POWER LEDGER

WHITEPAPER

We believe empowering individuals and communities to co-create their energy future will underpin the development of a power system that is resilient, low-cost, zero-carbon and owned by the people of the world.

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1.1 THE POWER OF POWER

The energy industry used to be simple.

Vertically-integrated utilities sat in the middle of the system, like benevolent spiders spinning a web out to the last consumer requesting connection: they decided where and when to build generating capacity; they decided how to bridge the distance between generators and loads; they kept the system in balance through the deft application of the levers available to a centralized controlling entity.

While progressive utilities and regulators try to position themselves as consumer-focused or consumer-centric, the reality is, even the most progressive are only rephrasing a narrative that pushes citizens into categories of consumers.

Clinging to the umbilicus of the power network, consumers are fed a steady diet of price and product. The cost of energy security can be counted in terms of control, certainty and economic independence.

But a global technology revolution has changed the power balance between consumers and centralized power authorities. The booming market in Distributed Energy Resources (**DER**) like solar photovoltaic systems (**PV**), batteries, microgrids and embedded networks has moved the power balance from central authorities to the edges of the grid, to where citizens have control.

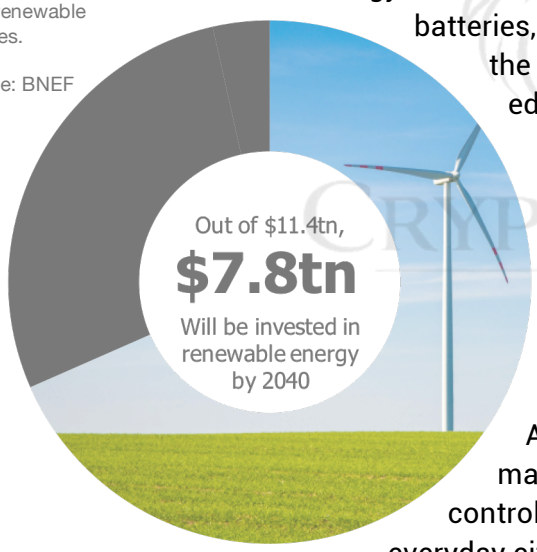


Figure 1.1.1: Out of the 11.4 trillion dollars invested in electricity generation, $7.8 trillion will be from renewable sources.

Source: BNEF

And it is not just about controlling the cost of energy consumption, it is a reflection of peoples' desires that their energy supplies are more sustainable, more socially-responsible, more local, more resilient and more democratic (See Figure 1.1.1).

All that is needed to move the revolution into the mainstream is a model for energy trading that takes control out of the hands of central players and puts everyday citizens in charge of a co-created energy future.

The Power Ledger Ecosystem is that platform.

1.2 THE MARKET SIZE

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1.2.1 STATIONARY ENERGY

Electricity is a critical enabler. The current electrification state of the global population is at 84%. Advanced and transitional economies require secure access to modern sources of energy, to underpin their development and growing prosperity.

In developing countries, access to affordable and reliable energy is fundamental to reducing poverty, improving health, increasing productivity, enhancing competitiveness and promoting economic growth.

Hundreds of millions of people have attained modern energy access over the last two decades through distribution networks, especially in China and India. This means that more people on Earth than ever before are now connected to ever-growing and interconnected electricity networks.

This creates an enormous appetite for innovative new energy peer-to-peer (**P2P**) energy transaction platforms.

1.2.2 NON-STATIONARY ENERGY

In addition to stationary electricity consumers (buildings, factories, apartments and houses), non-stationary electricity users are driving up electricity demand across the globe.

The year 2015 saw the global threshold exceed 1 million Electric Vehicles (**EV**) on the road, with the total number closing at 1.26 million.

To service this growing fleet, there were an estimated total of 1.45 million electric car charging points worldwide in 2015.

EVs are forecast to reach price parity with combustion engine cars by 2025, largely due to falling battery cost and increasing fuel density. The deployment scenarios for the stock of EVs range:

- Between 2 to 20 million EVs in use worldwide by 2020;
- Between 18 to 60 million by 2025; and
- Between 22 to 140 million by 2030.

1.3 AN ENERGY REVOLUTION

In 2012 in New York City, Hurricane Sandy destroyed the century-old concept of utility power supplies and heralded a new era of distributed energy supplies that value resilience over tradition.

In Australia, in the years between 2011 and 2016, more new generating capacity was installed on residential roofs than was connected to transmission networks.

If regulator forecasts are accurate, network businesses face the prospect of leaking hundreds of millions of dollars in revenue as a result of the load defection brought about through the proliferation of rooftop PV and the uptake of distributed energy storage.

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There is an inconvenient truth facing the traditional energy supply industry: at some stage, it will be cheaper and more effective to self-supply than to rely on the network to provide low-cost and reliable and clean energy.

It might happen in five years, it might happen in two (according to research for some consumers it has already happened, see Figure 1.3.1) but we need to accept the fact that if the only purpose of energy networks is the provision of energy, then we are putting them up against some stern competition in the form of DERs.

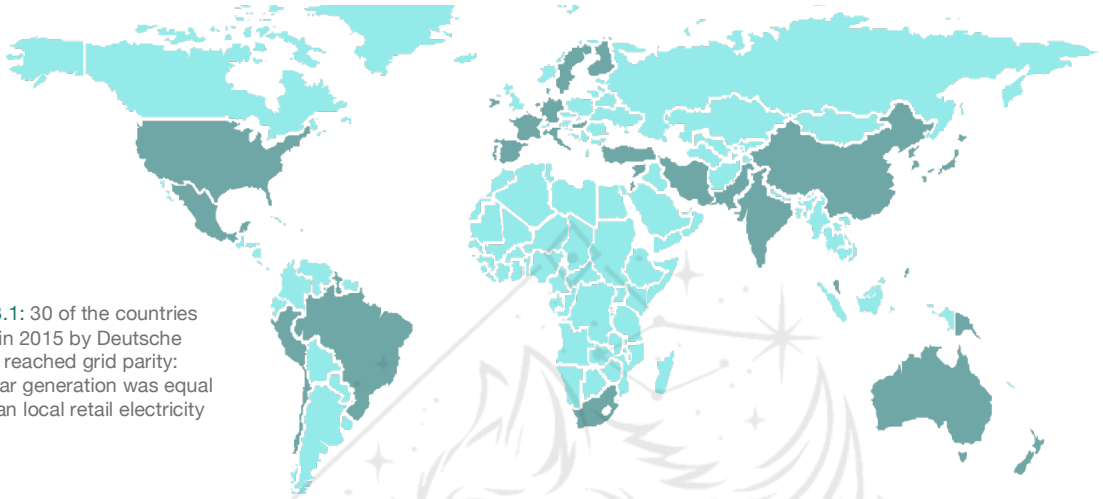


Figure 1.3.1: 30 of the countries analyzed in 2015 by Deutsche Bank had reached grid parity: where solar generation was equal or less than local retail electricity prices.

There is an alternative to this steadily emerging obsolescence and, oddly enough, it can help to preserve the value of existing network assets while reducing the risk of investment for those co-creating the energy system of the future.

Re-imagining the network as a decentralized and "trustless" trading platform.

The rapid penetration of DERs means we now have a distribution system characterized by bi-directional flows of energy and millions of active prosumers.

Prosumers: a consumer who becomes involved with producing or storing electricity for their own needs.

At a residential level, consumers are spilling energy into the network and feeling under-rewarded for their contribution. A network that allows consumers to realize value from their investment in DER presents an additional value proposition that could encourage even greater investment in distributed renewables and a new era of network management.

