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# Table of Contents

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<b>Introduction</b>	3
<b>Our Team</b>	5
<b>The Genesis of Soluna</b>	10
<b>Core Values</b>	10
<b>Business Model</b>	11

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<b>The Moroccan Wind Farm Project</b>	13
<b>Computing Facilities</b>	17
<b>Operations and Security</b>	19
<b>Risk Factors and Mitigation Plan</b>	21

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<b>Appendix</b>	24
<b>Board of Directors</b>	26

# Introduction

## Cryptocurrencies and the Global Search for Energy

In the last two years, cryptocurrencies have grown from a niche financial innovation to an entirely new asset class.

Billions of dollars of Bitcoin, Ether, and other cryptocurrencies are now exchanged around the world every day. By offering unparalleled transaction speed and security, many believe that cryptocurrencies and blockchains will fundamentally alter both the international monetary system and secure distributed computing at a faster pace than the adoption of the Internet.

The growing popularity of these technologies comes at a significant cost. Cryptocurrency mining is making unsustainable demands on the world's energy resources. As of June 2018, Bitcoin mining uses 71 terawatt hours (TWh) per year, equivalent to almost 10% of China's annual energy usage. If Bitcoin were a country, it would now be the world's 41st largest energy consumer, just behind Chile.<sup>1</sup>

The demand for energy to mine cryptocurrencies has set off a global scramble for inexpensive power, leading to the increased use of fossil fuels, such as coal, which have a negative impact on the environment.<sup>2</sup> In response, certain governments are regulating cryptocurrency mining companies, both to limit pollution and to lower the stress such companies have placed on the local power economies (see sidebar).

Soluna aims to address this problem by building computing centers powered by environmentally clean, utility-scale electric generating projects which produce renewable energy. Soluna is primarily focused on developing wind and solar generation projects.

### Our Unique Approach: Vertical Integration

Soluna's mission is to power the crypto-economy with clean, low-cost renewable energy. To do this, we are building a blockchain infrastructure and cryptocurrency mining company that owns its own renewable energy resources.

By developing renewable energy power plants dedicated to on-site, high-density computing, Soluna plans to add a unique innovation to the blockchain ecosystem: **vertical integration**.

Soluna's energy systems and computing technology will be self-contained, distributed, scalable, and flexible, allowing it to achieve efficiencies that are only obtainable with utility-scale operations.

Through this simple but effective approach, Soluna aims to be the infrastructure backbone of the blockchain revolution.

### Our Long-Term Vision

Today blockchains are predominantly seen as the core technology for cryptocurrencies, among other things. But in the future, blockchains will do much more — they will be the foundation for entire ecosystems of new decentralized applications. Social networking, file storage, advertising, banking,

real estate, national property records and many other applications can be rebuilt from the ground up using blockchains.

Soluna anticipates that the code for these applications will be primarily open source and free. However, they will require a computing layer to power them. Because they are distributed — not owned by any single company — these applications will not run on a single company's private hardware. You won't need to upload your files exclusively to Dropbox hard drives or host websites exclusively on Amazon servers. Instead, we believe new distributed applications will use whatever hardware is fastest and cheapest, no matter who owns it and no matter where it is located globally.

As more applications and services move onto the blockchain, Soluna's agile, flexible base of computing will provide a computing layer that powers the coming wave of blockchain technologies. Cryptocurrency mining will only be the start.

Soluna will provide computing power for whatever is most beneficial for its business, whether that's cryptocurrency mining, distributed graphics rendering, file storage, machine learning, AI or other services of the decentralized cloud of blockchain technologies that have yet to be invented. We are prepared to foster this future innovation. Green, renewable, low-cost power will serve as a key component.

Taken as a whole, distributed applications will form a new kind of Internet, one where protocols replace companies and algorithms choose the best computing backend and solutions they can find. This new Internet will need dedicated infrastructure to power it.

Soluna aims to be a key part of that infrastructure.

## Local Governments are, Directly or Indirectly, Regulating Cryptocurrency Miners

- Washington State County Moves to Limit New Bitcoin Mining Firms <sup>3</sup>
- New York State to Raise Electricity Rates on Bitcoin Mining Firms <sup>4</sup>
- China Moves to Shutter Bitcoin Mines <sup>5</sup>
- Iceland Lawmaker Proposes Tax on Incoming Cryptocurrency Miners <sup>6</sup>

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<sup>1</sup> <https://digiconomist.net/bitcoin-energy-consumption-as-of-June-2018>

<sup>2</sup> <https://www.independent.co.uk/news/business/news/bitcoin-energy-use-coal-power-cryptocurrency-generation-server-farms-dirty-secret-china-mongolia-a8111666.html>

<sup>3</sup> <https://www.coindesk.com/washington-states-chelan-county-moves-limit-new-bitcoin-mining-firms>

<sup>4</sup> <https://www.bloomberg.com/news/articles/2018-03-15/want-to-mine-bitcoin-in-new-york-you-ll-have-to-pay-a-premium>

<sup>5</sup> <https://www.ft.com/content/adfe7858-f4f9-11e7-88f7-5465a6ce1a00>

<sup>6</sup> <https://apnews.com/a6cd50b37105447991be9a9ce76c2421>

# Our Team

Soluna has assembled a team of experienced entrepreneurs, energy experts, and private equity professionals to lead the company in the blockchain ecosystem. It has also recruited a diverse strategic advisory board with the necessary experience to help the company achieve its goals.

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## Management Team



**John Belizaire**  
Chief Executive Officer

John has successfully founded, built, scaled, and sold industry-leading technology companies. Past companies he founded include FirstBest, a leading insurance software company that was acquired by Guidewire, and The Theory Center, an internet-application software company acquired by BEA Systems (now Oracle).

Prior to co-founding FirstBest, John was senior director of business development and strategic planning for BEA's Ecommerce Applications Division, where he grew annual revenue to over \$150 million.

Before BEA, John co-founded The Theory Center, a leader in Java-based internet-application software for enterprises. As CEO, he grew the company from inception to \$15 million in revenue. BEA Systems acquired the company in 1999 for over \$150 million.

John was previously lead architect for Intel's Digital Enterprise Group, where he was responsible for the industry's first implementation of network quality-of-service technology for personal computers.

John is an investor and senior advisor to a number of start-ups companies in the US including: Bowtie.ai, Aleria, Jobletics, Hi Marley, Bamboo Insurance, and LoveStoriesTV. John is also a member of NY Angels.

John serves on the board of trustees of Harlem Academy and the board of directors of Metabiota.

John has a BS and MS in Computer Science from Cornell University.



