Innovative V2G Business Models Emerging in Asia

GRIDWIZ

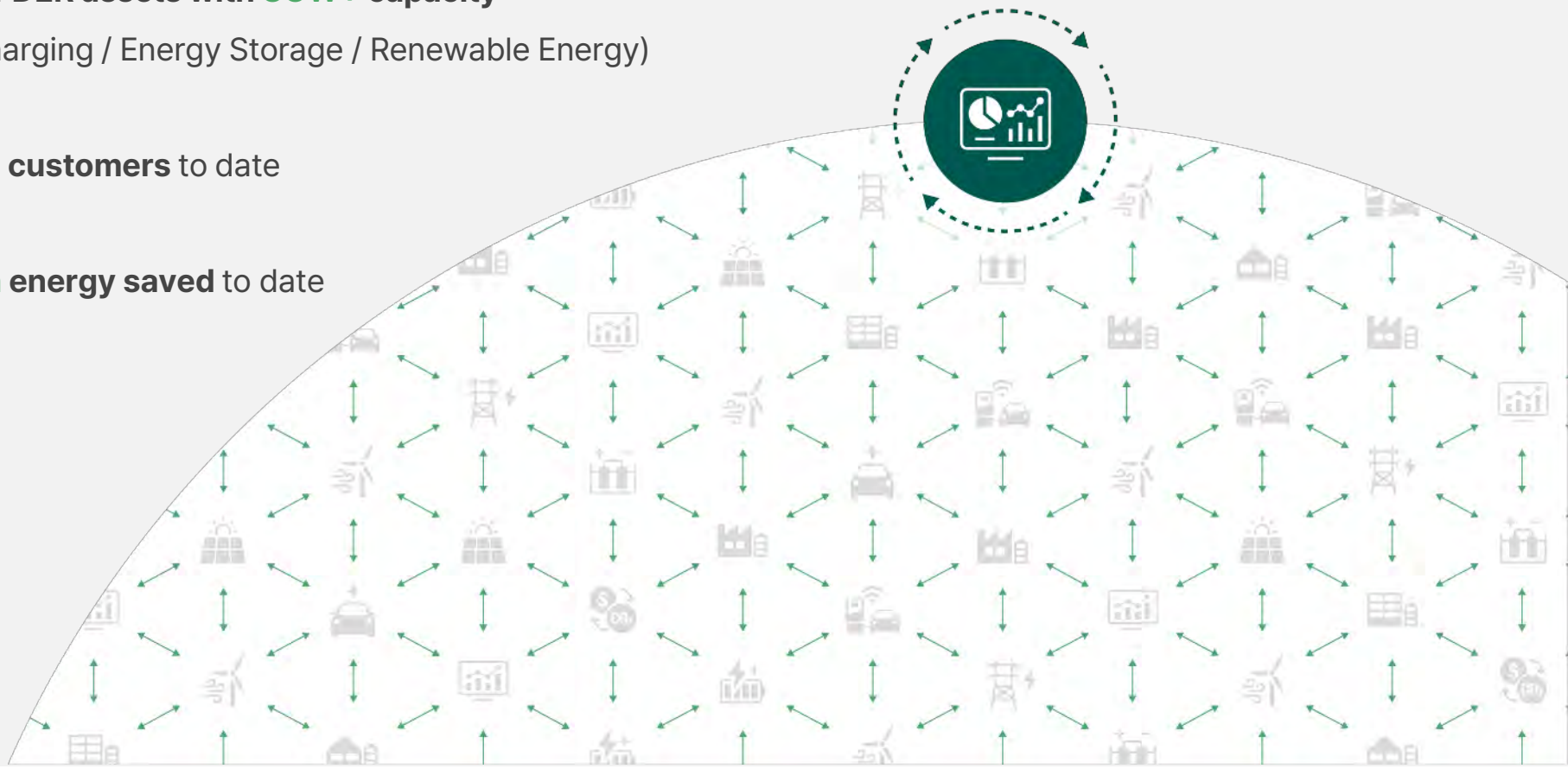
Clean Energy for Everyone Everywhere at Every Moment

An **intelligent platform** that **aggregates & manages DERs**

- Gridwiz aggregates & manages
  a **variety of DER assets with 3GW+ capacity**
  (DR / EV Charging / Energy Storage / Renewable Energy)

- **1700+ B2B customers** to date

- **2,035GWh energy saved** to date



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Gridwiz is one of the **fastest growing clean energy startups** in Korea

Established	Employees	Customers	Annual Sales	Offices
2013	**110**	**1,700+**	**$119M**	**Pangyo, Korea** **Jeju Island, Korea**
	GREW members	from the C&I sector	(in 2023) Consolidated Sales	