This new paradigm will see ever increasing levels of automation and resilience led, not by a small number of large-scale centralized investments, but by millions of micro-investments distributed across the system.

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1.4 A TRUSTLESS TRADING PLATFORM

Trustless: a trustless system is one designed so that nobody has to trust anybody else in order for the system to function. It makes it possible to trust the outputs of a system without trusting any actor within it.

A trading platform is a network that allows consumers to sell energy to their peers in a trustless environment.

It is a new component of the distributed economy that allows consumers to realize the value of their investment in DER by allowing them to monetize their excess energy in much the same way as Uber and AirBnb allow people to monetize their cars and spare rooms.

And trustless?

A trading platform that requires third-party settlement and reconciliation of millions of transactions between hundreds of thousands of traders across 5-minute trading intervals would be almost impossible to support without a central player taking control of all parties' data, prescribing fees, requiring trust, proving accuracy and binding the market up in red tape and bureaucracy. But the blockchain is an agreement machine that can facilitate the financial settlement of these transactions, in the same trading intervals in which the energy is produced and consumed, and it can be achieved at a speed not possible using current market settlement technologies.

Blockchain-enabled P2P energy trading will transform energy networks into trading platforms and invoke a transactive economy that moves away from bilateral retail arrangements to multi-lateral trading ecosystems, preserving networks' relevance to consumers.

1.5 WHAT IS BLOCKCHAIN TECHNOLOGY

Blockchain is a software innovation for establishing digital trust between users facilitating transactions of value, over a network.

The blockchain enables trust to be distributed throughout a network, without the need for a central intermediary to track, verify and approve the digital exchange of value. The notion of authorizing trust from a central intermediary currently underpins both private and government institutional structures, however this is proving to be costly, slow, and also vulnerable to attack. The blockchain overcomes these issues by operating as a decentralized distributed database, maintaining a continuously growing list of records called blocks.

Although blockchain technology is still an emergent one, current applications show it can be better, more efficient and more secure than traditional systems, which is why banks and governments globally are beginning to experiment with it.

1.5.1 SMART CONTRACTS

On-chain computer code or "**Smart Contracts**" are computer protocols that facilitate, verify, or enforce the performance of a contract making a contractual

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clause unnecessary. Smart contracts often emulate the logic of contractual clauses.

Smart contracts can exchange money, property, shares or anything of value in a transparent, conflict-free way, while avoiding the services of a middleman. Ordinarily, a process would require payment to a middleman, government agency, bank, lawyer or a notary, and then a processing time before the receipt of goods or services. However, with smart contract technology it can all be automated.

Smart contract technology can be compared to that of an automated vending machine. With a vending machine, money is deposited into the vending machine and the desired item drops for collection, provided that the correct amount is deposited.

Comparable to that, with a smart contract, the money is deposited into escrow on the blockchain for receipt of a transfer of a token (e.g. a digital certificate of title for a house), which is instantaneously transferred into a counterparty's control once conditions are met.

Smart contracts not only define the terms and conditions around an agreement in the same way that a traditional contract does, but also provide enforcement of those obligations.

1.6 WHY SOCIETY NEEDS AN ENERGY TRADING PLATFORM

It is not just network service providers that benefit from maintaining the relevance of one of our most important social assets.

The people that have the most to lose in the face of falling network utilization are the people that have the least ability to influence their exposure to rising network costs and the impact on grid-supplied energy.

The financially and socially marginalized renters, the huge number of tenants living in group housing developments and even those whose homes are oriented in the wrong direction or are exposed to shading from nearby buildings or trees, are the people who will bear the impact of falling network utilization if we do not find a way to incentivize Prosumers to stick tight to the network.

Unlike the centrally-managed power systems of the past, the future of the energy system, will be co-created by the prosumers and investors that will decide where and when to install DER.

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1.7 HUMAN ENERGY

Energy trading between citizens brings humanity to the energy system.

Citizen Utilities: participants who generate, consume and transact electricity

Instead of faceless traders hedging their positions, Citizen Utilities return profits to communities, incentivize community investments in generating assets, and allow the sharing or gifting of energy.

Ultimately, as dynamic distributed energy markets become mainstream, the owners of DERs can earn an income, not just from the energy they sell but from the network services they provide such as frequency and voltage control, load shifting, load shaping and load sinking.

EVs will become the back-up power source of choice as the owners of EVs monetize their spare energy, not through selling kilowatt hours but by selling resilient access to the lifestyles we take for granted.

In aspiring communities building modern economies through electrification, citizen-owned microgrids are a leap in technology that by-passes the mistakes of the past and supports the development of low-cost, low-carbon, and democratic power systems in towns and gated communities all over the developing world.

In modern cities, Neo-retailers, the new species of innovative energy retailer, will support P2P trading through effective aggregation of consumer preference and demand aligned transparently, with prosumer capacity managing risk and security and providing choice for consumers.

Human energy will change the face of the energy system because instead of being focused solely on profits, it will focus on the broader needs of communities, on aspirations for independence and co-creation, and the long-term sustainability of energy creation and consumption.

1.8 THE POWER LEDGER PLATFORM

The Power Ledger Platform (**Platform**) is a trustless, transparent and interoperable energy trading platform that supports an ever-expanding suite of energy applications, with an exchangeable frictionless energy trading token, Sparkz.

The Power Ledger Token (**POWR™**) is the fuel of the Power Ledger Ecosystem with bespoke private trading applications creating Sparkz in exchange for POWRs. Sparkz are currently purchased and redeemed using fiat currencies with individual trading platforms hosting closed-loop exchanges for energy and Sparkz.

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Energy trading applications are not just conceptual, they are proven and deployed in communities and energy markets around the world including Australia, New Zealand, Europe and Asia, such as PowerPeers.

Fiat Currency: is a legal tender that is backed by the sovereign government state that issues it. The Australian dollar and U.S. dollar is fiat money, as are many other major world currencies. This differs from money whose value is underpinned by some physical good such as gold or silver (commodity money).

Cryptocurrency: a digital currency in which mathematical encryption techniques and network consensus protocols
are used to regulate the generation of units of
currency and verify transactions (i.e. the transfer of funds), operating independently of
a central bank. It can be
used as a form of P2P digital money, purely relying on the blockchain ledger and verification through encryption algorithms, rather than a centrally controlled entity like a central bank.

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1.9 ACHIEVEMENTS



Q3 2016: **Australian Blockchain Trial**

The pilot project with National Lifestyle Villages (NLV) demonstrated the capability of our concepts and technology, specifically EcoChain. The project was a huge success, becoming the first of its kind in Australia. 15 dwellings were connected via the blockchain giving way to a community energy marketplace.

Q4 2016: **First International Deployment**

After the first successful trial, Power Ledger deployed the technology with Vector Ltd., a New Zealand DSO. The partnership with Vector confirms Power Ledger's business strategy is not to cut out existing market participants, but rather to let consumers and utilities drive the disruption in a feasible way.





Q2 2017: **Bank On-ramping**

Power Ledger secured a financial channel to enable direct exchange between Sparkz and fiat-currencies in real-time. In addition, Power Ledger developed the functionality exchange energy for Sparkz for real-time fiat currency remuneration. By providing bank on-ramping Power Ledger cleared the largest barrier for P2P energy trading, democratizing power in a way no one thought possible.

