Every utility will need BPL solutions

CORINEX

New demands on the grid: Distributed generation, EVs, and storage require high bandwidth and intelligence for grid management

Regulatory mandates: Compliance to provide detailed, realtime information to utility customers

Industry standards: In 2022, PRIME Alliance standardized BPL for deployment based on ITU's G.hn protocol

Advantages of BPL: High speed communication, edge computing, security, network coverage, lower cost, in one already proven integrated solution

"

smart grid communication is in **transition** from **narrow to broadband** communication...

...the industry is at an **inflection point** in the **adoption of BPL technology**.

[All utilities] which succeeded in their pilot projects and eventually moved to mass rollouts **chose the same product vendor... Corinex**

IDC Report

"

IDC Report, *Towards A Truly Smart Grid — The Case for Broadband Over Powerline*, 2021

About Corinex

Corinex is the sole provider of Broadband over Power Lines (BPL) solutions in mass rollout. Our solutions enable digitalization of the grid for energy service providers, electric utilities, EV manufacturers, and EV charging providers.

Our broadband offerings, EnergyGrid and GridValue, provide a complete solution that integrates distributed energy devices and enables real-time energy data, analytics and predictive models, with the highest level of security.

Commercial rollout of Corinex solutions demonstrates BPL's technological advantages, maturity and standardization, enabling mass adoption after a decades-long race with incumbent players.

Headquartered in Vancouver, BC

20 customers include 3 of the 10 largest European utilities:

e·on   IBERDROLA   CEZ GROUP

ITU and PRIME Alliance **standardized**

About 1 million BPL nodes **delivered**

IDC report names Corinex technology leader:

12 patents in the USA and the EU

250 person-years of software development

Corinex offers end-to-end vertically integrated grid digitalization solutions

Products

Corinex Grid Nodes: data collection, computation and transmission over existing electric grid

Corinex EnergyGrid

Products are based on BPL chips that deliver cost-effective processing power for edge computing, high-speed resilient communication, and best-in-class energy security

Software

Electric grid network management

Corinex Core Edge Computing Firmware

High performance software environment open to applications of third parties

Corinex GridValue Software

Provides nation-wide real-time management of millions of networked devices

- Processes 2 million transactions per minute per server
- 200,000 concurrent (D)TLS[1] tunneling support