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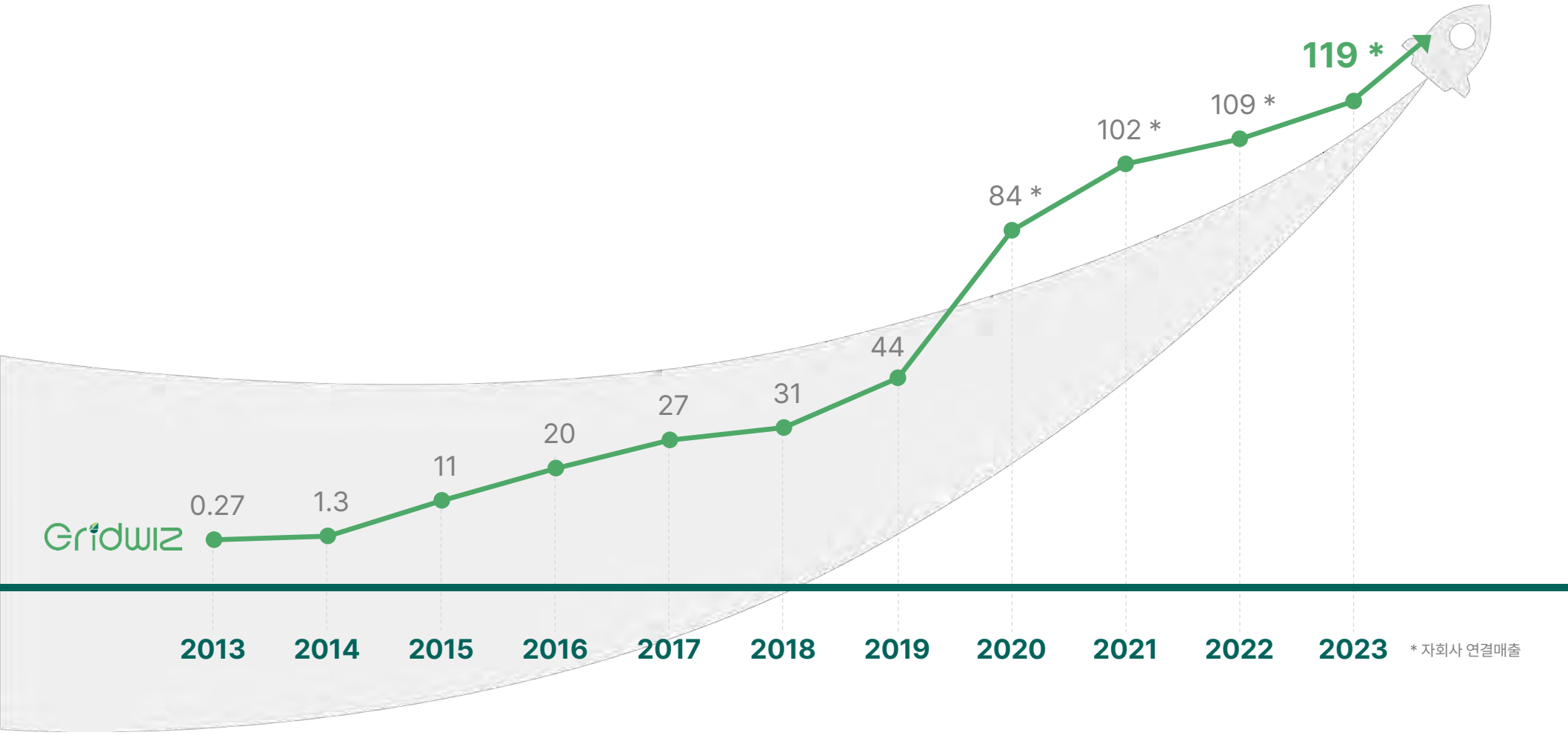
Continued revenue growth to **$119M** in only **10 years** and **IPO in 2024**

Revenue History

Unit : USD, M



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Gridwiz's energy services are **field & market-proven**

Demand Response

(Since 2014)

- **#1 DR aggregator** in Korea**(M/S 40%)**
- Total revenue of **$678M** for **1700+** C&I customers

EV Charging

(Since 2014)

- **First EV-to-Grid service** in Korea
- Supplied **150K+** PLC modems **(M/S global 30%, domestic 90%)**

Energy Storage

(Since 2017)

- Operating **875MWh** energy storage batteries
- Total revenue **$256M** for customers

(largest size in Korea)

Renewable Energy

(Since 2017)

- Installed & operating **15MW** rooftop solar
- Total revenue of **$36M** (expected)