Q2 2017: **Commercial Deployment at Multi-Tentanted Properties**

We began commercial operations in the White Gum Valley development in Fremantle, Western Australia. Power Ledger was the first company to successfully use distributed ledger technology to facilitate electricity trading across the meter and manage settlements without going through an electricity retailer.





Q2 2017: **Partnership With Indra Australia**

Power Ledger has signed a partnership agreement with leading global technology provider, **Indra**, to jointly develop network management solutions pairing **Indra's world-leading iSPEED** network control and optimisation platform, with Power Ledger's transactive energy platform, thus paving the way for the future development of autonomous distributed energy markets that respond in real-time to network conditions and consumer behaviour.

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2.0 PLATFORM APPLICATIONS

The Power Ledger Ecosystem supports a growing number of energy trading applications. The key classes of Platform Applications developed by Power Ledger are listed below, with some already operational, and others in advanced conceptual design or in development.

2.1 P2P TRADING



This class of Platform Application gives retailers the ability to empower consumers (or in an unregulated environment, the consumers themselves) to simply trade electricity with one another and receive payment in real-time from an automated and trustless reconciliation and settlement system. There are many other immediate benefits such as being able to select a clean energy source, trade with neighbors, receive more money for excess power, benefit from transparency of all your trades on a blockchain, and very low-cost settlement costs, all leading to lower power bills and improved returns for investments in distributed renewables.

2.2 NEO-RETAILER



This class of Platform Application provides Neo-retailers with smart demand and supply management, along with almost instantaneous remuneration and payment settlements while managing consumer exposure to the risk of non-supply.

Neo-Retailer: an innovative energy retailer who supports P2P trading through effective aggregation of consumer preference and demand

2.3 MICROGRID/EMBEDDED NETWORK OPERATOR/STRATA



This type of Platform Application enables electricity metering, big data acquisition, rapid micro-transactions, and grid management at an unprecedented granular scale. Trading in embedded networks breaks the nexus between generation ownership and energy consumption, meaning value can be derived from an investment in DER even if the investor is absent or doesn't consume all the energy they generate.

2.4 WHOLESALE MARKET SETTLEMENT



This Platform Application class offers rapid low-cost and transparent dispatch optimization and management, data aggregation, reconciliation, and settlement for wholesale energy marketplaces.

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2.5 AUTONOMOUS ASSET (**AA**) MANAGMENT



This current Platform Application allows for (1) shared ownership of renewable energy assets and (2) trading renewable asset ownership. The AA is able to buy and sell its own electricity and distribute its income to assigned wallet addresses.

2.6 DISTRIBUTED MARKET MANAGEMENT



This Platform Application provides optimized metering data, the collection of big data, right to access and dispatch of assets, rapid transaction settlement, network load balancing, frequency management, demand side response, and demand side and load management. The optimization of network assets is made viable by the near real-time remuneration of asset owners.

2.7 ELECTRIC VEHICLES



This class of Platform Application facilitates real time metering data (interfacing with the Open Charge Point Protocol (**OCPP**)), collection of data, user identification and rapid transaction settlement.

2.8 POWER PORT



A class of Platform Application whereby virtual pipeline and roadside assistance type assets may be automated via the platform, such as EVs, and can provide a mobile storage discharge facility maintaining energy supplies to predominantly self-sufficient energy consumers.

2.9 CARBON TRADING



This Platform Application class offers smart contracts for carbon traders to assure digital transactions across organizations: credibility of asset using immutable distributed ledger technology; and transparency and auditability. It supports reporting and surrendering of carbon credits or certificates to regulatory authorities.

2.10 TRANSMISSION EXCHANGE



In the management of transmission networks, the Platform can provide real time metering data, collection of big data, right to access and dispatch assets, rapid transaction settlement, and network load balancing, responding to non-stationary energy.

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3.0 POWER LEDGER'S ACHIEVEMENTS

3.1 INTRODUCTION

After months of research and planning, Power Ledger Pty Ltd (**Power Ledger**) was officially formed in May 2016 to address three of the major challenges facing the energy system globally:

1. Finding a way to include individuals in high-density housing in the booming distributed energy economy;
2. Re-inventing electricity networks to provide an incentive for the connection of DER; and
3. Mitigating the risk of stranding multiple billions of dollars in valuable network assets.

Power Ledger developed and trialled Australia's first P2P energy trading network in Busselton, Western Australia in August 2016. At the time, that was the biggest and most advanced trial in the world. This was quickly followed up with the world's first P2P blockchain-enabled energy trading platform across a regulated distribution network in Auckland, New Zealand working **with New Zealand's largest energy network business, Vector Ltd.**

Power Ledger has successfully separated the crypto-nature of the blockchain from a fiat-currency based financial exchange, satisfying regulated banking institutions to the point where we are now supporting P2P energy exchange between individuals **connected via regulated networks using local fiat currencies**.

Power Ledger has developed and deployed a commercial energy management system that facilitates the transparent allocation of on-site generated renewable energy to **tenants in multi-unit apartments**, providing, for the first time, a real financial incentive for deployment to jointly-owned multi-tenanted dwellings.

Power Ledger is working with property developers, one of which is Sustainable Settlements at the Witchcliffe Ecovillage, to support the creation of sustainable urban settlements. By using our unique energy-trading platform to support the high-penetration of DER in communities, we are able to exploit the naturaldiversity of demand and minimise the use of DER resources, while still achieving 100% renewable energy use.

Power Ledger has developed a series of world-leading Platform Applications, such as its P2P energy trading application (interface shown in Figure 3.1.1), meaning businesses, such as Utilities, can now host trading on the Platform.

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Our experience, gained from decades of work in the energy industry and honed by working with our partners throughout our trials, has led us to conceive how best to go about democratising the world's power systems.

We believe this is best achieved through the rapid implementation of our disruptive, consumer-driven transactive techologies, by fostering incentives, and by enabling collaboration between consumers, prosumers and industry incumbents.

Power Ledger's partners are rapidly increasing in number, and more recently we welcomed other new Application Hosts who will host trading on the Platform to accelerate the reach of community-focused trading enterprises globally.

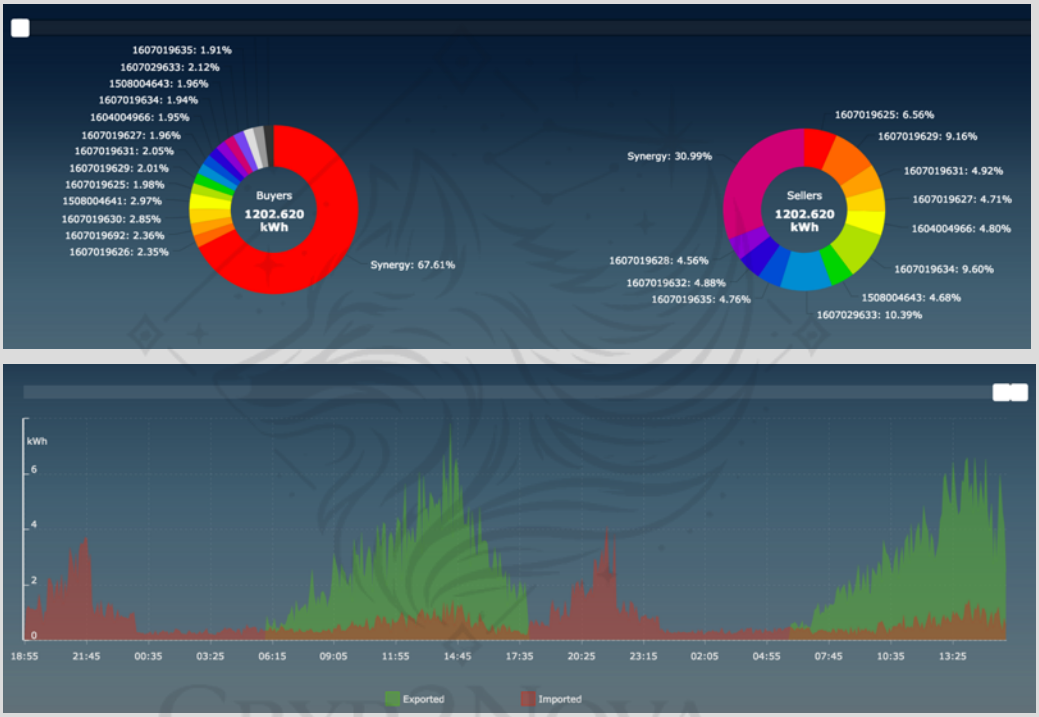


Figure 3.1.1: An example of the data an Application Host would see in Power Ledger's developed interface.