[1] Transport layer security that protects the transfer of data

Services

Product installation and network operation

Installation team

Operations team

Corinex enables energy redistribution at the local level, by providing key products, software, services
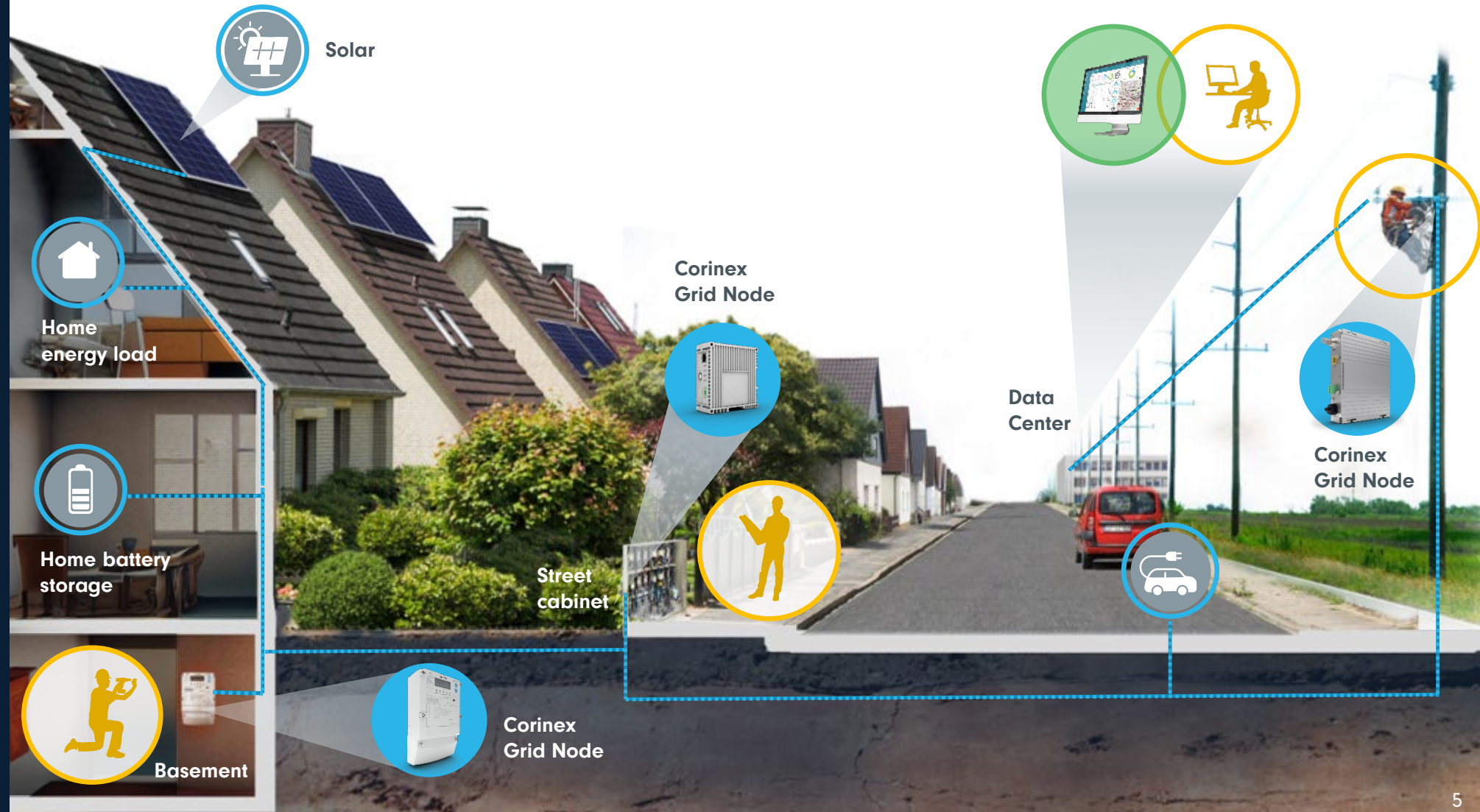
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Products

Corinex Grid Nodes: data collection, computation and transmission over existing electric grid
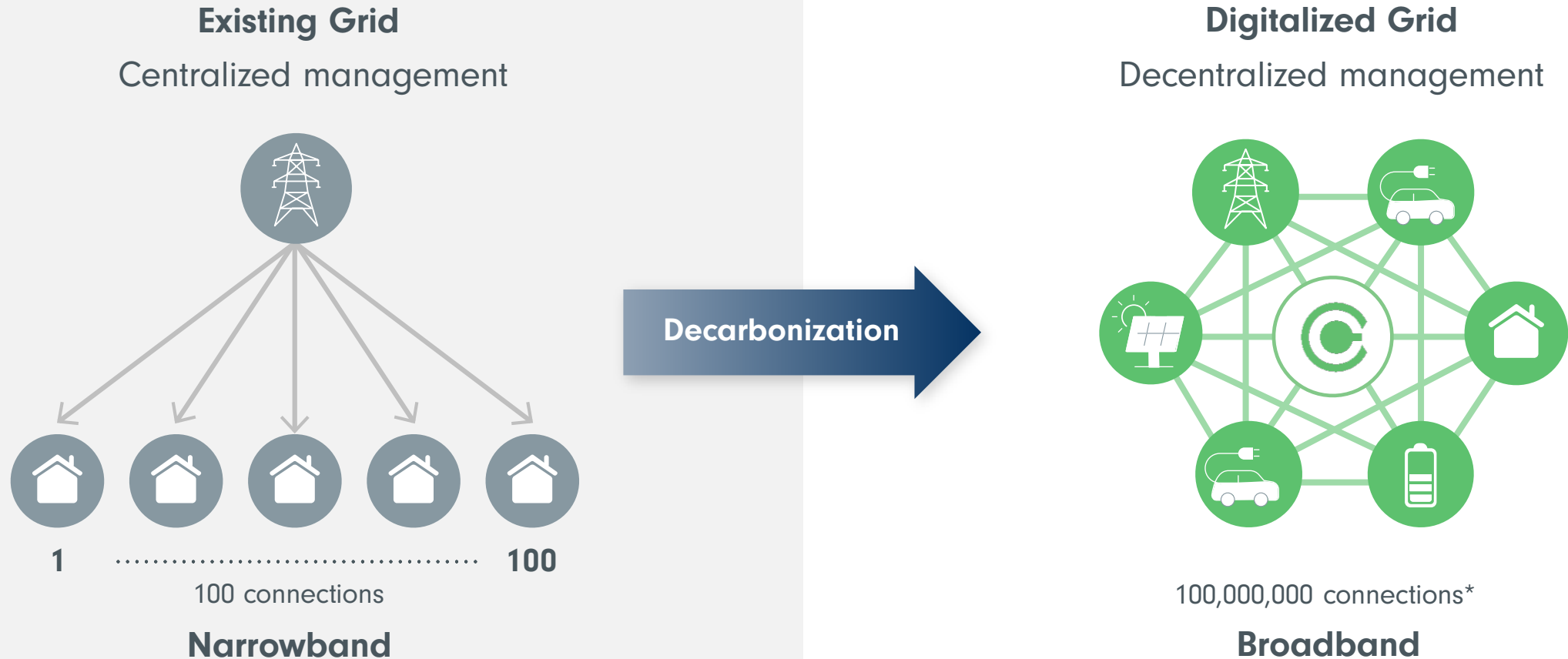
Software