**Dipul Patel**  
Chief Technology Officer

Dipul co-founded, managed, and grew Ecovent, a hardware company that improves homeowner comfort through the world's first wireless system for room-by-room temperature control. Ecovent is a graduate of the Techstars Boston program and raised over \$14M from industry-leading investors like Emerson Electric. Ecovent was acquired in 2017 by ConnectM.

Prior to Ecovent, Dip spent eight years at Lockheed Martin honing his knowledge of radar by working on and managing submarine sonar and anti-ballistic missile defense systems.

Dip received his BS in Electrical Engineering from Drexel University, his MS in Electrical Engineering from the University of Pennsylvania, and his MBA from the MIT Sloan School of Management.



### **Phillip Ng**

Vice President, Corporate Development

Prior to Soluna, Phillip was an Associate at Brookstone Partners, where he was responsible for the origination, evaluation, and execution of investment opportunities. He also worked with portfolio companies on strategic initiatives.

Phillip worked as a Senior Consultant at Ernst & Young (EY)'s Transaction Advisory group. At EY, he performed financial advisory services for both privately held and Fortune 500 companies.

Before EY, Phillip worked for Deloitte Chile's Financial Advisory group, where he performed valuations and integration monitoring for companies.

Phillip holds a BBA in Economics and Finance from the University of Georgia. He holds a Chartered Financial Analyst (CFA) designation.



### **M. Larbi Loudiyi**

Managing Director, A.M Wind

Larbi co-founded, managed and successfully grew A.M Wind SARL, an energy development company based in Morocco and acquired by Soluna in 2018. Larbi partnered with Altus AG to create the company in 2009. A.M Wind developed several wind sites in the country including Soluna's flagship site.

Larbi is an engineer with a decade of experience in renewable energy and energy efficiency. His expertise combines knowledge of organizational & industrial engineering with technology development and strategic market analysis.

Before A.M Wind, Larbi founded renewable energy consulting firm Cbiom whose customers comprised the leading French energy companies such as EDF Energies Nouvelles, ENGIE, Dalkia, Poweo, and Idex. Cbiom's specialty included applied research in the field of Biomass Valorization - the transformation of waste and biomass to energy, fuels, and other useful materials (valorization). Larbi received nearly \$1M in funding from the French National Agency of Research.

Larbi holds a Master of Science in engineering from the Polytechnic National Institute of Lorraine, France.

## Advisory Board

Soluna's advisors have considerable experience in cryptocurrency mining, blockchain research, energy development, and government relations.



**Dwight L. Bush**

Government Relations

Ambassador (Ret) Dwight L. Bush served as the U.S. Ambassador to the Kingdom of Morocco from 2014 to 2017 under President Barack Obama.

Ambassador Bush is a highly accomplished business executive with a background in banking and finance, corporate management, and public company and private organization governance. He is currently President of DL Bush & Associates, a strategic advisory firm based in Washington D.C.

Ambassador Bush started his career at Chase Manhattan Bank, where he served in various international banking capacities. Before Chase, Ambassador Bush held various corporate positions, including at Sallie Mae and Stuart Mill Capital LLC, before serving as President and CEO of Urban Trust Bank.

In addition to his corporate work, Ambassador Bush has been active in nonprofit governance, including serving on the boards of trustees of The GAVI Alliance, The National Symphony Orchestra, and Cornell University where he received a BA in Government.



**Ari Juels**

Blockchain & Cryptocurrencies

Ari is a Computer Science faculty member at Cornell Tech. He was previously Chief Scientist at RSA. Ari's interests span a broad range of topics in computer security, Blockchains, cryptocurrency, smart contracts, cryptography, and privacy.

Ari was named an MIT Technology Review "Innovator Under 35" and to Computerworld's "40 Under 40" list. Ari received a BA in Latin Literature and Mathematics from Amherst College and a PhD in Computer Science from UC Berkeley.





## **Murat Akdeniz**

Blockchain & Cryptocurrencies

Murat is the Founder and the CEO of Mirian, a social finance company offering a suite of smart contract and decentralized financial products.

Prior to founding Mirian, Murat was part of the engineering and data science teams developing big data applications at JP Morgan Chase's Intelligent Solutions division. As a hands-on project and product manager, he filled application developer and data scientist roles, and owned product development for the investment bank and chief investment office.

Murat received his Bachelor's degree in Business, Organizations, and Society from Franklin & Marshall College and his Master's degree in Technology Management from Cornell University.



## **Timo Hanke**

Cryptocurrency Mining & Blockchain

Timo is the Director of Engineering at DFINITY, a new peer-to-peer blockchain computer forming the decentralized cloud 3.0.

As a Bitcoin enthusiast since 2011 Timo has contributed several times to the project.

Timo is the former CTO of Cointerra, a large mining company that developed ASIC-based chips and software for the mining industry, including the world's first Bitcoin mining ASIC of the 14-16nm generation. He has filed several patents on ASIC optimization for Bitcoin mining.

Timo holds a PhD in Mathematics, has held post-doc positions at universities such as UC San Diego and the Technion, and was Assistant Professor at RWTH Aachen in Germany. His academic pursuits lie in the mathematical fields of Algebra, Number Theory, Computer Algebra and Cryptography.



## **Sanjeev Kumar**

Renewable Energy Development

Sanjeev is the Senior Vice President at GlassPoint, a leading solar energy supplier for the oil & gas industry. The company is building some of the world's largest solar energy projects to reduce emissions and improve oilfield economics.

Sanjeev has over 20 years of experience in global energy markets including alternative energy. He's developed extensive expertise in IPO, M&A, commercialization strategies, and strategic planning. He has also served as a board member for public and private companies with operations in North America, Europe, Asia, Persian Gulf and Africa.

Prior to joining GlassPoint, Sanjeev was CFO for TerraForm Power and Enphase Energy, companies he helped take public in highly successful IPOs.

Previously, Sanjeev spent 10 years at Occidental Petroleum.

Sanjeev received a BA in Business Administration/Accounting (Magna Cum Laude) from California State University, an MBA and a Master in Business Taxation from the University of Southern California.



## **Bill Phelan**

Private Equity

Bill is the co-founder and CEO of Bright Hub, Inc., a software company founded in 2005 that focuses on the development of online software for commerce.

In 1999, Bill founded OneMade, Inc., an electronic commerce marketplace technology systems and tools provider. Bill served as Chief Executive Officer of OneMade, Inc. from May 1999 to May 2004, including for a year after it was sold to, and remained a subsidiary of, America Online.

Bill serves on the Board of Trustees and is a Finance Committee member and an Investment Committee Chair for Capital District Physician's Health Plan, Inc. Bill also serves on the Board of Trustees and Chairman of the Audit Committee of the Paradigm Mutual Fund Family. Bill has served on Mechanical Technology Inc.'s Board of Directors since 2004.