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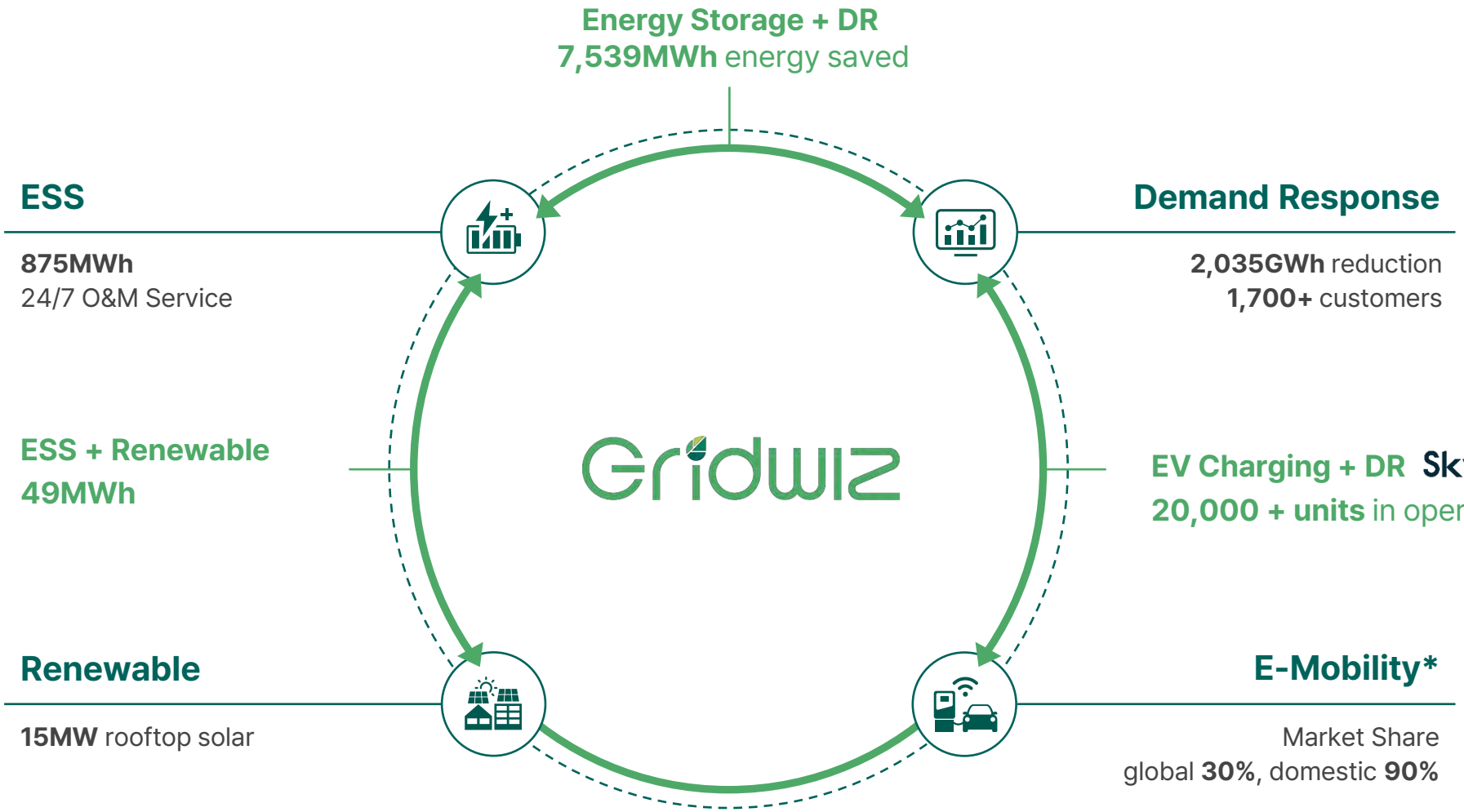
We maximize customer benefits through **integration of different DERs**



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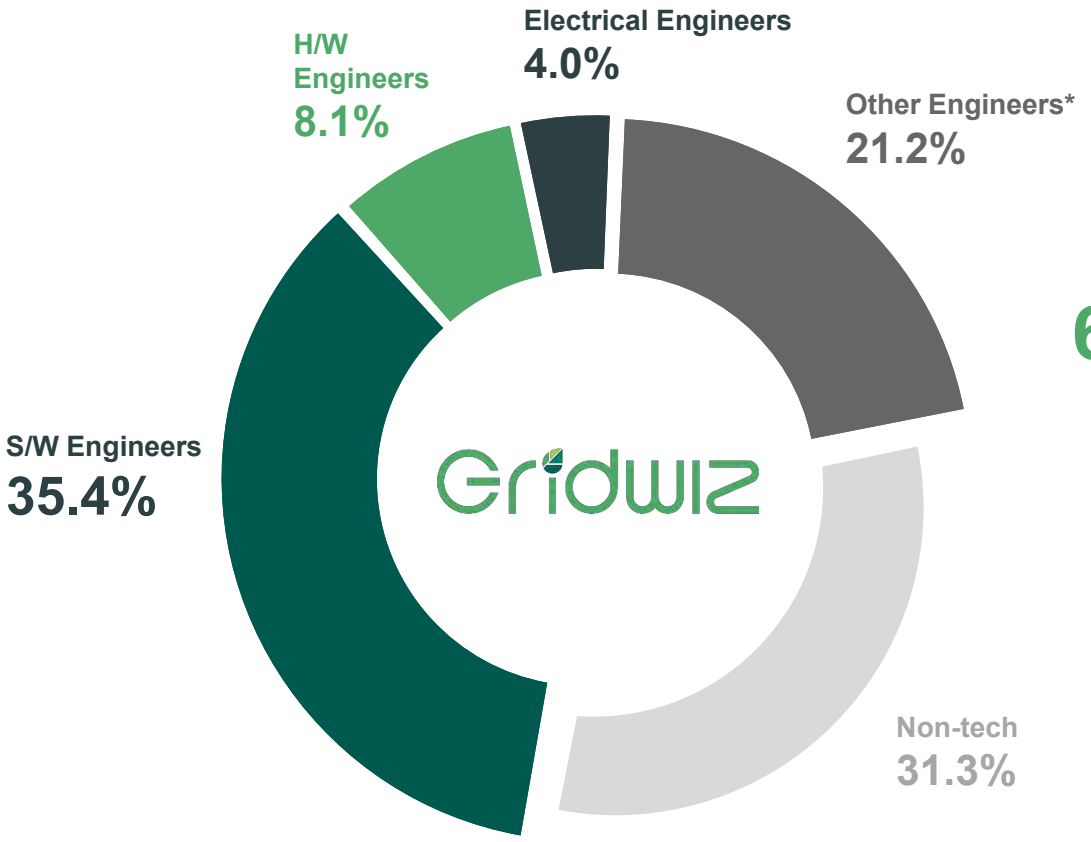
Highly tech-oriented company with **technical & operational agility**

Composition of Gridwiz Staff



67.7% of GRIDWIZ staff members are **technical engineers**

* Technical sales, etc.