Electric grid network management

Services

Product installation and network operation

Solar

Home energy load

Home battery storage

Basement

Corinex Grid Node

Corinex Grid Node

Street cabinet

Data Center

Corinex Grid Node

Decentralized energy production and storage require distributed intelligence and high bandwidth

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Existing Grid
Centralized management

Decarbonization

1 100

100 connections

Narrowband

Digitalized Grid
Decentralized management

100,000,000 connections*

Broadband

* 100M connections is derived from 100 households, each of which has 4 devices: electric vehicle, battery storage, generation device (e.g., solar), and smart metering systems

Broadband communication and edge computing are required to enable self-regulating energy systems
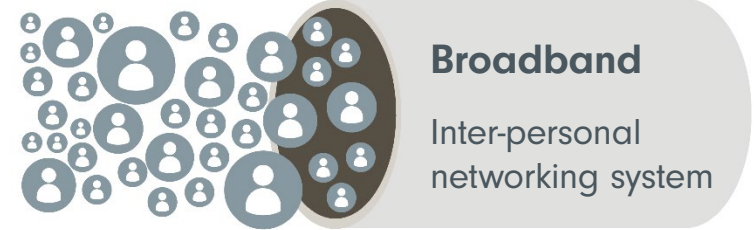
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Voice Providers

1990's dial up
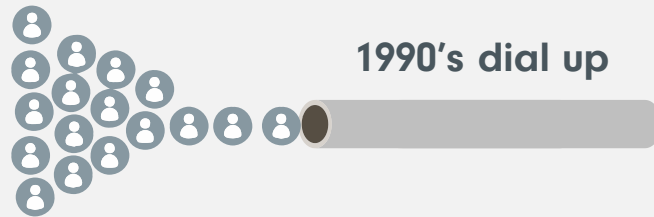
Millions of internet users

Internetization →

Internet Service Providers

Broadband
Inter-personal networking system

Billions of internet devices

E.g., Cisco

Utilities

Narrowband

Millions of metered homes

Decarbonization →

Energy Service Providers

Broadband
Self-regulating energy system
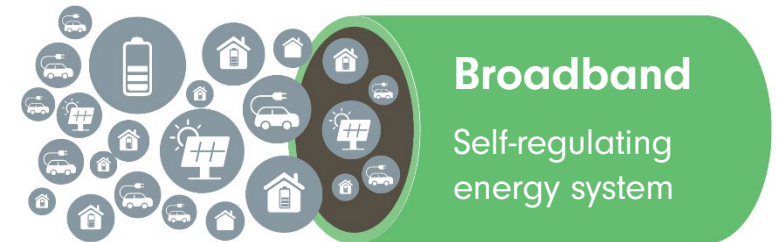
Billions of electricity devices

