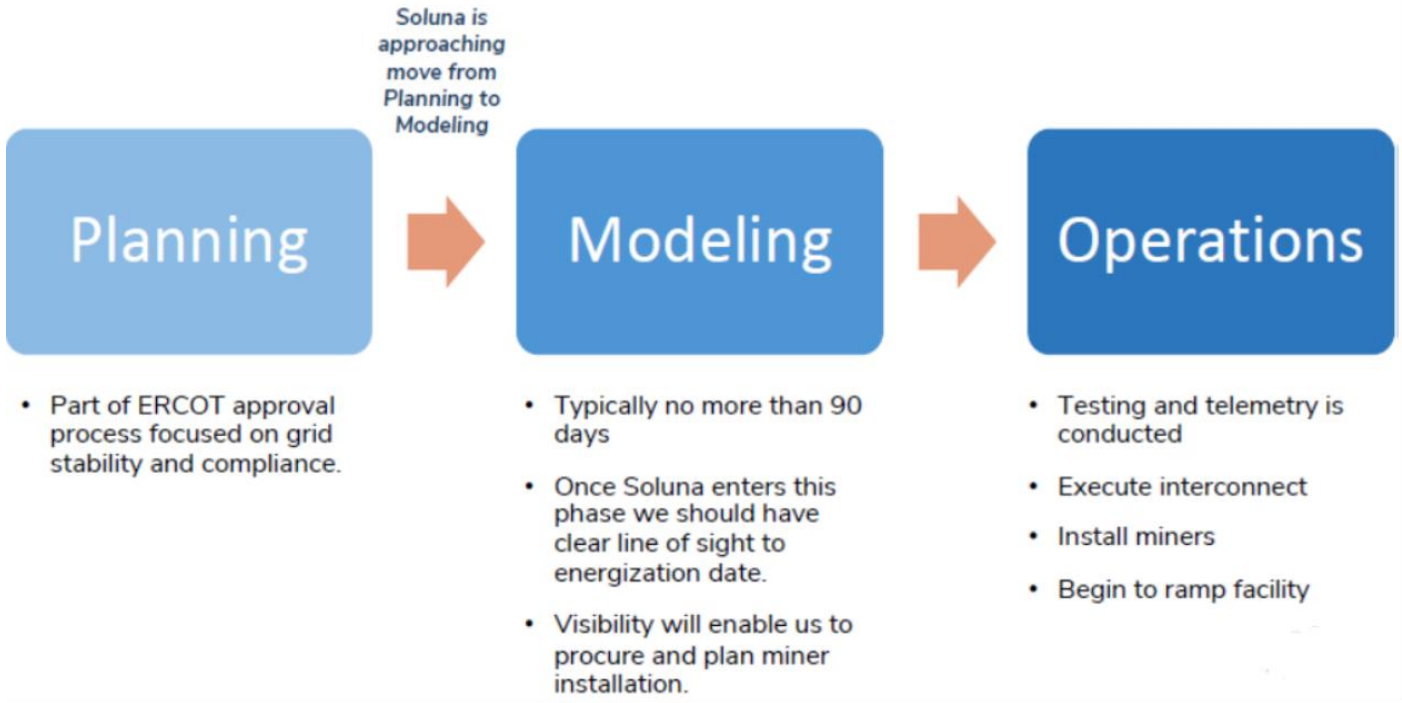
Source: Company reports, WTR

ERCOT Approval

Phase 1 had been expected to be online in mid-2022, but was pushed out due to delays in the ERCOT approval process. Before any project can connect to the grid, the grid operator (ERCOT in this case) will work to understand how the new asset will affect the grid and its reliability. This is usually a relatively straightforward process, however, the massive influx of renewable projects, energy storage, and cryptocurrency miners moving to Texas flooded ERCOT. This came on the heels of the 2021 winter storm power outages that were blamed for more than 100 deaths. On March 25, 2022, ERCOT issued a new Interim Large Load Interconnection Process to ensure grid reliability, which took time to develop and has slowed the approval process.