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3.2. THE BOARD OF DIRECTORS


Bill Tai
Board Advisor

Bill Tai | Board Advisor

Originally trained as a chip designer, Bill joined LSI Logic, a seminal Silicon Valley startup formed by the CEO of Fairchild Semiconductor after earning a BSEE with Honors from University of Illinois. After completing a MBA at Harvard, he was issued badge #A001 at TSMC, now among the most valuable tech companies in the world. He has been a venture capitalist since 1991 and today is the Chairman of Treasure Data, a Board Member of Bitfury and Voxer. Bill was Founding Chairman and CEO of iAsiaWorks (IPO via Goldman Sachs & Morgan Stanley) and Founding Chairman of IPinfusion. He has served as Board Director of 7 publicly listed companies that grew from startups he funded at their formative stages. He serves on the World Economic Forum's Technology Pioneer Committee and is an Adjunct Professor of Innovation at Curtin University.


Dr. Jemma Green
Co-founder & Chair

Dr. Jemma Green | Chair

Jemma, as the Chair, provides the strategic external relations, risk management, and leadership development for Power Ledger. Jemma has more than 15 years' experience in finance and risk advisory, having worked for 11 years in investment banking in London. Whilst there, she completed a Masters degree and two postgraduate diplomas from Cambridge University. Jemma is a research fellow at Curtin University Sustainability Policy (CUSP) Institute, whose doctoral research into "Citizen Utilities" has produced unique insights into the challenges and opportunities for the deployment of roof-top solar PV and battery storage within multi-unit developments and the application of the blockchain. Jemma is experienced in the challenges of sustainable cities through her role as an independent Councilor of the City of Perth. She is also the Chair of Climate-KIC Australia.


David Martin
Co-founder & Managing Director

David Martin | Managing Director

David manages the daily operations and commercialization of Power Ledger's technology, working to build the market acceptance of P2P trading and to gain the regulatory reforms required for democratization. David has nearly 20 years' experience in the electricity industry and has held executive positions in two State-owned electricity utilities. David has spent the past 6 years as a senior consultant to industry participants, specializing in regulation of distribution networks, DNSP consumer engagement, renewable/new technology feasibility studies, and business development. David has significant experience in the challenges and opportunities facing regulated DNSPs as they transition to a new energy-demand paradigm that sees customer behavior leading technology and service demand changes that can present "make or break" opportunities

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for DNSPs. David is passionate about the development of a low-carbon electricity system focused on the needs of all consumers.


John Bulich
Co-founder & Director

John Bulich | Technical Director

John provides the strategic direction for conceptual, system and application design and development for Power Ledger. John leads the technical team in the development of the Power Ledger Platform. John is a Director and Co-founder of Ledger Assets, a Perth-based blockchain developer specializing in the creation and commercialization of technical and commercial blockchain systems. Ledger Assets has successfully developed and deployed world-first blockchain-based products proving the provenance of artefacts including evidence-grade photography, video, document management and medical records management.


Dr. Gov van Ek
Co-founder & Director

Dr. Gov van Ek | Technical Development

Gov works on technical development. In 2015, he Co-founded Ledger Assets, a leading Australian blockchain company. He has a PhD from University of Manchester in Total Technology and before Ledger Assets, he was Managing Director of a number of private and listed companies. He is an investor and business founder and launched his first software company in 1991. Gov is experienced in concept development, systems architecture and design, commercial matters and has expertise in human/computing interface design and A.I.


Jenni Conroy
Co-founder & Director

Jenni Conroy | Company Secretary & Product Development

Jenni is Power Ledger's Company Secretary and manages regulatory and business services, which includes development of products for Power Ledger's Platform. Jenni has more than 30 years' experience in the Western Australian energy industry, holds Master's Degrees in both Business and Commercial Law, and is the owner of Future Effect, an energy sector consulting firm. Jenni has provided strategic, commercial, and regulatory advice to boards and senior management of Energy Market Participants and to governments in developing energy policy and regulation. She has built an enviable reputation in the West Australian electricity sector for economic and technical regulation, industry development, and electricity entity valuation.

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3.3 THE TEAM



Marc van Hoof

Chief Operating Officer



Vinod Tiwari

Manager Sales and Business Development



Marc Griffiths

Chief Technology Officer



Nuno Martins

Blockchain Expert



Carmen Grant

Program Manager



Anya Nova

Commercial



Aimie Rigas

Community & Marketing Manager



Daniel Sturton

Senior Software Engineer



Duncan McGregor

Analyst



Kristian Myhre

Energy Systems Specialist



James Eggleston

Senior Analyst



Meagan Cojocar

Senior Analyst



Jong-won Choi

Principal Software Architect



Lindsay Dick

General Counsel



Marie Stergiou

Executive Assistant



Mili Wijeratne

UX Developer



Sarah Graham

Research Analyst



Dr. Simon Kwok

Senior Software Engineer



Yung Yum Ang

Senior Software Engineer



Trevor Griffiths

Analyst

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4.0 TECHNICAL OVERVIEW

4.1 INTRODUCTION

The Power Ledger Platform is the Ecosystem that enables interoperability between diverse market management/pricing mechanisms and units of electricity (kWh) by way of pre-purchased tokens.

The Power Ledger Platform provides a transparent governance framework that allows the Ecosystem to seamlessly interface with energy markets around the globe, bringing innovation and a wide range of network benefits to consumers.

This approach means the Ecosystem is adaptable and scalable for applications within any existing or future regulatory environment, achieving the dynamic agility required to adapt to any number of regulatory structures. This dynamic agility, allows a redefinition of where Application Hosts (utilities, retailers, property managers, etc.) and customers (users) are positioned in the Ecosystem and who has market power in any transactive arrangement.

The market flexibility of the Ecosystem is facilitated by deployment of a dual token Ecosystem (POWR and Sparkz) operating throughout its two blockchain layers.

POWR tokens are the frictionless blockchain tokens that allow Application Hosts and Participants access to and use of the Platform (like a limited software licensing permission).

Sparkz tokens are issued against escrowed POWR tokens, via a Smart Bond, and used by the Application Host to onboard its customers.

Application Hosts are entities and businesses that run an Application on the Platform. For example, a utility company using the Platform will be an Application Host, as is an EV-charging services business. A Decentralized Autonomous Organization can also become an Application Host.