Corinex

One integrated solution based on a single chip provides all key functions for the new energy ecosystem

CORINEX

Three separate chips
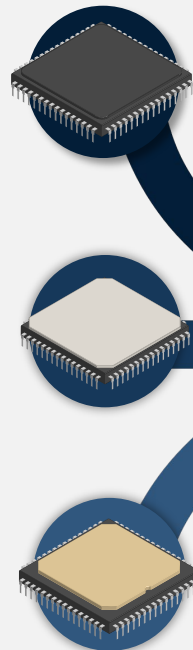
Current technology requires three separate chips, and the performance is inadequate
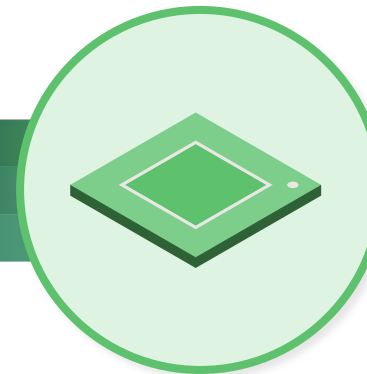
Security
E.g., NXP

Edge Computing
E.g., TI / Intel

Communication
E.g., NB IoT – Nordic

One integrated chip

Interoperable solution based on BPL PRIME standard provides all three key functions on one chip

BPL PRIME

Security
Edge computing
Communication

Corinex BPL is faster and more cost-effective than competing technologies

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Data transmission speed in Mbps

BPL PRIME	**250.00 Mbps**
5G[1]	100.00 Mbps
LTE	20.00 Mbps
HomePlug Green PHY	10.00 Mbps
G3 Standard	0.3 Mbps
Narrowband PRIME	0.3 Mbps

Cost per MB over a 10 year life cycle

BPL PRIME	**$0.71**
5G	N/A
LTE	$4.65
HomePlug Green PHY	$13.20
G3 Standard	$68
Narrowband PRIME	$68

[1] 5G will provide higher speed than LTE but poor coverage

Leading energy companies are starting mass deployments of BPL solutions based on PRIME standardization

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Narrowband PRIME
Based on UPA standard

Broadband PRIME
Based on ITU G.hn standard

Standardization   **Deployment Phase**   Standardization   **Deployment Phase**

2006   **2008**   **2010**   **2020**   **2022**   **2030**

Grid + AMI

EV + V2G

PRIME Narrowband initiative started

PRIME Narrowband specifications finalized

100K meters started at Iberdrola

10.7M meters deployed at Iberdrola

PRIME LV BPL Standard agreed

PRIME BPL use cases: low voltage (Grid) + advanced metering infrastructure (AMI), and V2G

5 members in PRIME Alliance

60+ members in PRIME Alliance

10

EU Legislation mandates near real time data to enable decentralized grid with massive data requirements

This can only be achieved with broadband solutions

Directive (EU) 2019/944*

Article 15,
Active customers

Member States shall ensure that active **customers are**:

... **entitled to sell self-generated electricity**, including through power purchase agreements

... **entitled to participate in flexibility schemes** and energy efficiency schemes;

Article 17,
Demand response through aggregation

Member States shall allow and foster participation of demand response through aggregation.

Member States shall **allow final customers**, including those offering demand response through aggregation, **to participate alongside producers** in a non-discriminatory manner in all electricity markets.