Project Dorothy is now approaching the move from the Planning to the Modeling phase, which should lead to energization in the coming months.

Figure 16: Project Dorothy Path With ERCOT



Source: Company reports, WTR

OTHER PROJECTS

Soluna's two projects in Kentucky were ramped up in 2H21 and into early 2022. The two projects rely on hydropower from plants owned by the Tennessee Valley Authority (TVA). Operating performance at these plants in 2Q22 and 3Q22 have been affected by the summer drought as well as higher fuel cost adjustments, however, the company sees operations returning to more normalized levels. The company also leases out a portion of its capacity at its Marie facility to third-party miners. In September 2022, Soluna renewed its hosting contract, which it expects will increase margins as well as mitigate volatility in both power and Bitcoin prices.

Project Sophie

Named for Sophie Wilson, Project Sophie has a 25 MW capacity and is in Kentucky and utilizes hydropower. Soluna began ramping its capacity in 2H21 and into 1H22 and currently has about 450 Gross PH/s deployed.

Figure 17: Project Sophie Non-GAAP Historic Financials*

($ in 000s) (Unaudited)

	Actual Q4 21	Actual FY 21	Actual Q1 22	Apr 22	May 22	Jun 22	Actual Q2 22	Estimate Jul 22	Estimate Aug 22	Estimate Sep 22	Estimate Q3 22	Estimate YTD 22
Revenue	2,772	2,772	3,808	1,634	1,310	1,077	4,022	1,099	1,176	895	3,170	10,999
Electricity/Direct Costs*	884	884	1,546	325	382	433	1,140	611	681	451	1,742	4,429
Overhead Costs	284	307	311	266	183	173	622	158	138	121	416	1,349
Adjusted Cost of Cryptocurrency Revenue 1** (Non-GAAP)	**$1,169**	**$1,191**	**$1,857**	**$591**	**$565**	**$606**	**$1,762**	**$768**	**$818**	**$572**	**$2,158**	**$5,778**
Cash Contribution Margin (Non-GAAP)	**$1,604**	**$1,581**	**$1,950**	**$1,043**	**$746**	**$471**	**$2,260**	**$331**	**$358**	**$323**	**$1,011**	**$5,221**
Cash Contribution %	**57.8%**	**57.0%**	**51.2%**	**63.8%**	**56.9%**	**43.7%**	**56.2%**	**30.1%**	**30.4%**	**36.1%**	**31.9%**	**47.5%**
Adjusted Cash Contribution Margin Excluding One Time Events & Projects* (Non-GAAP)**	**$1,705**	**$1,683**	**$1,950**	**$1,189**	**$830**	**$560**	**$2,580**	**$331**	**$358**	**$323**	**$1,011**	**$5,541**

*Includes Electricity costs

**Excludes Depreciation and R&D Expenses

***Excludes Year-to-date 2022 non-recurring expenses of $320 thousand (management estimate). Such non-recurring expenses are related to inventory reconciliation and quality assessment post installation of miners.

Key Operating Metrics:	Q4 21(1)	FY 21(1)	Q1 22(2)	Apr 22	May 22	Jun 22	Q2 22(3)	Jul 22	Aug 22	Sep 22	Q3 22(4)	YTD 22(5)
Avg. MW Deployed	7.39	7.39	13.74	15.24	15.64	14.66	15.18	16.09	16.08	15.81	15.99	14.97
Avg. Hashrate (SHA-256, PH/s)	92.44	92.44	214.79	300.03	322.65	357.62	326.77	371.53	381.74	377.00	376.76	306.10
Avg. BTC Price	55,932	47,449	41,281	41,435	31,706	24,384	32,508	21,539	22,366	19,805	21,237	31,676
BTC Equivalent Mined	49.56	58.42	92.23	39.44	41.32	44.19	123.72	51.00	52.58	45.18	149.25	347.24