"Off the shelf" applications may be used in the Ecosystem. Applications such as FuseBox, Power Ledger's P2P Energy Trading Application which acts as a

"Utility in a box", allowing Utilities to manage and on-board participants to the Platform and to reap the technology benefits and cost advantages it offers.

Applications may also be developed by third parties, using the Platform's designs and services to fast track innovative consumer applications. The

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POWR to Sparkz ratio for third party developers may be adjusted depending on their customer feedback and reputation.

Sparkz, the "low level" token, are specifically limited to representing the tokenized value of a unit of electricity in varying markets around the world. Sparkz and POWR tokens will be exchangeable, connecting the functions of the Ecosystem. Sparkz maintain a steady exchange rate between local market electricity prices and the exchange priced POWR token.

Figure 4.1.1 shows the design architecture where Application Hosts (i.e. an energy utility company) will buy POWR tokens from the open market.

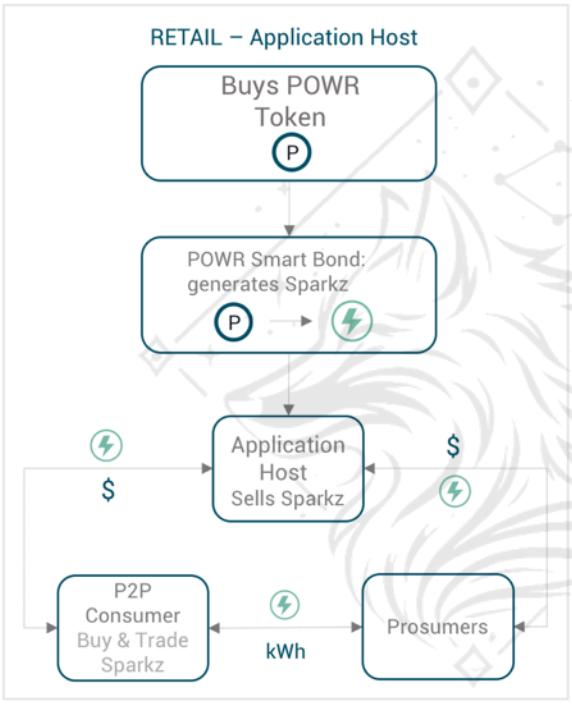


Figure 4.1.1: The retail model for working with existing market structures

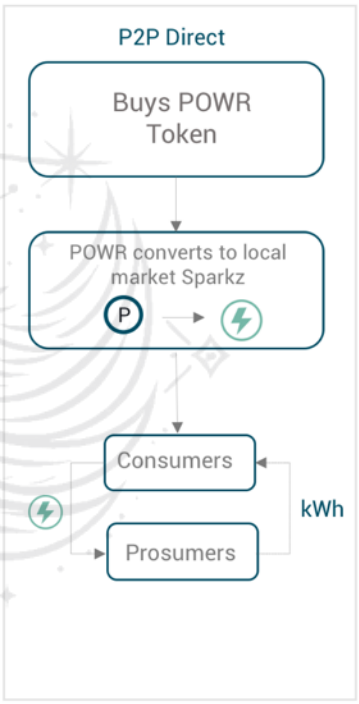


Figure 4.1.2: The direct peer-to-peer model for working within deregulated market structures

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Consumer and Prosumers buy and sell energy, which is settled with Sparkz tokens and may redeem the Sparkz for cash via their Application Host.

The level of disruption from the Ecosystem is able to be controlled by Application Hosts ensuring rapid and early adoption of the technology whilst supporting Utilities' needs to migrate at a speed that works for their

organization. This controlled deployment of the disruptive benefits will also help Application Hosts to transfer technology to consumers, helping them to grow their consumer base using their local market knowledge.

Figure 4.1.2 advances the concept such that POWR tokens can be used directly in P2P trading between Prosumers and Consumers, with near zero

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intermediation - and this is the way markets will operate as deregulation in the sector moves forward in the years to come.

4.2 POWR TOKEN

The POWR token will serve as the fuel of the Power Ledger Ecosystem.

POWR tokens help to facilitate low cost and better returns on electricity. They interact with the Ecosystem through:

- Providing governance and consumer protection through Smart Bond technology (section 4.4)
- Facilitating access to use the Platform (section 4.4)
- Providing loyalty rewards to Participants (see section 4.6);
- Contributing and connecting with renewable energy charities and organizations (see section 4.6);
- Providing access priority to Asset Germination Events and benefits from an asset's 'POWR' generation (see section 5.5.7); and

4.3 DUAL TOKEN ECOSYSTEM

To synchronize the Ecosystem globally and create cross-market electricity compatibility, a second token, Sparkz, is used for Ecosystem transactions.

Sparkz tokens are priced, issued, and redeemed in the local currency of the Platform Participant.

Purchasing a sufficient amount of POWR tokens allows Application Hosts access to the Ecosystem from where they can convert their POWR tokens to Sparkz and on-board their customer base.

POWR tokens are required to generate Sparkz. Sparkz are a local market level token and are priced for the exchange market they are deployed in, e.g. In Australia 1 Sparkz = 1 cent AUD. They allow for frictionless transacting throughout the FuseBox applications.

4.4 POWR TOKENS ARE ACCESS PERMISSION TOKENS

POWR tokens allow the Application Hosts and their consumers to gain access to the P2P trading features and other Power Ledger applications.

As an example, an Application Host would need to purchase enough POWR tokens to generate the necessary Sparkz for their consumers to transact electricity in their home market. The Application Host will need to maintain a

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sufficient number of POWR tokens to generate the necessary Sparkz required, for their consumer base.

In a deregulated market, where Participants are able to trade directly with each other without the need for intermediaries, Participants will be able convert their POWR tokens directly to Sparkz and transact on the platform without an Application Host.

To use services on the Platform each Application Host will require POWR tokens to transact for Sparkz, in their local jurisdiction. POWR tokens can be seen as the global token that opens access to the Platform for all Participants, to on-board the system. The POWR token is the access token, like a software license, that grants ability for Application Hosts to transact on the Platform, through trading POWR tokens for Sparkz.

Once an Application Host has exhausted all POWR tokens they can no longer transact on the Platform until they obtain more POWR to provide Platform access.

4.5 POWR FUNCTIONS AND SMART BONDS

For incumbent market participants, the POWR token will provide not only access to the network, but also the Smart Bond functionalities.

Smart Bonds: an automated contract bond using smart contract technology, that has in built code, to enforce compliance of the contract bond parties.

POWR tokens from the growth pool will be gifted to incentivize Application Hosts to use and contribute to the development of the Platform Applications and on-board their Consumers to facilitate its global reach.

Application Hosts such as Energy Retailers and Network Utilities will be required to provide the POWR tokens as surety for the Sparkz they receive from the Platform. The Sparkz are then used to transact electricity between their Customers in their home market.

POWR tokens will be escrowed for Sparkz in an Ethereum Smart Bond, and can only be unlocked from the Smart Bond upon the return of the Sparkz.

It is expected Application Hosts will need to acquire more POWR tokens over time to facilitate an increase in transactions as their consumer base grows and the technology becomes more widely adopted. The more POWR tokens that are escrowed for Sparkz, the more organic demand is created for the POWR tokens.

The Smart Bond contract will ensure consumer protection in the event of the failure of an Application Host (i.e. bankruptcy). P2P Consumers are able to redeem their Sparkz directly, against the POWR tokens previously provided as surety and port to another Application Host.