Article 20:
Functionalities of smart metering systems

Non-validated **near real-time consumption data** shall also be made easily and securely available to final customers at no additional cost, through a standardised interface or through remote access, in order to support automated energy efficiency programmes, demand response and other services;
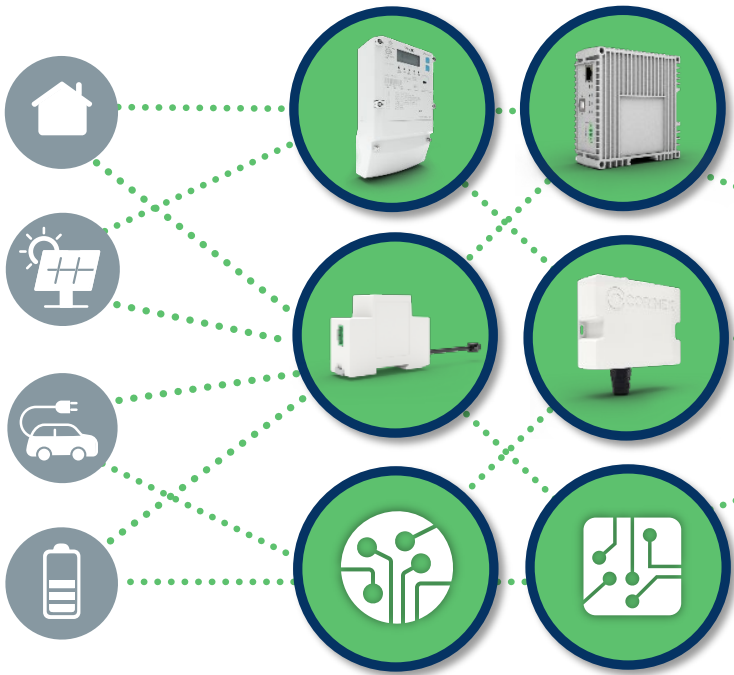
* (Emphasis added)

Overview of the Corinex validated end-to-end energy solution

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EnergyGrid Products

The world's only BPL products validated in utility and vehicle-to-grid operations

GridValue Software

Enterprise-class network management software capable of managing millions of IoT devices

Corinex CORE Firmware

Highest level security and smart-grid capabilities integrated into industry-standard semiconductors

Corinex solution can scale up to five million nodes on a single software platform, capable of managing country-wide deployments

Residential

Data collection

50
**Nodes per typical
street installation**

Grid

Energy info collection & transmission

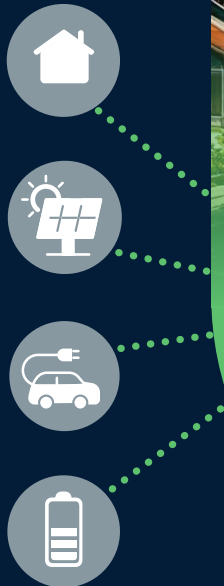## 250
**Nodes managed by
1 substation node**