In his career, Bill has held executive positions at Fleet Equity Partners, Cowen & Company, First Albany Corporation, and UHY Advisors Inc., formerly Urbach Kahn & Werlin, PC.

# The Genesis of Soluna



Brookstone Partners is a US-based investment firm that invests in businesses with revenues ranging from \$20 million to \$200 million with an EBITDA from \$4 million to \$20 million. For over a decade, the group has made investments in light industrial, distribution, technology, and consumer products companies.



Soluna is a Brookstone portfolio company. Soluna is the result of an acquisition of wind assets from A.M Wind to form a new vertically integrated energy and blockchain computing company.

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## Core Values

Soluna's culture of excellence is built on a foundation of core values. These values guide our daily decisions and support our vision.



### **Be transparent.** **Distributed. Democratic. Open.**

These are more than just words at Soluna. Soluna is committed to providing as much transparency as possible to its community of token holders. As soon as power generation becomes operational and mining begins, Soluna will publish a daily hash power report, a quarterly operations report, and an annual financial audit.



### **Support local economies.**

Wherever Soluna has operations, we will strive to recruit and train local talent from the relevant countries to support our operations. Over time, Soluna plans to become a significant employer in the regions it operates and will seek to partner with local colleges and trade schools to provide an educational funnel for technicians and engineers. We will then employ these technologists at our local computing facilities and use local services and equipment when possible to help support developing economies.



### **Use 100% renewable energy.**

Our goal is to increase the footprint of green power globally. Therefore, we will set a target of using 100% renewable energy to power our computing operations.

# Business Model

## Overview

Soluna plans to vertically integrate best-in-the-world renewable power generation experience and capabilities with blockchain computing facilities. By doing so, Soluna can mine cryptocurrencies more cheaply and with less adverse environmental impact than other companies.

Soluna anticipates that it will deploy its resources to develop its integrated renewable energy and computing assets. The computing assets will in turn be used to mine cryptocurrency as profitably as possible. The company anticipates that it will also have the opportunity to pursue a portfolio of monetization strategies, including selling electricity into the regional market of the country where its operations are located. Over time, Soluna's computing facilities will also begin supporting other blockchain networks such as distributed storage (e.g. Filecoin) and distributed computing (e.g. Golem, Dfinity).

## Revenue

Soluna's business model provides multiple sources of revenue:

**Cryptocurrency mining:** Most importantly, the company is a cryptocurrency miner, powered by its own electricity. In choosing which currency to mine, Soluna will dynamically adapt its mining operations to meet market demand and optimize profitability.

**Electricity sales:** Soluna can generate revenue by selling electricity that it generates and does not use. The primary strategy will be to sell electricity into regional markets. There is also the potential for identifying third party customers for the renewable power generated to the extent not used in Soluna's operations.

**Blockchain computing and data center operations:** As the blockchain ecosystem evolves, Soluna plans to diversify by becoming a "service node" for multiple blockchain networks. A service node is a member of a network that provides services such as security (e.g., block validation), and computing (e.g., renting compute resources for AI rendering, or machine learning via a blockchain network).

## Best-in-Class Power Costs

Soluna's fully depreciated cost of power is projected to be US\$0.03 per kWh (unsubsidized), which will make Soluna's power costs among the lowest quartile of cryptocurrency miners in the world<sup>7</sup>. With such a low cost of power, Soluna anticipates that it can profitably mine in almost any foreseeable cryptocurrency price environment.

## Geographic Locations

Soluna's flagship site comprises 37,000 acres in Morocco with over 900 MW of wind power potential available for development. It is a Class I wind site, meaning it has an average wind speed (measured at the maximum hub height of a turbine) of at least 10 m/s (22 mph).

While the Morocco site is being developed, Soluna will commence mining operations in sites leased from large and established mining companies with renewable energy generation facilities co-located on the site. Such sites will allow Soluna to earn revenue while keeping its power costs low. The revenues generated from operations will be reinvested back into the company to support further development of the Moroccan project. As the Moroccan site reaches scale, Soluna will explore additional vertically integrated renewable energy locations around the world.

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<sup>7</sup> Source: JPMorgan, *Decrypting Cryptocurrencies: Technology, Applications and Challenges*, Kaneva et al., 9 February 2018

## **Management Team and Advisors**

Soluna has assembled a core team of talented individuals with experience in the power, software, and technology sectors, with a special expertise in entrepreneurial start-ups and growth management. Its founding team consists of serial entrepreneurs and technologists led by John Belizaire, a seasoned executive who has founded, grown, and successfully sold several multimillion dollar companies. Soluna is committed to building on this outstanding management foundation by continuing to add the most talented individuals available in the areas of blockchain technology, energy development, and software development.

The company has institutional backing from Brookstone Partners, a private equity firm based in New York with expertise developing industrial companies around the globe. Soluna is also supported by a world class board of advisors that includes experts in cryptography, cryptocurrency mining, energy development, and business management. This advisory board will assist the management team in the development of its power assets, procurement of computing infrastructure, and recruitment of key technical talent in the near term. In the long term, this diverse network of expertise will ensure the company's strategic plan keeps pace with developments in blockchain, cryptocurrencies, and energy-related technologies.

## **Modularity and Flexibility**

Soluna plans to build its Moroccan wind farm and computing facilities using a modular, approach that allows for flexible and cost-conscious deployments.

Soluna also plans to deploy flexible technologies in its data centers that allow the company to adapt to a variety of business conditions. This modular development style helps ensure that the company can adapt rapidly to changing business environments and economic conditions.

## **Energy Expertise**

The company is supported in Morocco by A.M Wind, Mott MacDonald, and Afrique Advisors. This gives Soluna access to Africa's most talented energy development team.

## **Scalability**

Today, many miners struggle to build a significant footprint due to associated energy demands. Small miners do not get the economies of scale and are far less efficient than established computing providers like Google and Apple<sup>8</sup>.

Soluna believes this problem will only become more acute over time for most cryptocurrency mining operations. As blockchain applications become a part of our everyday lives, however, the ability to provide blockchain services at scale will be essential to competitive success. With nearly one gigawatt of energy potential owned by Soluna at its site in Morocco, Soluna believes its ability to scale its operations will be unrivaled in the crypto economy. Soluna has the potential to capitalize on efficiencies that can only be achieved at utility scale.

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<sup>8</sup> Who, notably, power their data centers using clean energy.

# The Moroccan Wind Farm Project

Soluna has acquired the rights to a 37,000 acre wind farm site in southern Morocco. Development of the site started nine years ago by A.M Wind, a Moroccan corporation and affiliate of ALTUS AG. ALTUS is a German-based wind energy development company.