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Solid customer base that covers a wide range of **C&I sectors**

1,700+ customers, including 6 of FORTUNE 500 Companies

Customer Retention Rate **99%**

Industrial Sector

SAMSUNG 삼성전자 · LG Innotek · KCC · SAMPYO Cement · 현대제철 HYUNDAI STEEL · Hanwha · TOTAL · HANKOOK driving emotion · posco · VOLVO · SK Advanced · MOORIM 무림페이퍼 · HYOSUNG TNC · HYUNDAI · 롯데정밀화학 · SK 이노베이션 · SAMSUNG 삼성엔지니어링 · SAMSUNG 삼성중공업 · 르노코리아자동차 · SK 머티리얼즈 · Huvis 휴비스워터 · DOOSAN 두산중공업 · LG전자 · EcoPro BM · 금호석유화학 · SK 에너지 · SEAH 세아베스틸 · SK picglobal · HYUNDAI ENERGY SOLUTIONS · 한화임팩트 Hanwha Impact · DC · SK 케미칼

Commercial Sector

롯데쇼핑 · SNUH 분당서울대학교병원 · JEJU SHINHWA WORLD · WALKERHILL · Homeplus · KB국민은행

Public Sector

대전교통공사 · 119 · 한국도로공사 · 대전도시공사 · 울산대학교 UNIVERSITY OF ULSAN · 대구환경공단 · KOMSCO · KOREA POST · LH 한국토지주택공사 · 제주대학교 JEJU NATIONAL UNIVERSITY

Local Governments

세계속의 경기도 · Jeju 제주특별자치도 · 강원도 · 대전광역시 DAEJEON METROPOLITAN CITY · 춘천시 · 속초시 · 경기도의회 Gyeonggido Assembly · 원주시 · 노원구 · 성남시 Seongnam City

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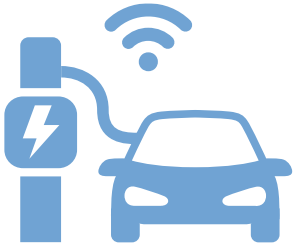
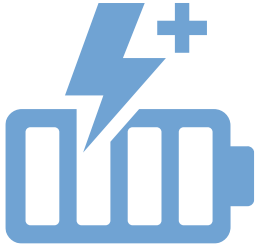
Why EV?

EVs are batteries that are highly responsive, mobile, and scalable



EV + Chargers



Energy Storage

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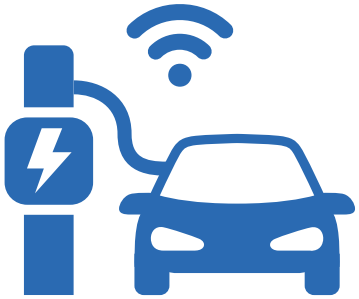

10,000 EVs + Slow Chargers

70MW, **640**MWh

Appx. US$20M
for installation

Energy storage

70MW, **210**MWh

Appx. US$63M
for installation

* Assumptions:
- EV battery capacity 64kWh per vehicle
- Installation cost of one EV slow charger (7kW) US$2,000
- Installation cost of 1MWh energy storage US$300,000