Data Center
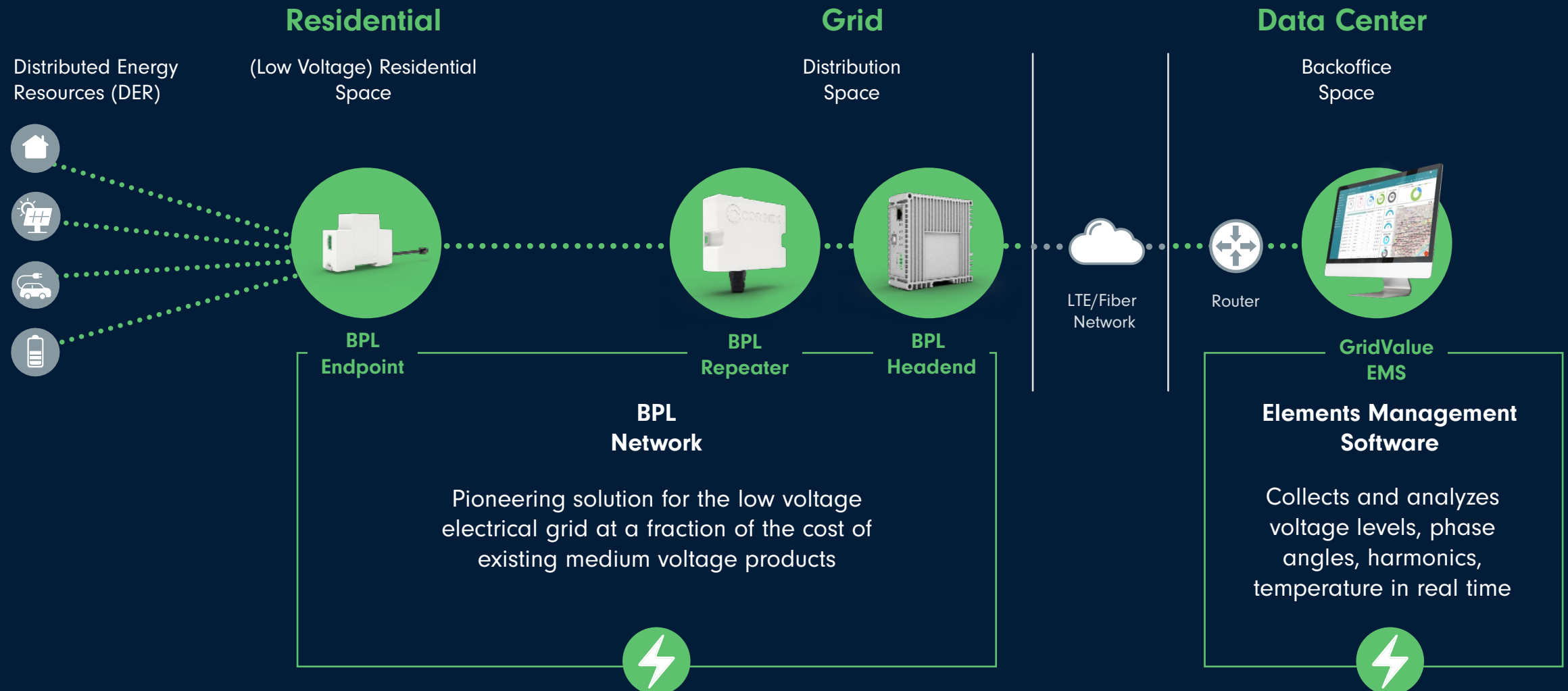
Network management & analysis

5,000,000
**Nodes managed by
1 software platform**

Number of nodes are based on smart meter gateway (use case 2) solution

The solution monitors real-time electricity parameters, which is necessary to create a new energy ecosystem

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Residential

Grid

Data Center

Distributed Energy
Resources (DER)

(Low Voltage) Residential
Space

Distribution
Space

Backoffice
Space

LTE/Fiber
Network

Router

**BPL
Endpoint**

**BPL
Repeater**

**BPL
Headend**

**GridValue
EMS**

**BPL
Network**

Pioneering solution for the low voltage
electrical grid at a fraction of the cost of
existing medium voltage products

**Elements Management
Software**

Collects and analyzes
voltage levels, phase
angles, harmonics,
temperature in real time

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Corinex solution is being successfully deployed in all four key utility use cases

CORINEX

Use Case	Deployments	Residential		Grid			
	Utility Companies	(DER)	LV Residential Space	Distribution Space	MV Space	LTE/Fiber Network	Backoffice Space (Data Center)

1 — BPL AMI
e·on UK, CEZ GROUP, PRE, Energa, innogy PL
Residential Node — BPL Smart Concentrator

2 — Smart Meter Gateway
e·on, mainova, Stromnetz Berlin, der Netzbetreiber REGENSBURG NETZ, Stromnetz Hamburg
BPL Endpoint — BPL Repeater — BPL Headend

3 — Low Voltage
IBERDROLA
Narrowband Node — BPL Repeater — BPL Headend

4 — Medium voltage
IBERDROLA
BPL Gateway

Router

GridValue EMS

Prime Alliance is adding a BPL solution to integrate energy companies and EVs in use cases #5 and #6