Soluna completed the acquisition of A.M Wind from ALTUS in 2018, giving it exclusive rights to develop the wind farm site going forward.

## One of the Windiest Sites in the World

The wind farm site is a Class I site in an area known for some of the best wind resources in the world (see wind map). It has an average wind speed of 22.36 mph (10 m/s) at the maximum hub height of a turbine. Average temperatures range from 63.3° F to 73.4° F (17.4° C to 23.0° C). The total area of the site is 37,000 acres (15,000 hectares) across 58 square miles.

Wind Farm Site Vital Stats	
Quality	<b>CLASS I</b>
Average Wind Speed	<b>23.36 MPH</b> (10 M/S)
Capacity Factor	<b>&gt;50%</b>
Area	<b>37K ACRES</b> (15K Hectares) Across 58 Square Miles
Average Temp	<b>63.3° F to 73.4° F</b> 17.4° C to 23.0° C

Figure 1: Wind farm vital statistics

A.M Wind commissioned two Energy Yield Assessments (EYA) studies by world-class engineering firms Garrad Hassan (GH) and CUBE Engineering GmbH (CUBE) to determine the expected annual energy output of the wind turbines to be installed on the company's site. The wind assessment of the site revealed excellent conditions for wind energy and capacity factor over 50 percent.

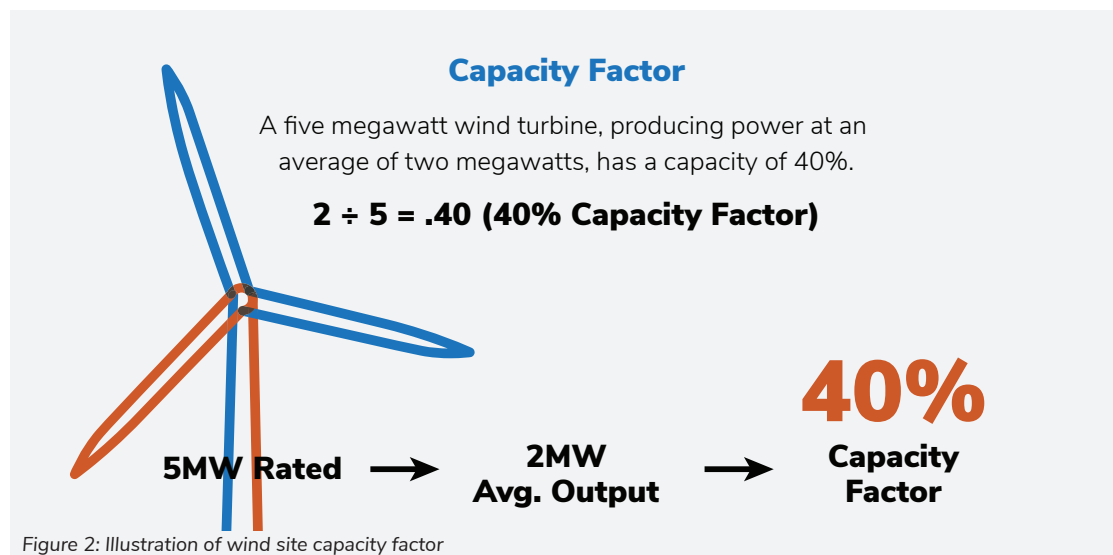


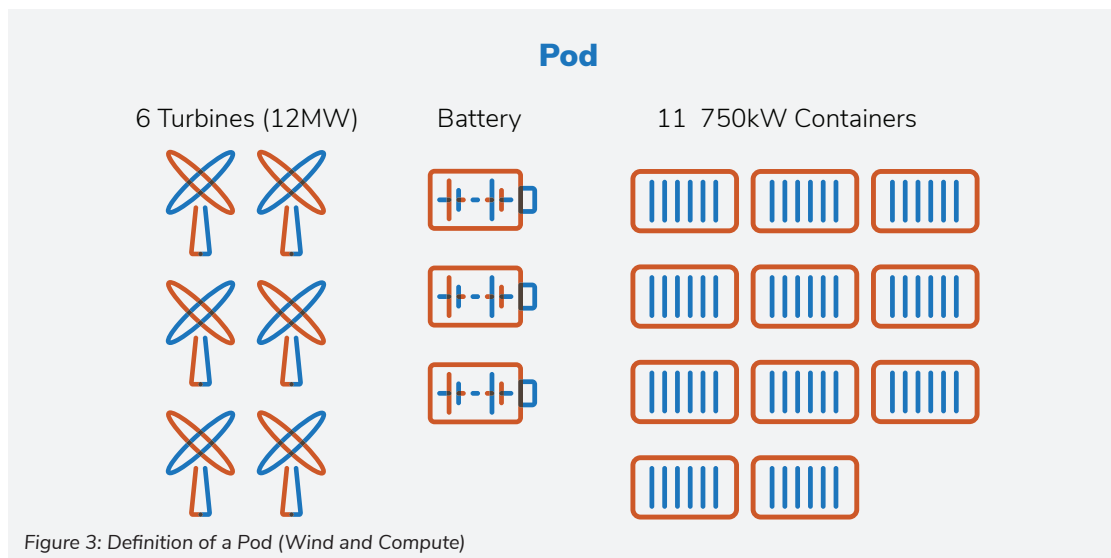
Figure 2: Illustration of wind site capacity factor

## The Plan

Soluna will develop its flagship wind site in a modular fashion called Pods. Each Pod comprises 12MW of power generation, an associated storage system, and a 6MW cryptocurrency mining or blockchain computing center. The full site can accommodate approximately 75 Pods, based on current turbine technology. This would be equivalent to at least one-quarter of the current energy used by the Bitcoin network.

Phase One will consist of at least three Pods, the equivalent of 36MW of energy production capacity and 18MW of crypto-mining facilities, with the ability to produce 160,882 tera hash per second.

In the future, Soluna anticipates that it will develop additional phases using either internally generated capital or through future capital raises. Each additional phase will be a self-contained, "ring-fenced" project.



## Optimized for Off-grid Operation

By design, Soluna's wind farm will be an off-grid operation, with the plan to integrate it with the grid. We expect the high-voltage transmission lines to reach the site by mid-2019. If we are not connected to the grid, our site will be one of the largest off-grid mining operations.

In designing an off-grid operation efficiently, we must consider the variable nature of wind generation. To solve this problem, Soluna plans to build nominal energy storage which will provide flexibility as to when the power is used regardless of when it is generated. Soluna will also design the data centers to consume variable power.

