ABB ABILITY ENERGY MANAGEMENT FOR SITES

OPTIMAX® for Smart Charging

ABB Ability™ Energy Management for Sites

Smart Energy Management for EV Charging – February 2020

OPTIMAX® for Smart Charging

OPTIMAX for Smart Charging - Smart Energy Management for EV Charging helps customers that install EV charging infrastructure to

- meet grid limits
- minimize grid extensions
- avoid peaks
- reduce energy cost
- ensure safe operation

What’s happening in the industry?

The problem

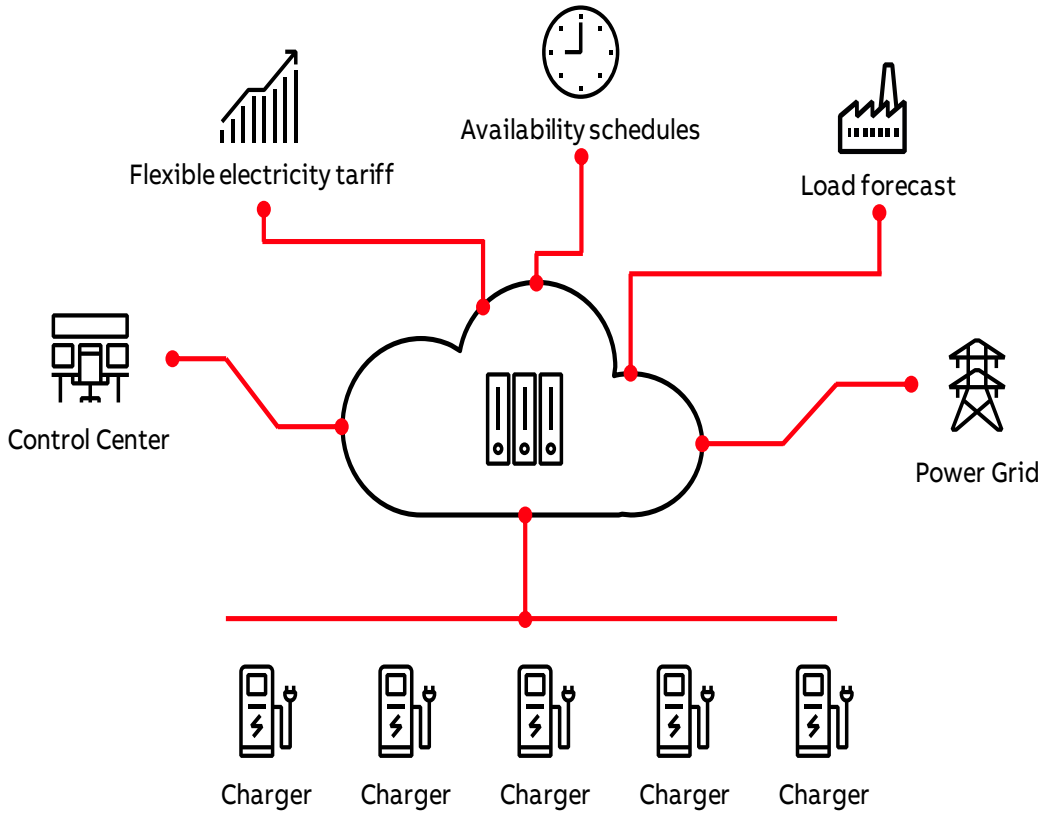
The key challenge for customers installing EV Charging Infrastructure is

- Significantly higher energy consumption than before
- All cars and busses need to be charged to be fully operational

The situation

- Charging infrastructure requires a bigger grid connection
- High power charging can exceed grid limits
- Peak loads at prime times
- Long standing time

OPTIMAX® for Smart Charging



The benefit

- Avoid extensive grid extensions
- Avoid exceed grid limits
- Avoid peaks at prime times
- Reduce cost of energy consumed by charging vehicles

The value

Reduce the cost for power and energy, when installing and operating charging stations.