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Residential

EV BPL PRIME

V2G BPL PRIME

Grid

Distribution Space

Data Center

Backoffice Space

LTE/Fiber Network

Router

Residential Node

Substation Node

GridValue EMS
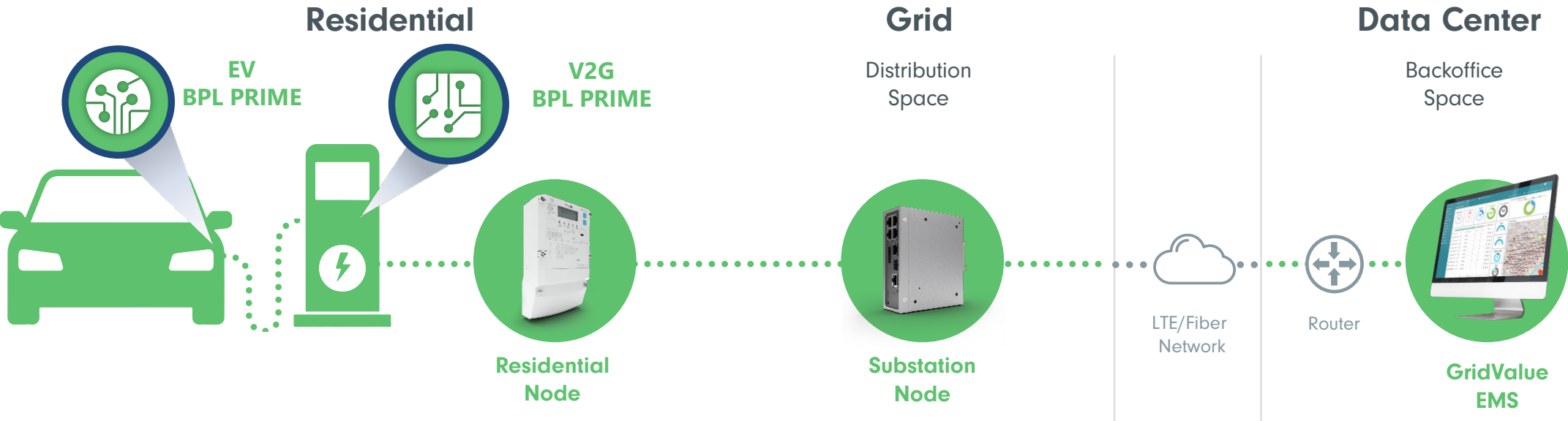
5 Harmonized V2G Solution	Corinex validated in EU vehicle-to-grid test project	
6 BPL EV Charger Solution	**Webasto** Corinex being deployed in pilot EV charger project	

The V2G solutions bring benefits for each player in the V2G ecosystem, enlarging the market for BPL technology

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V2G Network

EV
BPL PRIME

V2G
BPL PRIME

V2G
BPL PRIME

EV
BPL PRIME
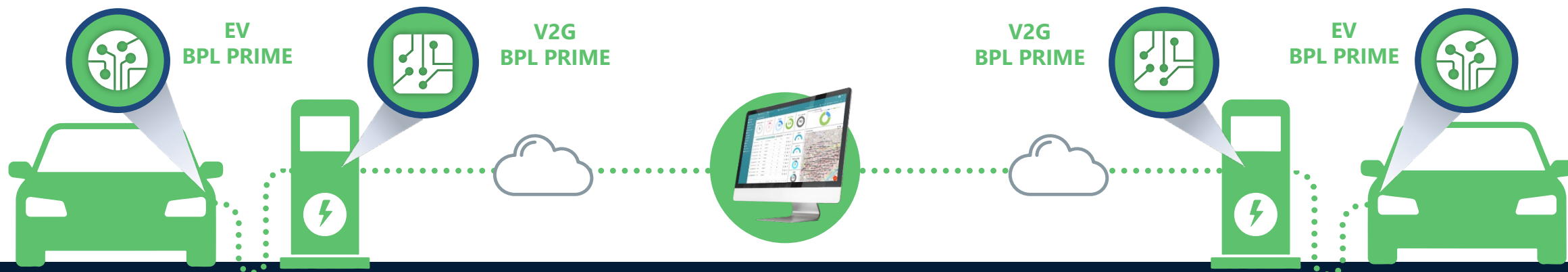
EV customer applications

Connect using BPL at speeds of up to 1 Gbps, during charging

Keeps EV systems up to date for customer convenience and safety

Link to multiple vehicles in residential applications

Encrypted secure link with PKI authentication to avoid theft and fraud

GridValue
EMS IoT Software

Monitors charging status for up to 5,000,000 electrical vehicles

Processes 2 million transactions per minute per server

200,000 concurrent (D)TLS tunneling support

Processes more than 1,000 events per second per server

Energy distributor applications

Provides, for each charging vehicle and charging station: location, estimated time required to charge, actual time and duration of charging, price, identity of utility or other energy service provider