## Phase 1 = 3 Pods 36MW

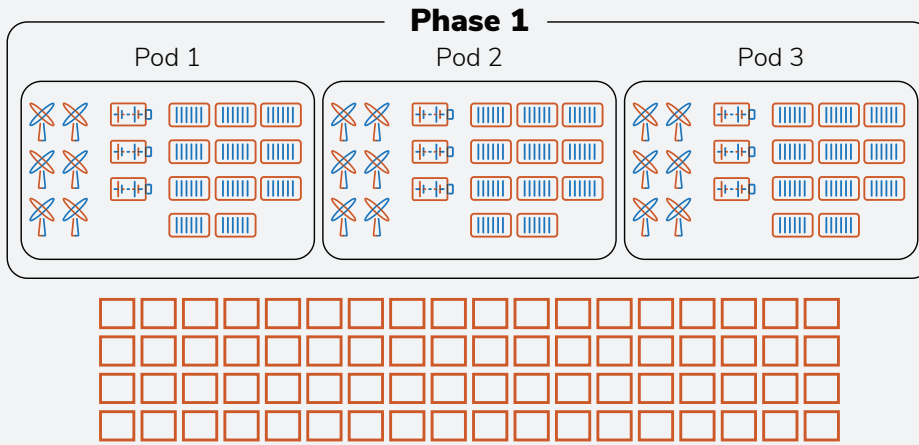


Figure 4: Phase one and beyond

37K Acres Will Fit 75 Pods Total

### Engineering

Soluna has retained Mott MacDonald (MM), a global engineering firm, as its consulting engineer in connection with revisions to the development of the wind farm site. MM has extensive experience in developing renewable power projects in Africa and has worked on over 72 gigawatts of wind projects worldwide.

Soluna will work with MM to develop a feasibility study for the site that includes the latest turbine technology, energy storage solutions, and computing facility layouts. MM will also be responsible for completing an updated feasibility study using the data collected by CUBE and GH for A.M Wind.

### Permits

A.M Wind completed a number of key environmental studies regarding the wind site and procured certain material permits and approvals. These permits must be updated with the revised project design based on new turbine technology and the addition of the computing facilities. The company also needs to update the construction and operation plan and present it to the appropriate regional and federal authorities for approval.

The company will work over the next few months to revise the existing permits and acquire additional permits and approvals needed for the proposed wind project. Soluna has also retained local counsel — Afrique Advisors, a strategic advisory firm with extensive experience in energy regulation — to assist with this process.

A summary of key project contracts and permits and their status are included in the following page.



**Permit / Approval:**  
Regional Investment Committee

**Status:** Approved  
**Plan:** Revise to include computing facilities; revised investment.

**Permit / Approval:**  
Environmental Impact Study

**Status:** Approved  
**Plan:** Revise to include computing facilities, battery storage.

**Permit / Approval:**  
Civil Aviation Authority

**Status:** Not Applicable  
**Plan:** The site is nearly 70 kilometers from the nearest airport and a permit not required, but will be pursued nonetheless.

**Permit / Approval:**  
Framework Investment Agreement

**Status:** Draft  
**Plan:** Update investment plan based on technology used in the energy plan, site construction, and future operations details; submit to the ministry of trade and investment. Develop a list of specific requests from the Moroccan government in exchange for investment in the area.

**Permit / Approval:**  
Land Lease Agreement

**Status:** Draft  
**Plan:** This will be included in the list of specific requests in the Framework Investment Agreement.

**Permit / Approval:**  
Building Permits

**Status:** Pending  
**Plan:** Request following the completion of the revised feasibility study by MM and before the purchase of turbines.

**Permit / Approval:**  
Ministry of Energy Authorization

**Status:** Pending  
**Plan:** Submit authorization based on law 16-08, the Moroccan law allowing development of energy for self-consumption.

## Procurement and Construction

To accelerate the development of the first Pod and mitigate risks associated with the project, Soluna will award a single turnkey engineering, procurement, and construction contract (EPC Contract). This contract is anticipated to include the supply and installation of wind turbines (WTG), civil works, balance of plant (ancillary construction), and the supply and installation of the battery storage unit and control systems.

Multiple consultations have already been made with major WTG manufacturers, including Siemens-Gamesa, General Electric, Vestas, and Goldwind.

Mott MacDonald will also assist Soluna with the management of the EPC process.

## Service and Maintenance Agreements

Soluna will enter into a long-term service contract for the project ("LTSA"), including service of the wind turbines and storage unit. The firm selected is anticipated to provide construction, procurement, and installation services under the EPC Contract and thereafter will provide scheduled maintenance and coordination of unscheduled maintenance, parts repair, and parts replacement pursuant to the LTSA in order to ensure high performance and minimal downtime.

# Computing Facilities

## Modular Approach to Computing Facilities

Like the wind farms, the computing facilities will be built using a modular approach, allowing for maximum flexibility during design, construction, and operation. Each Pod will comprise 11 standalone 40-foot sealed containers.

The three initial Pods for Phase One will comprise 11 standalone 750 kW containers. The composition of a Pod was based on internal technical studies conducted by Soluna, which evaluated current hardware, cooling, power supply, and software architectures.

Soluna will develop Phase One with 100% ASIC miners specialized in mining the SHA-256 algorithm. During the first refresh cycle, Soluna may introduce GPU miners for added flexibility. Over time, Soluna will change the overall mix of the containers to reflect market conditions and to capitalize on new crypto-mining technologies, such as distributed storage (e.g. Filecoin) and distributed computing (e.g. Golem).

As circuits age, chips become obsolete, and new applications come online, individual containers will need to be serviced or replaced. Soluna's technology allows the containers in each Pod to be changed out quickly and independently. This modularity allows the company to test new solutions in power usage, cooling, chips, wattage, software, and more with minimal disruption.

Modularity will also enable Soluna to maximize profitability throughout the life of each Pod. As technologies improve, the company will evaluate each Pod and related computing facilities independently and choose the best technology mix for optimal profitability.