(1) Average of October 2021 - December 2021

(2) Average of January 2022 - March 2022

(3) Average of April 2022 - June 2022

(4) Average of July 2022 - September 2022

(5) Average of January 2022 - September 2022

Note: BTC Price in FY 21 column is the average of January 2021 to December 2021

Note: Non-GAAP reconciliation can be found in the September Flash Report on the company's website

Source: Company reports, WTR

Project Marie

Named for Nobel Prize winner Marie Curie, Project Marie has a 20 MW capacity facility that is co-located with an industrial facility in Kentucky. Ramped up in 2H21 and into 2022, the facility initially was to have a 25 MW capacity but has since entered into a renewed contract to better reflect the operating capacity that the plant is able to deliver.

Figure 18: Project Marie Non-GAAP Historical Financials

Excludes ~$276k of power costs which are passed directly to hosting customer

($ in 000s) (Unaudited)

	Actual Q2 21	Actual Q3 21	Actual Q4 21	Actual FY 21	Actual Q1 22	Apr 22	May 22	Jun 22	Actual Q2 22	Estimate Jul 22	Estimate Aug 22	Estimate Sep 22	Estimate Q3 22	Estimate YTD 22
Revenue (Non-GAAP)	$668	$1,463	$4,354	$6,589	$4,940	$1,567	$1,562	$1,107	$4,236	$1,061	$1,114	$801	$2,977	$12,153
Prop Mining	668	1,114	2,626	4,512	3,488	1,192	1,129	737	3,058	711	669	613	1,993	8,538
Hosting	0	349	1,729	2,078	1,452	375	434	370	1,179	350	445	188	984	3,615
Electricity/Direct Costs*	$190	$522	$1,456	$2,191	$2,083	$509	$815	$798	$2,122	$941	$993	$506	$2,440	$6,645
Prop Mining	190	338	566	1,117	997	244	453	449	1,146	498	480	384	1,362	3,505
Hosting	0	184	890	1,074	1,086	265	362	349	975	443	513	122	1,078	3,140
Overhead Costs	$0	$54	$290	$345	$333	$117	$132	$153	$401	$143	$123	$93	$358	$1,092
Prop Mining	0	54	290	345	333	117	132	153	401	143	123	93	358	1,092
Hosting	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjusted Cost of Cryptocurrency Revenue 2** (Non-GAAP)	$190	$577	$1,746	$2,535	$2,416	$626	$947	$950	$2,523	$1,083	$1,116	$599	$2,798	$7,737
Prop Mining	190	393	856	1,461	1,329	360	585	602	1,548	640	603	477	1,720	4,597
Hosting	0	184	890	1,074	1,086	265	362	349	975	443	513	122	1,078	3,140
Cash Contribution Margin (Non-GAAP)	$478	$886	$2,608	$4,054	$2,524	$941	$616	$156	$1,713	($22)	($2)	$203	$178	$4,415
Prop Mining	478	721	1,770	3,050	2,158	831	544	135	1,510	71	65	136	273	3,941
Hosting	0	166	839	1,004	366	110	72	21	203	(93)	(68)	66	(94)	475
Cash Contribution % (Non-GAAP)	71.6%	60.6%	59.9%	61.5%	51.1%	60.1%	39.4%	14.1%	40.4%	-2.1%	-0.2%	25.3%	6.0%	36.3%
Prop Mining	71.6%	64.7%	67.4%	67.6%	61.9%	69.7%	48.2%	18.3%	49.4%	10.0%	9.8%	22.2%	13.7%	46.2%
Hosting	n/a	47.4%	48.5%	48.3%	25.2%	29.3%	16.6%	5.7%	17.3%	-26.6%	-15.2%	35.1%	-9.6%	13.1%
Adjusted Cash Contribution Margin Excluding One Time Events & Projects* (Non-GAAP)**	$478	$886	$2,642	$4,088	$2,687	$1,219	$616	$156	$1,991	($22)	($2)	$203	$178	$4,857