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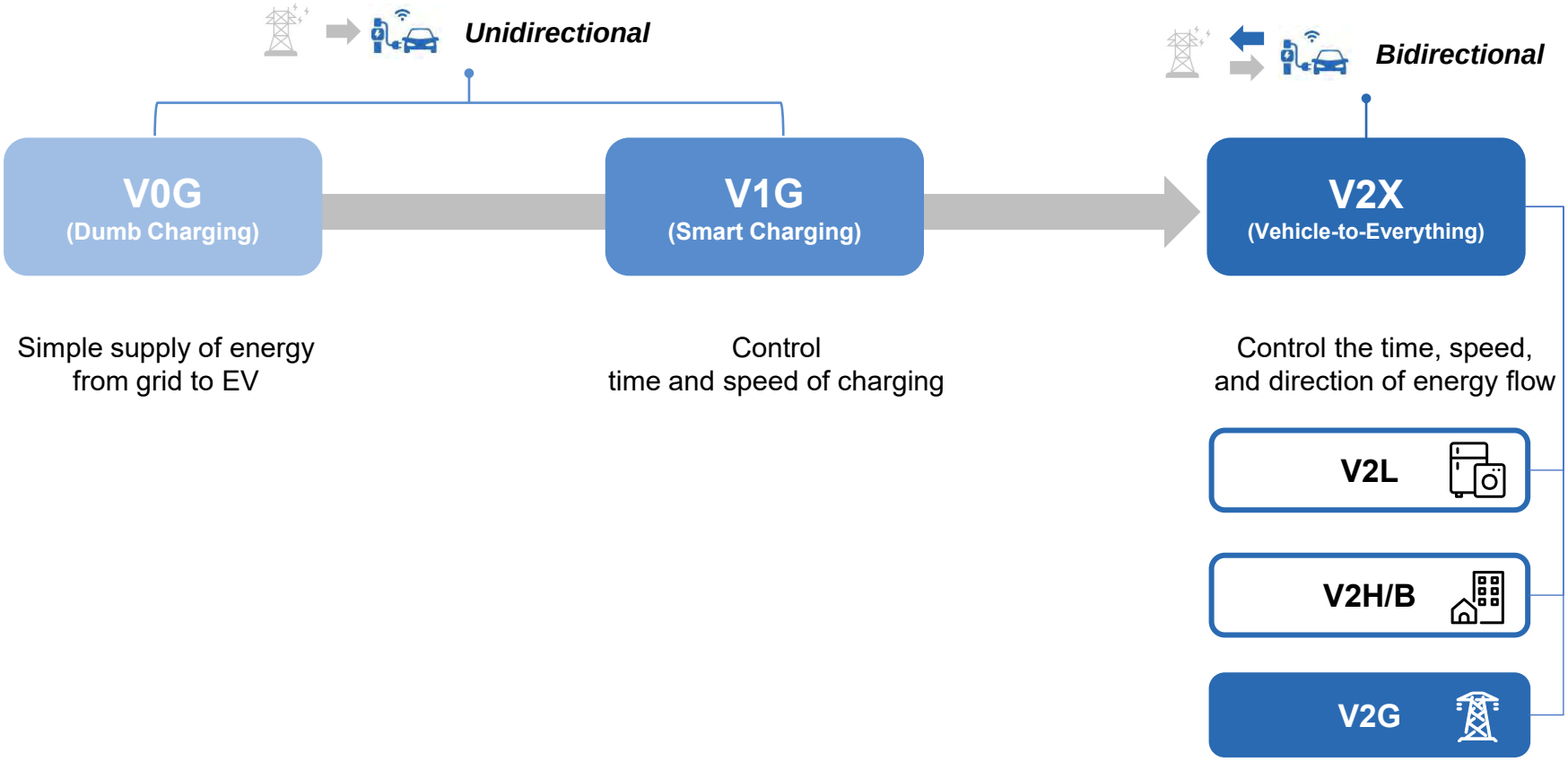
The Basics – Smart Charging Technologies

More advanced smart charging technologies are required to fully utilize EVs as energy resources



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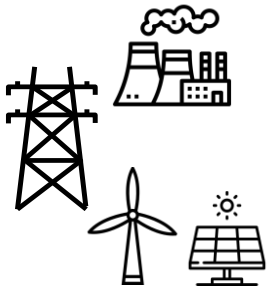
Values of Smart & Bidirectional Charging

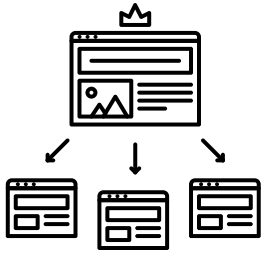
Smart & Bidirectional charging is beneficial from the perspectives of both energy users and providers

Utilities



- Defer additional investments

Grid Operators



- Grid stability
- Renewables integration

EV & Charger Owners

- Emergency backup power
- Monetary benefits

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Application of Vehicle-Grid-Integration

Smarter EV charger and real-time platform are key to fully utilize EVs as energy resources

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Business Case

Skyblue service is Asia's first commercial smart EV charging + energy service

Skyblue

GRIDWIZ E-mobility Solutions

✓ **Platform S/W (App & Web) for charging & energy services**

✓ **In-house developed H/W**

Communication Controller

(AC) (DC)

V2G-ready Chargers

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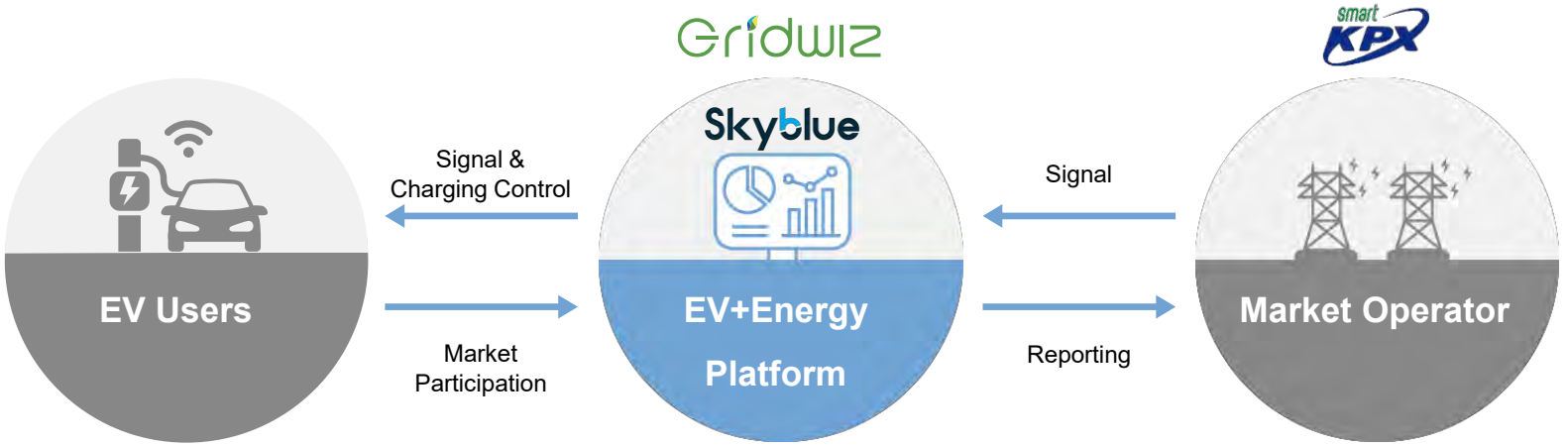