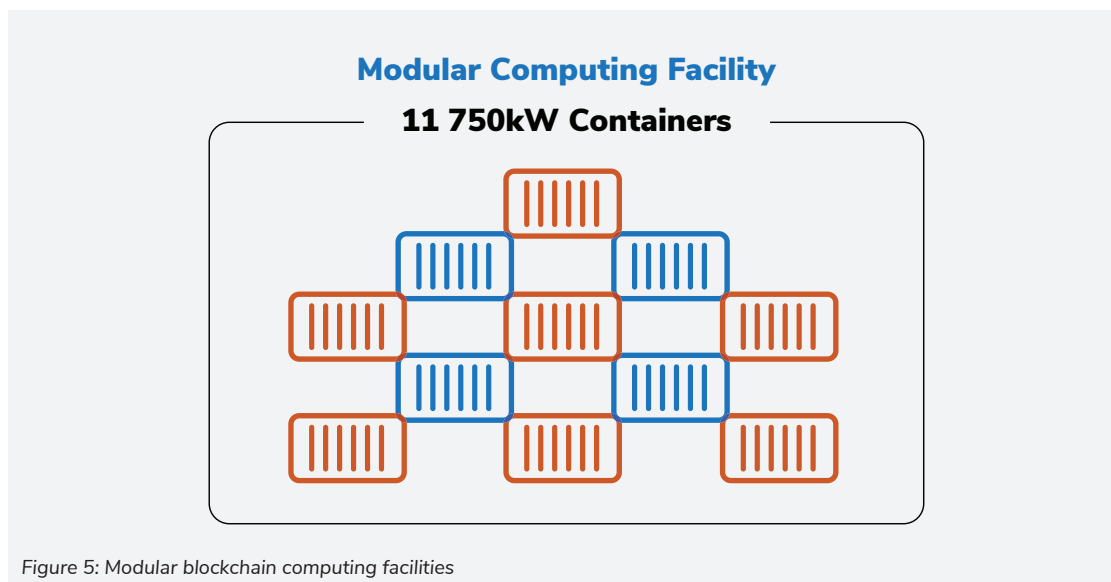


Figure 5: Modular blockchain computing facilities

## Cooling Technologies: Immersion and Air-Cooling

Computation and its associated energy consumption create a lot of heat. Managing this problem is a perennial problem for both miners and computing facilities. Soluna has devoted significant resources to studying this problem in order to find industry-leading solutions. There are now several innovative cooling technologies available to handle the extreme heat that computer processing at scale creates.

Cooling technologies fall into two categories:

**Air Cooling:** Designs which utilize large heatsinks and fans to move the hot air away from the chips.

**Immersion Cooling:** Designs in which the chips are immersed in a liquid and transported away to remove the heat it has absorbed from the chips. Immersion cooling may be either single phase or dual phase.

In **single-phase immersion**, cooling is accomplished by immersing circuits in a mineral oil or similar fluid. The oil is then circulated through a heat exchanger to maintain temperature.

In **dual-phase immersion**, the cooling material changes states from liquid to vapor and back again. For example, circuits may be immersed in a phase change material, such as Fluorinert. This material boils as it removes heat, then the vapor is re-condensed in a coil and cooled.

Single-phase immersion cooling is already being used in mining operations, however it is not nearly as efficient as dual-phase cooling systems.

Employing bleeding edge cooling techniques will be critical to allow the Pods to consume variable energy by over-clocking the mining equipment. This is essential for maximum efficiency, due to the nature of off-grid, renewable energy.

## Sourcing the Initial Mining Equipment

Soluna's scale and modularity is anticipated to afford the company significant supply chain leverage. For example, rather than being tied to a single ASIC supplier, the company can work with several at once and utilize different ASICs in different Pod containers.

For the company's initial Pods, Soluna has formed partnerships with three companies who have direct sourcing relationships with the chip suppliers. This allows Soluna to source chips from three vendors at competitive prices and timelines.

The company's management and advisors have deep expertise in the design and manufacturing of chips, including ASICs and GPUs. This allows Soluna to develop direct sourcing relationships with top chip suppliers and negotiate attractive prices.

# Operations and Security

## Onsite Operations and Operations Security (OPSEC)

Onsite data center operations personnel will comprise engineers, operators, security, and maintenance specialists. Soluna will manage the computing facilities in Morocco and will hire local personnel from Morocco to operate them.

Soluna will develop a local team focused on operations security (OPSEC). It will also seek to acquire or develop the best talent possible and offer professional opportunities for local employees to develop technical and blockchain expertise.

As part of the hiring process all employees responsible for the operations of the computing facilities will go through a background check and an extensive training process which will cover the following topics:

- ▶ Competitive Intelligence
- ▶ Social Engineering / Hacking
- ▶ Attack Surfaces
- ▶ Information Assurance
- ▶ Ethics
- ▶ Cybersecurity
- ▶ Anti-Tampering

## Physical and Cyber Security

Large mining operations have to stay vigilant about both physical security and cybersecurity.

From a physical security perspective, Soluna's site will be protected initially by storing cryptocurrency keys and wallets offsite. The hardware in the company's computing facilities will also be monitored, making it easy to tell if something has been tampered with.

On the cybersecurity side, other mining operations have been plagued with issues including network attacks, theft of private keys, social engineering, poor passwords, and poor operational security. Soluna will institute a comprehensive set of procedures, techniques, and technologies designed to eliminate these issues and mitigate the risks associated therewith.

## Security Summary

The table below outlines our approach to important aspects of physical, operations, and cyber security.

**Security Threat:** Physical Security  
**Method:** Physical Barriers

**Approach:** The Pods will be protected by a series of 15-foot high fences which will serve as a first line of defense. The fences will keep employees only in the spaces they need to access.

**Security Threat:** Physical security, OPSEC  
**Method:** Compartmentalized Access and Monitoring

**Approach:** All employees of Soluna will receive an access card along with a randomly generated PIN. When employees enter and exit the company's facilities, they will need to use this card along with the PIN. This approach will allow the company to remotely monitor access and the location of all onsite employees. It will also allow for real-time updates of security protocols.

**Security Threat:** Physical security, OPSEC  
**Method:** CCTV/IR Tracking

**Approach:** In addition to monitoring our sites using the card and PIN system, Soluna will have CCTV cameras throughout the site recording footage using visual and infrared motion tracking.

**Security Threat:** Physical Security, OPSEC and Cybersecurity  
**Method:** Sensor Fusion

**Approach:** Soluna will use software that integrates all of its security systems to create a holistic view of security. For example, if we detect motion but no associated card plus PIN verification, we can react accordingly.

**Security Threat:** Cybersecurity  
**Method:** Cyber-compartmentalization

**Approach:** The company's systems will be designed to detect and act immediately in case of an attack. Soluna will employ a cyber-compartmentalized tiered system similar to its approach for physical security and designed to mitigate the impact of any cyber-attacks.

**Security Threat:** Cybersecurity  
**Method:** Network Security

**Approach:** Each computing Pod will have redundant broadband network connections. There will be a fiber link and a redundant satellite/microwave network. Each container in a Pod will be linked separately to the Internet, meaning that containers do not share any data with each other and remain independent. In addition, our mining pool will receive the latest blockchain blocks directly from a low latency satellite broadcast to ensure we get access to the latest blocks as quickly as possible.

**Security Threat:** Cybersecurity  
**Method:** Information Security and Attack Surface

**Approach:** Remote and local access and reporting will be based on a tiered control system.

**Security Threat:** Cybersecurity, OPSEC  
**Method:** Securing and Storing of Private Keys

**Approach:** All mining proceeds and wallets will be stored in a multi-tier, air-gapped vault. Access to the vault and wallets will be managed by a strict RFID and PIN-based security system.