*Includes Electricity and Hosting costs

**Excludes Depreciation and R&D Expenses

*** Excludes impact of tornado and shutdown

Note: Excludes pass-through revenues from legacy hosting contracts

Note: Non-GAAP reconciliation can be found in the September Flash Report on the company's website

Source: Company reports, WTR

COMPETITION

There are several players involved with crypto mining operations, ranging from individuals using one or more systems to industrial-scale mining farms with thousands of systems. The mining business is global and is not dominated by any particular individual or organization. Soluna believes Marathon Digital Holdings, Riot Blockchain, Inc. CleanSpark, Inc., Core Scientific, Inc., Cipher Mining, Inc., HIVE Blockchain Technologies, Ltd., and Hut 8 Mining Corp. are its closest competitors.

RISKS

Soluna is not profitable and in its June 2022 10Q, the company stated that there was substantial doubt about its ability to continue as a going concern. Since the filing of the 10Q, the company has raised equity capital and extended the maturity of its October 2022 notes.

Prices of cryptocurrencies are extremely volatile and can result in lower-than-expected revenues when the mined cryptocurrencies are converted into dollars.

The cryptocurrency mining industry is very competitive and Soluna may have difficulty keeping pace with technological developments in the industry and could face difficulty in obtaining new equipment.

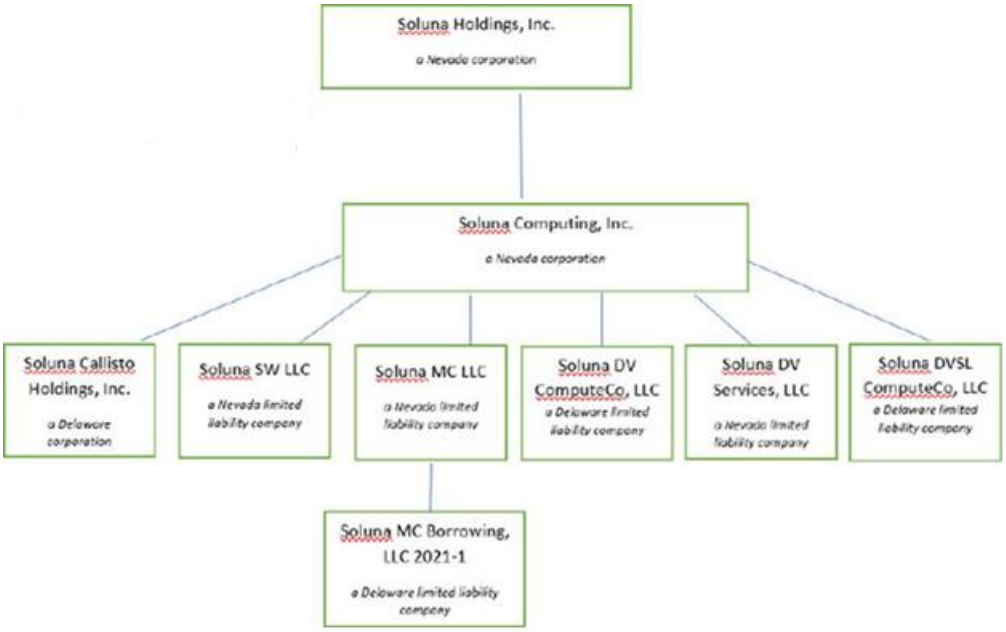
Regulatory changes or actions may have a material impact on the company's operations and adversely affects the profitability of mining cryptocurrencies.

COMPANY BACKGROUND

Soluna Holdings, Inc., was incorporated in Nevada on March 24, 2021, and is the successor to Mechanical Technology, Inc, following a merger that became effective on March 29, 2021. In November 2021, the company changed its name to Soluna Holdings, Inc.

The company operates through its wholly owned subsidiary Soluna Computing Inc. and is headquartered in Albany, New York.