Identify other EVs in the grid

Vehicle-to-vehicle (V2V) communication

Corinex solutions have been validated and deployed in mass rollouts

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Use Case	Validation	Mass Deployment	UPA	G.hn
1 BPL AMI	e·on, edenor, TAURON, CEZ GROUP, PRE, UGVCL, पावरग्रिड, KAHRAMAA, Energa, ZSE, BEDAŞ	SKELEC	✓	
2 Smart Meter Gateway	e·on, mainova, Stromnetz Hamburg, Stromnetz Berlin, REGENSBURG NETZ, Netze BW	e·on	✓	✓
3 Co-existence	IBERDROLA			✓
4 Medium voltage	IBERDROLA, enel	IBERDROLA	✓	
5 Harmonized V2G Solution	Webasto Feel the drive			✓

Corinex BPL solutions are already being deployed across energy companies

CORINEX

Today's validated BPL pilots/rollouts by country

Country	
Spain	IBERDROLA
Germany	e·on Germany · mainova · Netze BW · Stromnetz Hamburg · der Netzbetreiber REGENSBURG NETZ · Stromnetz Berlin
UK	e·on Innovation
Poland	e·on (Innogy Poland) · Energa
Czechia	CEZ GROUP · PRE
Slovakia	ZÁPADOSLOVENSKÁ DISTRIBUČNÁ
Romania	enel

Disrupting a total addressable market worth $300 billion

$160 Billion

Utility Customers
Based on ~2.1B households multiplied by ~ 94% household electrification rate multiplied by $80 revenue to Corinex per household

$65 Billion

V2G Ecosystem
Based on replacement of 1.4 billion existing cars vehicles with EVs with BPL-integrated chips

$23 Billion

Energy Software
Source: Research and Markets, Outlook on the Smart Grid Software, 2021

Intelligently connecting billions of new electricity devices is the next big investment opportunity for decarbonization

CORINEX

$350B already invested in large electricity devices that require broadband solutions

$26B +

(Solar) Prosumer Generation

$161B +

Battery Storage

$163B +

Electric Mobility

Source: *Investments Into Cleantech Companies (United States, Canada, Europe, China)*, Pitchbook 2023

Management team with unmatched domain expertise

CORINEX

Founder & CEO
Peter Sobotka, PhD

Founding member of IEEE 1901 Group; Chairman of BPL Task Force, PRIME Alliance

CORINEX

CTO
Sam Shi

Represents Canada and Corinex at ITU and PRIME Alliance

Co-author of 12 key patents in BPL industry

ITU

Sales VP
Jana Gottstein

Sales Leader - Data Intelligence at SAP

Gartner, SAS institute

SAP **Gartner.**

Senior Director Technology
Ali Inan, PhD

Former CTO/VP of EFR, (E.ON, EnBW, MVV company), leading metering digitalization at Siemens

Co-founder and initiator of the DLMS User Association

e·on Germany

Senior Director
John Huang

Product Line Management – Sierra Wireless

20+ years leading successful engineering teams

SIERRA WIRELESS

Senior Director Strategic Accounts
Wolfgang Heiler

Head of Project Delivery at PPC

20+ years in BPL responsible for all worldwide projects

PPC Power Plus Communications

CSO Germany
Stefan Heyn

Managing Director at Canadian Solar

20+ years in Cleantech

CanadianSolar

Director Strategy & Marketing
Jan Sobotka

Entrepreneur & Designer

Leader of international design-projects, featured in Venice Biennale and Royal Academy of Arts

RA Royal Academy of Arts

Advisory Board Member
Dan J. Cohrs, PhD

Former CFO: D-Wave, Rentech, Global Crossing

mobileX **D:wave**

Advisory Board Member
Tom Ligocki

Founder & CEO of Clevest Solutions

CLEVEST AN IFS COMPANY

Advisory Board Member
Enrique Ochoa Reza, PhD

Former CEO: CFE, Mexico's nation-wide utility

CFE

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