# Risk Factors and Mitigation Plan

The table below summarizes certain primary risks to Soluna's proposed business and operations, including in connection with the development of the initial generation project in Morocco and with the cryptocurrency mining business generally. It includes a description of the risk, the potential impact of the risk, and the mitigating actions to be executed by Soluna; however, this list should not be considered as an exhaustive list of the risks related to Soluna and its anticipated business. There may be other risks both known and unknown, some of which may be considered immaterial but may end up becoming material. Note that subsequent generation projects that Soluna or its affiliates may develop would be subject to the same risks.

**Risk:** Permit Procurement

**Potential Impact:** There may be delays due to the administrative, environmental, and regulatory permits necessary for a generation project of this scale or the company may not be able to procure the required permits needed to proceed with construction or operation of the proposed wind project.

**Mitigation/Management:** Soluna's advisors and partners have strong relationships with the local and national authorities in Morocco. Several of the required permits and authorizations have already been obtained. However, the existing permits must be updated based on the new design for the project.

1. Soluna has retained Mott MacDonald to assist with updating technical engineering plans and studies and present this information during the permit process.
2. Soluna has also retained Afrique Advisors, local counsel with extensive energy regulation expertise to assist with the permitting process.
3. Soluna will leverage our subsidiary, A.M Wind and our partners' extensive experience and deep relationships at the regional and national level in Morocco.

**Risk:** Wind Energy Resource

**Potential Impact:** The energy production may be significantly lower than the projected rate.

**Mitigation/Management:** Our subsidiary, A.M Wind, has procured two wind assessments with independent, internationally-recognized engineering firms who have ranked the site in Morocco as a Class 1 resource. Mott MacDonald has been retained to update the original assessment based on the current business plan.

**Risk:** Risks associated with the completion of development of the proposed generation project

**Potential Impact:** There may be delays in completing key development milestones, including the negotiation of key contracts such as the Framework Agreement, the EPC Contract, supply agreements or the interconnection agreement associated with interconnecting the project with the local transmission grid when possible.

**Mitigation/Management:**

1. Soluna will execute a lump sum, turnkey procurement and construction arrangement to limit risks associated with multiple suppliers or service providers and with the potential cost of construction.
2. Soluna will leverage all our partners' extensive expertise negotiating these types of contracts.
3. Soluna has engaged Matt MacDonald and local counsel, Afrique Advisors, to assist with negotiating an EPC contract with the chosen vendor.

**Risk:** Construction

**Potential Impact:** A generation project requires the installation and testing of complex equipment, including wind turbines, and the successful installation and integration of multiple systems, including the energy storage system, the control system and other infrastructure. Completion of construction may be delayed or may not be completed due to default by the contractor, default by the company or other unexpected events.

**Mitigation/Management:** Soluna will execute a lump sum, turnkey procurement and construction arrangement to limit risks associated with multiple suppliers or service providers and with the potential cost of construction.

**Risk:** Operations

**Potential Impact:** Poor operations and maintenance practices (whether or not as a result of a default by the applicable service provider) may raise the cost of operating the generating facility or may result in less-than-optimal operations or may result in shut-downs or a cessation of operations. Also, there is a risk that the wind turbines, batteries or other equipment will not perform as expected, including as a result of a design or manufacturing defect.

**Mitigation/Management:** A.M Wind will secure a full-service LTSA through its selected wind turbine supplier. A.M Wind will have certain remedies against its contractor, wind turbine supplier and certain other counterparties, including pursuant to any warranties provided by such parties.

**Risk:** Regulatory and Political

**Potential Impact:** Soluna may be affected by dynamics of the political environment in the jurisdictions it operates, including the regulatory regime of Morocco. Soluna may also be affected by a change in the political environment in the future or a change in law of Morocco in the future the negatively impacts or makes more costly the operation by Soluna (and/or its subsidiary A.M Wind).

**Mitigation/Management:** Morocco has long standing, strong diplomatic relations with the US. Soluna, Afrique Advisors, our partners, and Ambassador Bush have strong relationships with the Moroccan regulators. Soluna will:

- 1.** Focus on transparency and contributions to local economies, showing how the community benefits from Soluna's presence.
- 2.** Establish collaborative relationships with governing authorities in each country in order to develop effective regulatory regimes to support both Soluna and its local partners and employees.
- 3.** Leverage long standing relationships with regulators across Morocco.

**Risk:** Procurement of Computing Hardware

**Potential Impact:** Soluna may be unable to source the necessary chips on its planned timeline or at favorable prices.

**Mitigation/Management:** The company has already formed relationships that are expected to allow us to procure chips at favorable pricing. We will order processors through these relationships initially. In addition, Soluna will:

1. Sign additional commercial partnerships with companies who have strong relationships with chip suppliers.
2. Develop direct relationships with chip manufacturers globally.

**Risk:** Cryptocurrency Mining Difficulty

**Potential Impact:** Soluna's profitability may erode if cryptocurrency mining difficulty increases substantially as a result of an unexpected overall increase in cryptocurrency computing power.

**Mitigation/Management:** Soluna will:

1. Have downside protection through the ability to sell electricity to the national grid, creating an alternate path to revenue.
2. Have the best operating model for low priced power in the industry.
3. Have the ability to diversify across mining platforms and into other blockchain computing services.

**Risk:** Cryptocurrency Prices

**Potential Impact:** Soluna's profitability may suffer from substantial, sustained declines in cryptocurrency prices.

**Mitigation/Management:** Soluna will:

1. Have downside protection through the ability to sell electricity to the national grid, creating an alternate path to revenue.
2. Have the best operating model for low priced power in the industry.
3. Have the ability to diversify across mining platforms and into other blockchain computing services.

**Risk:** Physical and Cyber Security

**Potential Impact:** Soluna may be exposed to security risks related to its cryptocurrency mining operations.

**Mitigation/Management:** Soluna will:

1. Use a multi-layered offline, paper wallet to limit exposure before coins are secured in company's coin vault.
2. Compartmentalize physical access to minimize exposure.
3. Build surveillance protocols which fuse data from multiple sensors across our facilities to quickly detect security breaches.

**Risk:** Internet Reliability

**Potential Impact:** If Soluna's internet connection is not reliable or lacks sufficient bandwidth and latency, then profitability will suffer.

**Mitigation/Management:** Soluna will:

1. Lease private fiber connections.
2. Develop redundant internet connections using satellite, second fiber line, and microwave technology.



# Appendix

## About Morocco

In November 2016, the King of Morocco announced new goals for the country’s renewable energy sector. Morocco now aims to produce over 52% of its electricity through green power by 2030. This energy plan intends to add over 6,000MW of renewable projects by 2020 — a huge opportunity for private producers.