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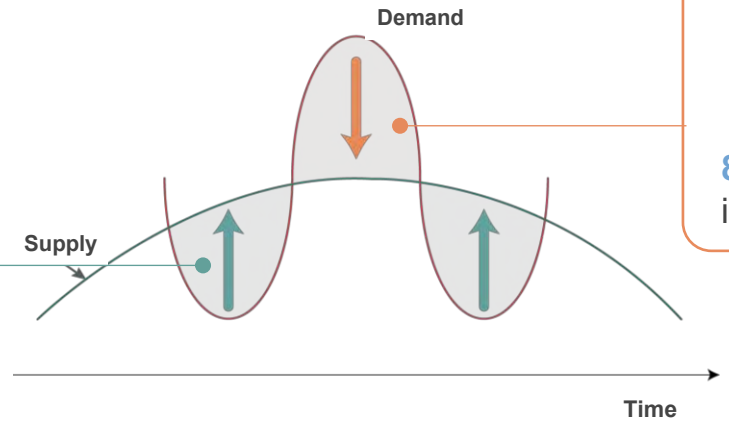
Business Case

Skyblue contributes to grid stability and provides monetary & environmental benefits to customers

Demand > Supply **EV DR**

Stop or slow down charging to reduce energy demand

8,152 Chargers (61MW)
in operation



Demand < Supply **Plus DR**

Charge EVs to absorb excessive renewable energy

1,680 Chargers (122MW)
in operation

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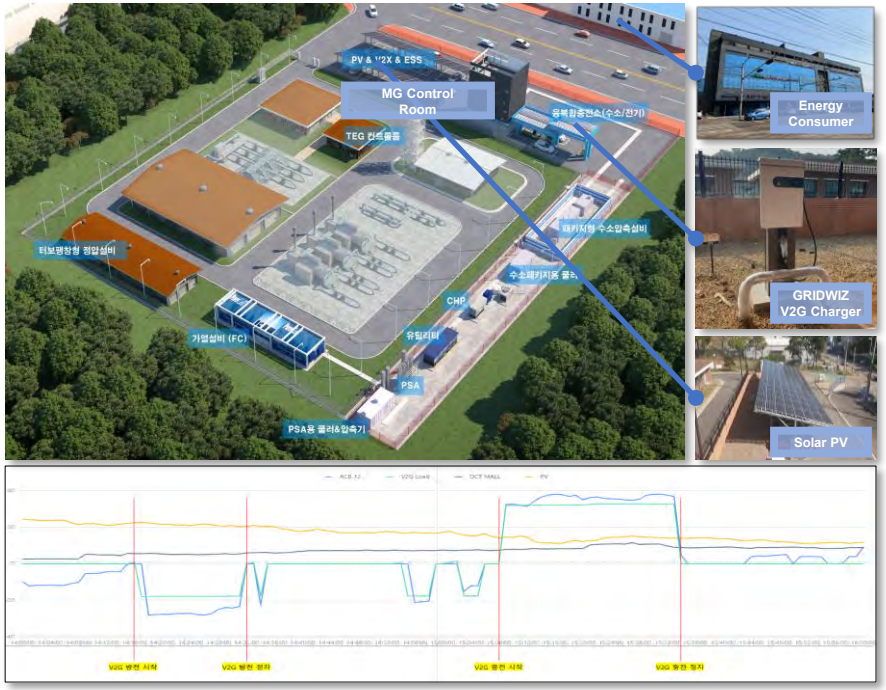
Next Steps Toward V2G

It is time to think about how to integrate V2G into the picture

Vehicle to Microgrid with Solar Energy



EV+Energy Storage

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GRIDWIZ E-mobility Ecosystem

Gridwiz is a full stack provider covering H/W, S/W and platform solutions for smart EV charging

Gridwiz E-mobility (CCS) Ecosystem

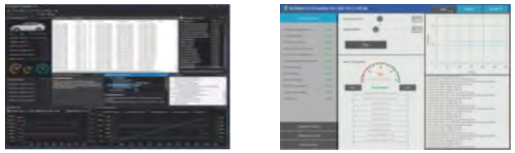
Automakers
- EV
- E-motorcycle
- E-truck
- E-bus
- E-aircraft
- E-boat