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4.6 POWR TOKENS ARE INCENTIVE TOKENS: A VIRTUOUS CYCLE

All Prosumers generating and Consumers purchasing renewable energy are rewarded POWR tokens, under the Green Energy Loyalty Rewards program, for using the Platform. The incentive formula is weighted towards renewable energy producers. The Loyalty Incentive Program is funded by charging a small fee for all P2P transactions on the Platform. Part of the fee is then used to purchase POWR tokens on exchanges and distribute them under the program, incentivizing renewable energy generation.

The goal of the POWR tokens is to ensure that incentives for Developers, Application Hosts, and Participants are all aligned and, as they contribute to the democratization of energy, they are rewarded for the evolution and future success of the Power Ledger Ecosystem. As the Ecosystem user-base grows, the demand for POWR™ tokens will likely increase.

For the Platform to be truly global and decentralized, the POWR tokens may in the future facilitate Green Energy Generation Initiatives, driving sustainability. Customers could donate micro-portions of their transactions to charities and/or organizations that contribute towards innovative renewable and sustainable energy projects

Through P2P trading of clean energy and the supporting of Green Energy Generation Initiatives, more users are incentivized to adopt the Platform creating a virtuous cycle for sustainable energy.

4.7 POWR AND EXCHANGES

The standardized Ethereum ERC20 POWR tokens may also be used on public exchanges. Exchanges are independent and not operated by Power Ledger. However, Exchanges serve to further decentralize and add transparency to POWR tokens, by giving the holders of POWR the choice to exit or enter the token Platform.

POWR tokens provide efficiency in the ease of transfer for clean energy. Participants with POWR tokens will be able to instantly transact through an Application Host once the Platform is live in their region and the requisite regulatory framework emerges. As markets become fully deregulated the Participants will be able to transact directly through the platform without the requirement for Application Hosts.

Prosumers and Consumers of the Power Ledger Ecosystem will be able to transfer and receive clean green energy credits anywhere in the world as the

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Platform is gradually rolled out globally. If a Prosumer or Consumer moves to another country, it is not necessary for them to close their account and exit the system. The Power Ledger Ecosystem will be a global Platform that allows users to migrate between applications and instantly transact with their POWR tokens.

The transparent governance framework at the Ecosystems center will be inclusive by design, enabling an easy interface by Application Hosts. This will drive early adoption and allows seamless interfacing with energy markets around the world, bringing innovation and a wide range of network benefits to Consumers.

At its core, the focus is providing lower cost energy and better returns on energy for citizen investors, whilst providing powerful incentives to prioritize the adoption of renewable clean energy.

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5.0 TECHNOLOGY APPLICATION LAYERS

Public Blockchain: Anyone with an internet connection can set up as a node that is then synced with the entire blockchain history. Each transaction is verified and synced with every node affiliated with the blockchain before it is written to the system. This redundancy makes public blockchain extremely secure.

Sustainability is one of Power Ledger's core values, therefore, we aim to minimize the energy consumed by any proof-of-work algorithm.

For this reason, a hybrid public and consortium blockchain approach has been selected. POWR tokens on the public Ethereum blockchain and a fee-less Ethereum blockchain handle the high transaction volume of P2P energy trading.

We will transition entirely to a public proof-of-stake blockchain in due course.

Sustainable public blockchains are the future!

5.1 ETHEREUM BLOCKCHAIN - PUBLIC LAYER

The Public Layer utilizes the Ethereum blockchain and is where the Ecosystem interfaces with third party token exchanges.

The Public Layer and third-party exchanges operate independently and are outside of Power Ledger Ecosystem's control and provide the most advanced security and decentralization available to the ERC20 standard POWR tokens.

Users may choose to exchange their POWR tokens publicly or store them and later utilize them within Power Ledger's FuseBox P2P application software, if/when they become available within the user's local energy marketplace.

The Public Layer provides a mechanism for interfacing and transacting with the Consortium and Application Layers through the POWR tokens.

5.2 POWER LEDGER CORE

The Power Ledger Core layer is the public smart contracts layer which provides a trustless and open-sourced implementation of the key components of the POWR token Ecosystem:

- POWR/Sparkz Exchanger and Smart Bond contract for Application Hosts;
- Growth pool escrow services for POWR token beneficiaries;

Oracles: where external information is accessed by Smart Contracts. The Oracle normally gives a history and often receives a financial incentive to report accurate information.

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- Customer POWR incentives and Green Energy Loyalty Rewards Program management;
- Renewable Energy Assets Germination and participation Events;
- Direct Participant POWR/Sparkz exchange for participation in deregulated P2P market structures; and
- Oracles using smart contract to gather information external to the blockchain protocol required for internal operations and communicating with the consortium chain.

Private Blockchain: Only a predetermined private entity writes and verifies each transaction. Though it does not offer the same decentralized security as its public counterpart, it exhibits greater efficiency and runs significantly faster.

Proof of Stake (POS): concept states that a person can mine or validate block transactions according to how many coins he or she holds.

5.3 ECOCHAIN SERVICES - CONSORTIUM BLOCKCHAI

Power Ledger's industry specific Consortium blockchain.

Currently Power Ledger uses the EcoChain™ (**EcoChain**) blockchain, a private Proof of Stake (**PoS**), low-power blockchain developed in-house and live tested in the energy markets during trials in 2016 and 2017. EcoChain has been stress-tested in high-load environments and has provided valuable insights into blockchain functionality and compatibility, with energy data collection and settlement

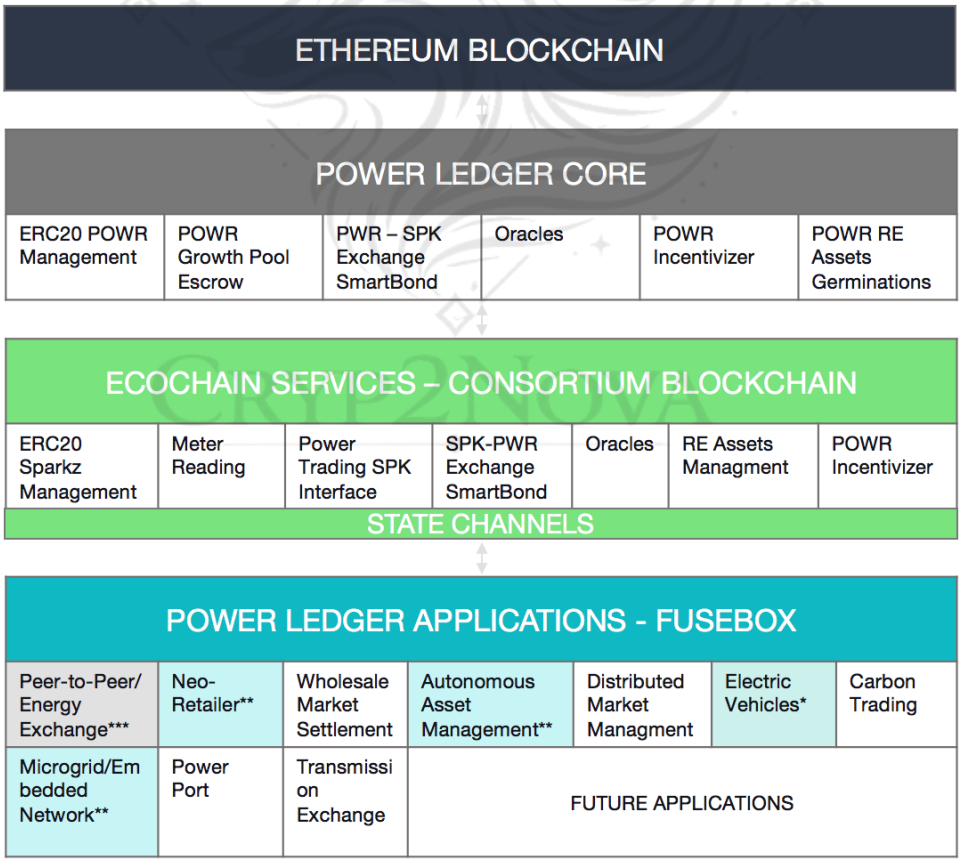


Figure 5.3.1: The Ecosystem is realized by a number of technology layers

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***Built and in beta test
**Built and in alpha test
*Under development

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Power Ledger successfully developed EcoChain, in September 2016, its own private Proof-of-Stake blockchain for use in the power industry. It was deployed in Western Australia, and internationally in New Zealand, and is currently in use in a number of other existing trials.