Figure 19: Corporate Structure



Source: WTR, company reports

COMPANY LEADERSHIP

Michael Toporek has served as the Chief Executive Officer of Soluna Holdings since November 2020 and since 2003, has served as the Managing General Partner of Brookstone Partners. Prior to founding Brookstone Partners in 2003, Mr. Toporek was both an active principal investor and an investment banker. He began his career in Chemical Bank's Investment Banking Group, later joining Dillon, Read and Co., which became UBS Warburg Securities Ltd. during his tenure, and SG Cowen and Company. Mr. Toporek currently serves on the Board of Trustees of Harlem Academy and on the Board of Directors of Capstone Therapeutics Corp. Mr. Toporek has a B.A. in Economics and an M.B.A. from the University of Chicago in Finance/Accounting.

John Belizaire has served as a member of the Board and as Chief Executive Officer of Soluna Computing since October 2021. Prior to joining Soluna, Mr. Belizaire was the founder and CEO of FirstBest, a transformative insurance software company acquired by Guidewire Software, and Theory Center, an e-commerce software company acquired by BEA Systems. Before becoming an entrepreneur, he was the lead architect for Intel's Digital Enterprise Group. Mr. Belizaire has a B.S. in Computer Science and a Master of Engineering in Computer Science from Cornell University.

Philip Patman has served as Chief Financial Officer since August 2022, joining Soluna from Ameresco where he was Vice President and Head of Renewable Fuels M&A and Strategy. Prior to Ameresco he worked at Huron Consulting Group, Inc., VAALCO Energy, Inc., Thailand's PTT Exploration and Production Public Company, Limited, AES Corporation, Franklin Templeton Investments, Marathon Oil Corporation and Enron Corp. He holds a law degree from the University of Houston Law Center and he earned a bachelor's degree from the University of Texas at Austin through its Plan II Honors Program.

Dipul Patel has served as the Chief Technology Officer of Soluna since 2018 having previously founded and sold Ecovent Systems, a climate control systems company. Earlier in his career, he worked at Lockheed Martin focusing on Ballistic Missile Defense programs and multiple advanced radar and electronic warfare systems. He received a B.S. from Drexel University, a master's in Electric Engineering from the University of Pennsylvania and an MBA from the Massachusetts Institute of Technology where he serves as an Entrepreneur in Residence and Lecturer.

Mary O'Reilly has served as Chief People Officer at Soluna Computing since September 2021. Mary has spent the last 20 years in operations and organizational development roles helping build startups and transform large media organizations. Prior to Soluna, Mary was the Chief Operating Officer of nonprofit Farm Sanctuary, and VP of Human Resources at Viacom, bringing the brands MTV, Vh1, TV Land and Comedy Central into the digital content landscape. Before Viacom, she helped build and scale several media and technology startups including Meadowlark Media, Dstillery, CBS Interactive, Alloy and Organic, Inc. Mary is an advisor to several startup organizations through SHINE People, the people & talent advisory collective she founded. She is also a volunteer at iMentor and The David Lynch Foundation, bringing meditation to veterans and at-risk populations. She is an early member of Chief, the private membership network focused on connecting and supporting women executive leaders. Mary holds a BA degree in Psychology from Antioch University.

ABOUT THE ANALYST

Graham Mattison
Senior Research Analyst
ClimateTech & Sustainable Investing

Graham Mattison brings more than 20 years of experience in equity research, investor relations, and corporate operations, growth, and development. Graham was the Investor Relations Officer for two NASDAQ-listed companies where he led multiple equity raises as well as managed an activist investor campaign, M&A and corporate restructuring, and a NASDAQ delisting and relisting.

Previously, he was a Senior Equity Research Analyst, most recently at Lazard Capital Markets, covering the industrial and cleantech industries. He began his career in Southeast Asia as an Investment Analyst for Daiwa Securities. He was also co-founder of an online residential real estate start-up that developed a web-based auction platform.

Graham received his BA in East Asian Studies with minors in Economics and History from Hobart College and his MBA in Finance with honors from the Thunderbird International Business School at Arizona State University. He is an Investor Relations Charter (IRC) holder from the National Investor Relations Institute.

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