Charger makers
- CCS DC chargers
- CCS AC chargers

Hardware

PLC Modems **Testing Equipment** **V2G-ready Chargers**

Software

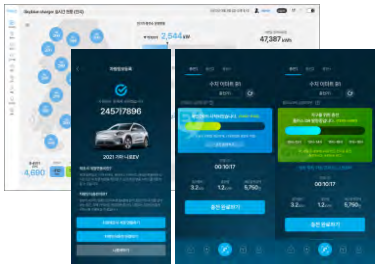


Backend Platform

Platform

Skyblue

- EV+Energy Service



Charging Service Web & App

B2B
- Car OEMs
- Offices/Parking lots
- Car rental companies
- Taxi companies
- Logistics companies
- Apartments

B2C
- EV drivers
- Charging station owners

DIN SPEC 70121 | **ISO 15118** | **OCPP 1.6** | **OpenADR 2.0**

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GRIDWIZ Smart Charger

Skyblue 11 is a smart EV charger equipped with trending features and up-to-date technologies

Key Features

- **Plug & Charge (PnC)**
- **Bi-directional Charging** (V2H/V2B/V2G)
- **Energy Management**
  - Dynamic Load Management
  - Energy Market Participation
- Over-the-Air (OTA) services
- LTE/Wi-Fi Connected

International Standards

- CCS Combo 1
- OCPP 1.6 JSON
- ISO 15118-2 DC
- DIN 70121
- OpenADR 2.0
- IP55

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Emerging Smart Charging & V2G Opportunities

Public & private efforts to realize VGI & V2G business cases are ongoing

Pilot V2G Projects

131+ pilot projects going on in **27** countries (Source: V2G Hub)

Policy Movements Toward V2G

- **UK** requires all EV charging stations to have **smart charging features since 2022**
- **California**'s utilities are **piloting V1G & V2G rates and programs**
- **South Korea** is requiring **EV chargers to have bi-directional charging feature**

⋮

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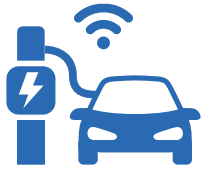
Takeaways

Reflecting on our experience, it is better to start smarter

- ✓ Clean energy transition is an irreversible movement
- ✓ Growing renewable energy can pose a huge issue to the grid
- ✓ EVs are not just sources of energy demand but they are sources of energy supply as well

- ✓ **SMART** charging infrastructure that enables smooth transition will be needed in a foreseeable future



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Korea's **#1 DR aggregator** managing energy use of **1700+ customers**

Demand Response Service

Gridwiz acts as a bridge between the energy market and customers by providing customized DR service

Settlement ↑ ↓ Reduction

Gridwiz

Settlement ↑ ↓ Reduction Monitoring

smart KPX 전력거래소

WHY GRIDWIZ?

- Real-time energy monitoring for higher reduction reliability
- Effective portfolio composition and DR service based on know-hows accumulated from 1700+ customers
- Stable & reliable service based on in-house developedH/W & S/W solutions

- One minute interval power meter (THYME-II)

- Real-time energy monitoring system (PINE) Web/App

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Operator of the **largest portfolio** of energy storage batteries in Korea

Energy Storage Solution

Intelligent operation & management
of energy storage batteries
based on real-time energy data and algorithms

SK eternix Gridwiz

Investment
EPC

H/W, S/W
O&M

Peak Shaving | **ESS + DR** | **ESS + RE**

Energy Cost Saving

WHY GRIDWIZ?

- End-to-End energy storage solutions covering hardware, software and services

Services

Consulting	In-depth assessment of energy storage installation to identify the max. benefit for each customer
EPC	High quality EPC service provided with top-tier partners
O&M	24/7 remote monitoring & tailored operation for each customer
ESS +α	Korea's first DER integration services (DR, renewable energy, etc.)

Software (PMS)

In-house developed PMS with real-time (1-sec) monitoring & control features

Hardware (PCS)

Newly Launched

Safe & Flexible PCS with various applications (peak cut, back-up supply, grid-forming, renewable integration, etc.)

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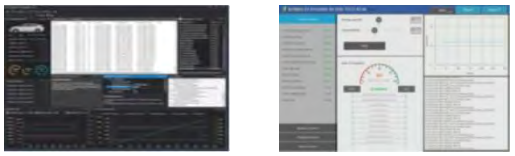
EV Charging ecosystem encompassing H/W-S/W-Service

Gridwiz EV Charging Ecosystem

Automakers
- EV
- E-motorcycle
- E-truck
- E-bus
- E-aircraft
- E-boat

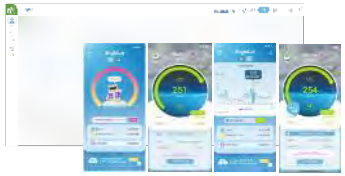
Charger makers
- CCS DC chargers
- CCS AC chargers

Hardware
PLC modems | Testing equipment | Bi-directional chargers (DC to be launched)

Software


Backend platform

Service
Skyblue
EV-to-Grid service



Charging service
Web & App

B2B
- Car OEMs
- Offices/Parking lots
- Car rental companies
- Taxi companies
- Logistics companies
- Apartments

B2C
- EV drivers
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Global market-proven **EV charging communication** solutions

EV Charging H/W Solution

In-house developed communication solutions essential for EV charging

WHY GRIDWIZ?