Power Ledger has already commenced the transition to a modified fee-less Consortium Ethereum network, while retaining its existing Ecochain system benefits for specific platform services where current Hosts run applications.

Consortium Blockchain: is partly private and partly public. A few select nodes are predetermined to verify transactions.

Both Ethereum (consortium) and the original private EcoChain blockchain currently run in the Ecochain Services, Consortium Blockchain Layer.

The transition means the EcoChain Services Blockchain layer is benchmarked against the latest blockchain technology while retaining 2016's active settlement layers, and also ensures it is open to future Ethereum development and proposed Casper POS implementation.

The transition also provides further benefits and enhanced token protocol functionality throughout the Ecosystem. The Ecochain Services Blockchain Layer functions include:

- Sparkz token creation and management;
- Fiat payment processor integration;
- Storage and verification of smart meter readings and trading related data;
- Autonomous Asset management; and
- Green Energy Loyalty Rewards manager.

5.4 STATE CHANNELS

State Channels provide a way to execute blockchain transactions in an off-chain manner by locking the blockchain state utilizing multi-signatures or smart contracts. In order to update the state, a specific set of Participants must completely agree with each other. Eventually the state is closed and sent to the blockchain.

Due to the high frequency nature of energy transaction settlement, the Platform will increasingly utilize state channels to handle these events.

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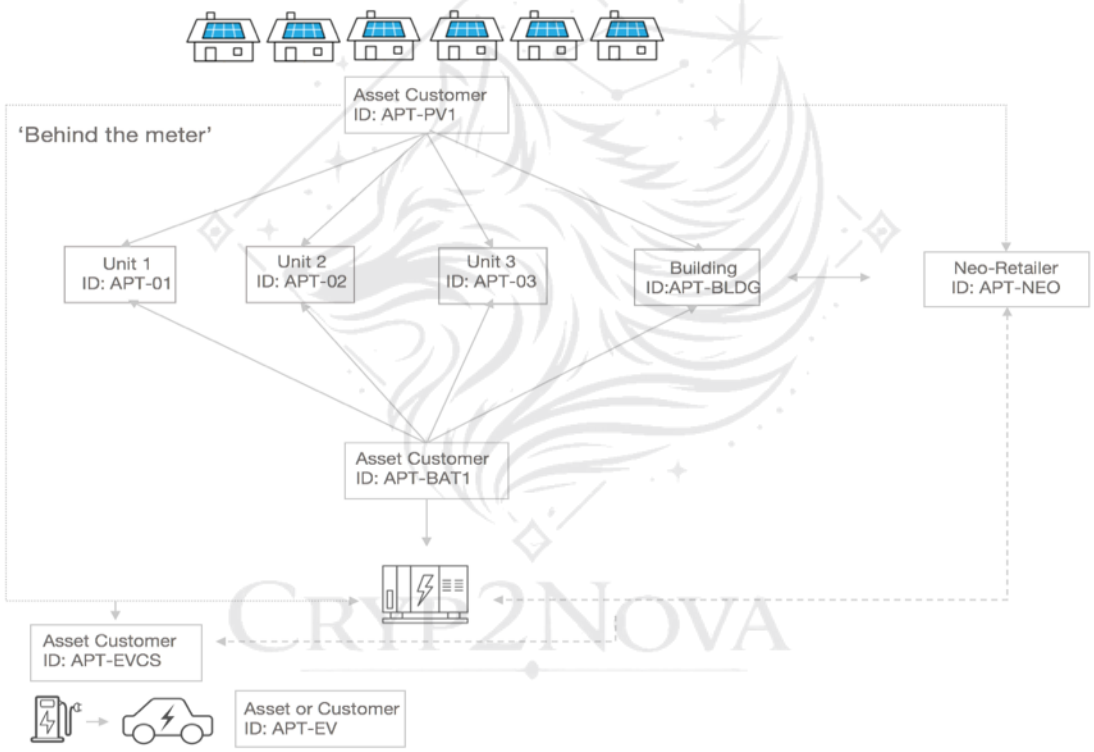
5.5 THE POWER LEDGER APPLICATIONS LAYER – FUSEBOX

The Ecosystem's Application Layer is the FuseBox. It's where the magic happens!

The Ecosystem's architecture facilitates easy adaptation for both highly regulated and deregulated energy markets.

The Ecosystem's most advanced Application was developed by Power Ledger and is a versatile P2P Trading Application. It allows for direct trading between Prosumers and Consumers with or without the inclusion of industry intermediaries such as market operators, retailers or transmission network operators. Application Hosts are already trialing this Application for their consumers.

Figure 5.5.1: Example of a FuseBox application:



The Application was designed to be configured to suit prevailing market structures and existing regulations with the ability to reconfigure itself and continue trading seamlessly as policy change occurs within the local operating environment.

Currently, all transacting of energy is performed via the Sparkz tokens, which are pegged to the local unit of currency. This allows for any number of economic and time-based pricing scenarios, to be applied across all countries and electricity pricing structures.

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User migration is possible via the standard POWR token, which has its Sparkz conversion rates anchored to the currency of the financial market where it was originally deployed.

5.5.1 METER READINGS

Meter reading details are recorded in intervals of 1 to 30 minutes depending on the Application Host's requirements and can be displayed to the Participant, in near real-time or 24 hour delayed depending on the hardware and communication network available. Trial readings in 2016 and early 2017 were generally taken every 15-30 minutes, for design and stress testing of the Platform and to provide the most realistic actual trade matching time interval.

5.5.2 TRADE ENGINE

Power Ledger has developed its own unique trade matching algorithms which transact available power equitably, between Prosumers and Consumers, without favoring any of the Participants.

Consumer orders on both sides of the market are filled in equal increments and cycled continuously, until the market has cleared. This allows new consumers to on-ramp and immediately receive equal allocation of the available pool of renewable energy in their area, whilst minimizing the distance between consumers. This has an impact on transmission efficiencies and thus minimizing carbon emissions.

Trading run cycles are configurable and can be selected, based on the Application Host's requirements. They currently range from 5 minutes to 24 hours.

5.5.3 TRADING GROUP BUILDER

Power Ledger's trading group priority allows for maximum flexibility in the trading configuration of the various Application Hosts. Individual meters can be grouped and their electricity transacted within market and proximity based priority groups (See example in Figure 5.5.3.1).