In 2018, Africa Investment Index named Morocco the 2017 most attractive economy in Africa for investment.<sup>9</sup> The country is experiencing solid economic growth, increased foreign direct investment, and low levels of external debt. Situated in the continent’s northwest corner, Morocco also enjoys strategic proximity to Europe, the Mediterranean, and the North Atlantic.

<b>Key Facts</b>	
Region	North Africa
Capital	Rabat
Largest City	Casablanca
Currency	Moroccan Dirham
GDP (2017p)	USD 110b
GDP Growth (2017p)	4,4%
Inflation (2017p)	0,9%
Credit Rating (S&P)	BBB - Stable

Morocco and the United States have historically had strong diplomatic and economic relations. Morocco was the first nation to recognize the independence of the United States in 1777. The US is Morocco’s third largest trading partner, after France and Spain. The trade between the two countries also offers new access to services, intellectual property protection, open government procurement, and protections for labor and the environment.

<sup>9</sup> <https://quantumglobalgroup.com/article/morocco-top-ranked-investment-destination-in-africa-for-2017/>

## Current Energy Profile

Morocco has limited natural gas, crude oil, and coal resources and depends upon imports for nearly 95% of its energy requirements. Furthermore, more than 80% of Morocco's annual production of electricity is generated by 'dirty' thermal power plants, including coal, gas, and fuel. The rest is produced by hydroelectric power facilities and wind farms.

In 2016, total installed energy capacity in the country was 8,262 MW. It produced 30,840 giga-watt-hours (GWh) of power and consumed a total of 35,415 GWh. The difference was imported from Spain through two high capacity transmission lines.

<b>Installed Capacity (MW)</b>	
Thermal (i.e., coal, gas, fuel)	5,412
Hydroelectric	1,770
Wind	920
Solar	160
<b>Total</b>	<b>8,262</b>

## Renewable Energy Future

In 2009, the Moroccan government launched ambitious plans for the development of new renewable energy (solar, wind and hydro) generation sites. The goal was to have renewable energy represent 42% of the country's electricity production by 2020. There are close to 1,000 MW of wind energy projects currently under operation, and 1,000MW more under construction.

In November 2016, at the United Nations climate change conference held in Marrakesh, the King of Morocco announced new goals for the country's renewable energy sector. Morocco now aims to produce over 52% of its electricity through green power by 2030. This energy plan intends to add over 6,000MW of renewable projects by 2020 — a huge opportunity for private producers.

# Board of Directors



**John Belizaire**

Chief Executive Officer

John has successfully founded, built, scaled, and sold industry-leading technology companies. Past companies he founded include FirstBest, a leading insurance software company that was acquired by Guidewire, and The Theory Center, an internet-application software company acquired by BEA Systems (now Oracle).

Prior to co-founding FirstBest, John was senior director of business development and strategic planning for BEA's Ecommerce Applications Division, where he grew annual revenue to over \$150 million.

Before BEA, John co-founded The Theory Center, a leader in Java-based internet-application software for enterprises. As CEO, he grew the company from inception to \$15 million in revenue. BEA Systems acquired the company in 1999 for over \$150 million.

John was previously lead architect for Intel's Digital Enterprise Group, where he was responsible for the industry's first implementation of network quality-of-service technology for personal computers.

John is an investor and senior advisor to a number of start-ups companies in the US including: Bowtie.ai, Aleria, Jobletics, Hi Marley, Bamboo Insurance, and LoveStoriesTV. John is also a member of NY Angels.

John serves on the board of trustees of Harlem Academy and the board of directors of Metabiota.

John has a BS and MS in Computer Science from Cornell University.



**Michael Toporek**

Chairman

Michael founded Brookstone Partners in 2003 and focuses on managing the firm, originating transactions, and actively working with portfolio companies on organizational transformation, market expansion, implementing financial discipline and strengthening operations. Michael's particular strength is working with entrepreneurial management teams to build their companies and help them execute their strategic vision. He currently serves on the board of directors of Instone and Mechanical Technology.

Prior to Brookstone, Michael worked extensively with Fortune 100 companies to formulate and execute complex merger, acquisition, and financing strategies in diversified sectors such as manufacturing, building products, medical and analytical instruments, environmental services, technology, and transportation/logistics. He has also structured innovative debt, equity, and equity-linked financing in the U.S. and European capital markets.

Michael began his career in Chemical Bank's Investment Banking Group and later joined Dillon Read (which became UBS Warburg during his tenure) and SG Cowen.

Michael serves on the board of trustees of Harlem Academy and holds a BA and an MBA from the University of Chicago.



### **Matthew Lipman**

Board Member

Matthew joined Brookstone in 2004 and focuses on originating transactions and actively working with portfolio companies on organizational transformation, market expansion, implementing financial discipline, and strengthening operations. Matthew's particular strengths include working with companies to manage their capital structures, executing add-on acquisitions, and other portfolio company-related strategic projects. He currently serves on the board of directors of Denison, Instone, and Mechanical Technology.

Prior to joining Brookstone, Matthew was a member of the mergers and acquisitions group at UBS responsible for formulating and executing on complex merger, acquisition, and financing strategies for Fortune 500 companies in the industrial, consumer products, and healthcare sectors.

Matthew received his BS from Babson College in Business Administration.



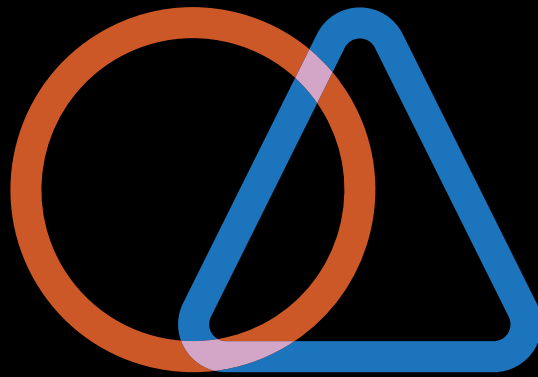
### **Chuck Dana**

Board Member

Chuck has been an investor in Brookstone Partners since 2003. In 2016, he joined the firm as an operating partner. His main responsibilities are to identify and acquire middle market companies in several verticals.

Chuck has over 25 years of financial and general management experience. He started his career at GE Locomotives Indonesia, working his way up to the role of President of that division. Subsequently, Chuck joined Owen Corning and held various positions including VP of Composite Solutions, VP of Financial Planning & Analysis, and Group President of Building Materials. Mr. Dana retired from Owens Corning and served as Executive Vice President of the Molded Fiber Glass Companies before joining Brookstone.

Chuck received a BA from Dartmouth College in Economics.



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