- Collection real-time data through international standards-based protocols

Open Charge Point Protocol
ISO/IEC 15118
DIN SPEC 70121

Collection and analysis of **278 real-time data** for smart charging and **vehicle-to-grid integration**

- Leading the global market with advanced technologies and proven interoperability
  - Market Share Global 30%, Domestic 90%

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Korea's first **EV-to-Grid service, Skyblue**

EV-to-Grid Service

Gridwiz aggregates EV batteries and remotely controls EV charging speed to participate in the DR market

Settlement ↑↓ Market Participation

Skyblue

Settlement ↑↓ Monitoring Reporting

WHY GRIDWIZ?

- We provide values beyond simple EV charging based on expertise in the energy & e-mobility sectors

Smart Charging	Controlling charging time & rate for economic benefits
Regular DR	Stop charging or lower charging speed when energy demand is high
Plus DR	Absorb excessive renewable energy by charging EV batteries
Bi-Directional Charging	Discharging energy stored in EV batteries to home or the grid
Data Analyzing	Optimization of energy services through EV charging data analysis
Fleet Management	Vehicle management though anlysis of mileage and battery stats

To be launched

- Provide stable service with in-house developed H/W & S/W solutions

Skyblue Web / App

Skyblue Charger

International Standards-based CCS Modem

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A-to Z solar PV solution to support customers' clean energy journey

Solar PV Solution

A-to-Z solar PV solution utilizing
idle land assets (parking lots, rooftops, etc.)

- ✓ EPC, O&M
- ✓ Load Analysis
- ✓ Generation Forecasting
- ✓ Energy Trading
- ✓ PV + ESS

Generation Business

1. SMP + REC
2. RE100 Direct Trade
3. Trading Market

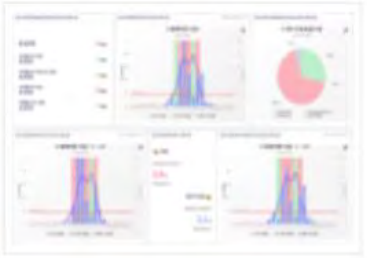
Self-Consumption

1. Energy Cost Saving
2. Sales Profit of Surplus Electricity (PPA, Net Metering)
3. Greenhouse Gas Mitigation

WHY GRIDWIZ?

- Increasing revenue with unmatched proficiency
- Using real-time monitoring systems to optmize power generation
- Creating new revenue streams by taking part in trading market

Renewable Energy Trading System



- Energy Trading & Bidding
- Plant Management
- Forecasting & Optimization
- Reports & Analytics

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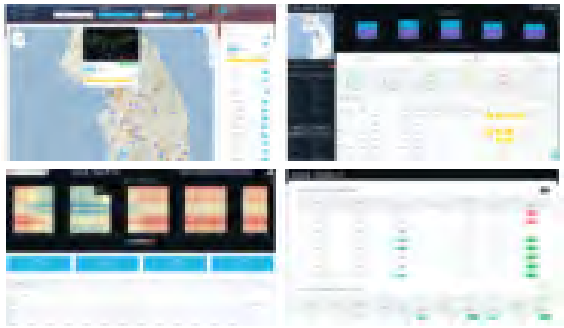
All-in-one energy platform from demand analysis to power plant management

Demand Response Operate Platform



- Load Optimization
- Aggregation & Control
- Energy Cost Consulting
- Reports & Analytics
- Grid Analytics

Optimizing Load & Cost

Renewable Energy Trading System

- Energy Trading & Bidding
- Plant Management
- Forecasting & Optimization
- Reports & Analytics

DER Trading & Management

Charge Point Operate Platform

- Dynamic Load Management
- Smart Charging
- Billing & Invoicing
- Security & Scalability
- Reports & Analytics
- DR Integration

Optimizing EV Infrastructure

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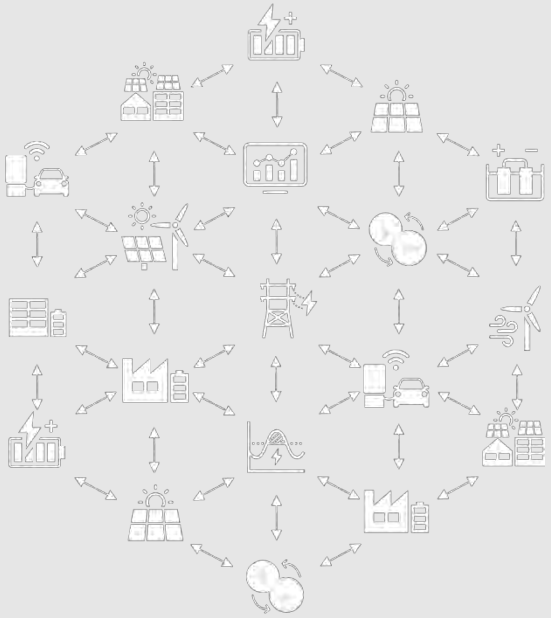
THANK YOU



Rayeon Park
rayeonpark@gridwiz.com

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