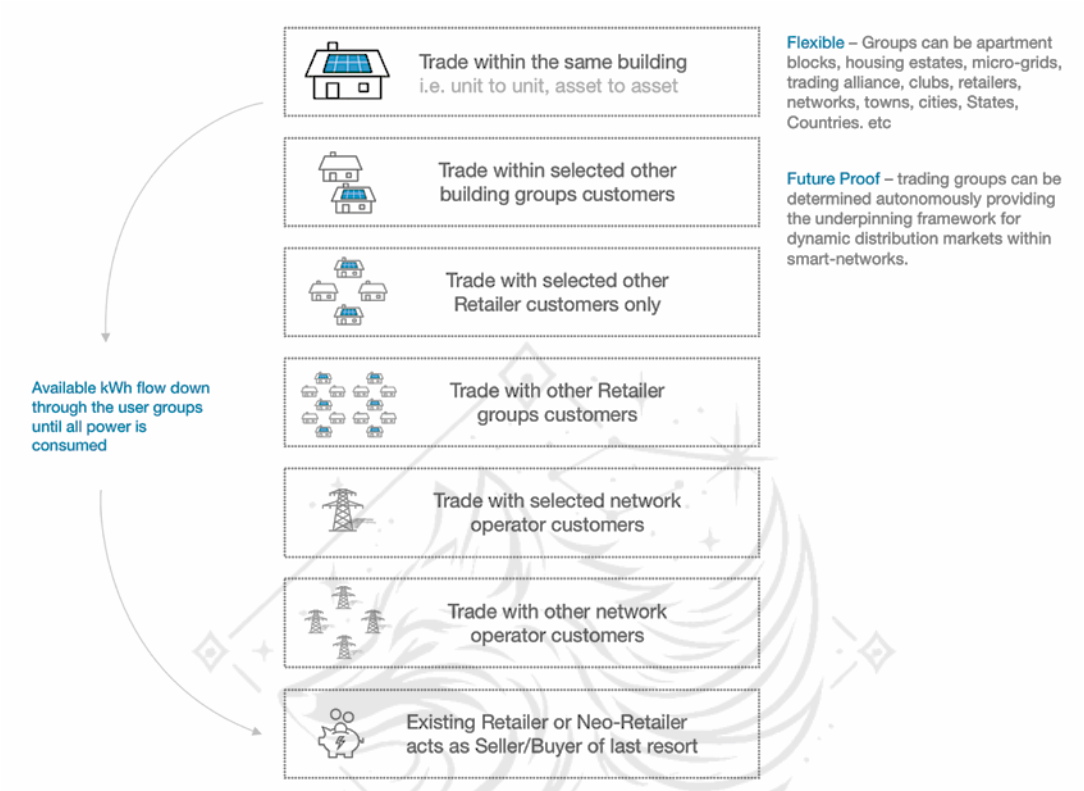
Platform Participants trade within a specified trading group configured by their Application Host (regulated) or by Power Ledger (unregulated). Participants with remaining import/export kWh to trade move up the trade priority groups until all remaining kWh are sold.

A Retailer or Neo-Retailer may ultimately fill any remaining orders acting as the “risk manager” or the buyer and seller of last resort.

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Trading groups can also be determined autonomously by pre-configured network condition monitoring. This provides the underpinning framework for dynamic distribution markets, within smart-networks.

Figure 5.5.3.1: Example of Trading Priority Groups



5.5.4 BLOCKCHAIN

Currently readings are recorded directly into the EcoChain Blockchain Services Interface as they are collected from smart power meters, via a suite of Power Ledger APIs. All energy trading is similarly immediately settled via the interface as they occur and provides for a secure and trustworthy audit trail, for all Participants. The existing EcoChain was designed to run multiple private blockchains (allocated to cover geographical areas) with tangling into a public blockchain, that also minimize data mining for maximum scalability.

5.5.5 GEO-LOCATION PRIORITY *(UNDER DEVELOPMENT)*

As Prosumers generate and export electricity to the grid, the electricity naturally flows to its closest consumption point. Power Ledger's Trade Engine 2.0 is currently being designed to geo-locate Participants and prioritizes proximity to assist in network load balancing and provide economic incentive for the deployment of distributed generation sources, at efficient intervals across the distribution network.

Power Ledger's blockchain P2P trade and settlement engine provides the backbone for other FuseBox applications.

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5.5.6 CONSUMER CHOICES

Power Ledger's Ecosystem puts choice in the hands of the Consumer by allowing them to specify where they want to purchase their energy from.

For example, an energy consumer may choose to pay a premium to ensure their energy comes from locally produced solar energy at buildings built with eco-materials, this incentivizes eco-driven choices.

5.5.7 AUTONOMOUS ASSETS AND ASSET GERMINATION EVENTS

Power Ledger's current Autonomous Asset (**AA**) management module allows for shared ownership and trading of renewable assets. The AA is able to buy and sell its own electricity and distribute its income to assigned wallet addresses (See example in Figure 5.5.7.1)

This allows communities to collectively invest in renewable energy infrastructure increasing the rate we move towards a zero emissions future.



PV001 Owners Wallet - ID	Ownership	Distribution of Income
APT-01	25%	15%
C00344	25%	15%
APT-02	25%	15%
APT-04	25%	15%
APT-BLDG		30%
APT-PV01		10%

C00344: PV manufacturer asset owner
APT-02: Apartment and partial PV owner
APT-BLDG: Strata Company, income only used to pay for common areas power consumption
APT-PV01: PV asset wallet used to fund its own maintenance and replacement

Figure 5.5.7.1: Example of Autonomous Asset Management Application

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6.0 ROADMAP & MILESTONES

Our goal is for the adoption of the Platform and Ecosystem globally.

We aim to democratize power: to bring the benefits of our technology to consumers leading to lower power bills, better prices for excess renewable power, and use of cleaner energy.

At the same time, we aim to help businesses to host advanced applications and services in a rapid, transparent, and profitable way.

6.1. POWER LEDGER DEVELOPMENT ROADMAP

The development funds will be allocated towards meeting the following milestones:

6.1.1 Q3 2017

TOKEN GENERATION EVENT

The Token Generation Event will ultimately allow the substantially accelerated platform development and incentivization of early users onto the Platform.

6.1.2 Q4 2017

APPLICATION DEVELOPMENT

The first Applications to be in beta testing after the Token Sale will be the Microgrid / Embedded Network Operator/Strata and the Electric Vehicle Trading Applications.

GREEN ENERGY LOYALTY REWARDS PROGRAM

The green energy incentive formula weighted towards renewable energy producers will begin and accelerate renewable energy generation

6.1.3 Q1 2018

BEGIN DISTRIBUTION OF GROWTH POOL

Early Application Hosts will be gifted POWR tokens to incentivize their use of and contribution to the Platform

TECHNOLOGY LAYERS TRANSITION

Power Ledger will complete the transition to a modified fee-less Consortium Ethereum network

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6.1.4 Q3 2018

First Asset Germination Event

Power Ledger and Platform Application Hosts will begin conducting Asset Germination Events.

Marketing and Partnerships

As new Applications are developed potential Application Hosts will be targeted and/or Power Ledger may directly deploy the Application

6.1.5 Q4 2018

Beta Test of New Applications

Begin beta test of Autonomous Asset Management and Neo-Retailer and Carbon Trading Applications

6.1.6 Q2 2019

Frequent Asset Germination Events

Asset Germination Events will be frequently conducted by Power Ledger and its Application Hosts.

Transition to Public Blockchain

Power Ledger aims to be operating fully on a public PoS blockchain.

6.1.7 Q3 2019

PowerPort & Future Applications

Begin beta testing of the PowerPort Application, as well as Wholesale Market Settlement, Distributed Market Management, and other future Applications that cannot even be imagined yet!

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