- **Reduce CAPEX**: decrease grid connection cost when installing Charging infrastructure, avoid exceed grid capacity
- **Reduce OPEX**: Better distribute energy consumption while loading E-Vehicle to avoid peaks and high price times

No manual interaction for delivering

OPTIMAX for Smart Charging

Are you facing the challenge ?

Bus depot charging	Bus operators Transportation companies who are switching to electric buses
Service stations	**Utilities** building up service stations along the road
	Charging point operators or municipal utilities who offer electric charging infrastructure but need to satisfy grid limits
	Charging station operators operate many sites with multiple chargers on each site
Service car fleets	Companies having electric service cars Enterprises with large EV fleets
Commercial areas	Private car owners are charging on someone else's premise
	Retail customer parking Commercial site owners like shopping malls, hotels supermarkets who offer electric vehicle charging to their customers
	Company employer parking Enterprises with increasing number of employees owning electric vehicles
	Municipalities (parking houses, public car parking,…)
	Airports
Residential areas	Charging for private residents and hotels, smart cities / urban developer

OPTIMAX® for Smart Charging

How it works and what’s delivered

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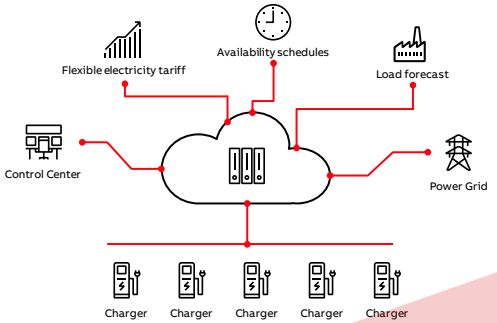
OPTIMAX® for Smart Charging - Smart Energy Management for EV Charging



Essential	Adaptive	Predictive	Site EMS	Virtual Power Plant
For sites with a fixed charging allocation	**For sites with dynamic charging allocation**	**For large EV fleets, bus and service centers**	**For sites with on-site generation**	**Trading the flexibility of multiple sites**
✓ Improved safety ✓ Never exceed your grid limit ✓ Avoid overloading your circuit ✓ Reduce likelihood of a grid extension	✓ Flexibility to meet your site needs ✓ Maximized charging power ✓ Avoid overloading your circuit ✓ Reduce energy costs	✓ Reduce energy costs ✓ Reduce grid extensions ✓ Safe and optimal control ✓ Enable data based decision making	✓ Maximize on-site generation ✓ Reduce energy costs ✓ Safe and optimal control ✓ Enable data based decision making	✓ Maximize revenues ✓ Trade flexibilities ✓ Grid stabilization ✓ Enable data based decision making

A solution to fit the needs of every charging application

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Smart Charging – Functionalities per product

	EVI	OPTIMAX		
Functionalities and Modules	**EVI**	**Essential**	**Adaptive**	**Predictive**
Smart Charging Optimization	x	x	x	x
Visualization		x	x	x
Setpoint to all chargers	x	x	x	x
Alarms and Warning		x*	x	x
Email notification				x
Adaptive grid limit			x	x
Optimal charging schedules				x
Pre-configured IPC		o	o	o
Redundant Setup on Pre-configured IPC				o
Power measurement			x	x
BESS as booster (Modbus TCP)			o	o
PV Inverter (Sunspec)			o	o
Additional Loads (Modbus TCP)			o	o
Advanced Monitoring (archive function for KPI calculation)			o*	o
Vehicle schedules Import				x
Price forecast import				x
Dynamic Pricing				x
Archive				x

	Smart Charging CARE			
Yearly Services	**Essential**	**Adaptive**	**Predictive**	**Site EMS**
Software Usage	X	X	X	X
Application support	O	O	O/X*SaaS	O/X*SaaS
Provision of Patches	X	X	X	X
Provision of Software Update	X	X	X	X
Annual review[1]		O	X	X
Quarterly review		O	O/X*SaaS	O/X*SaaS

X … included
O … optional
* … coming soon

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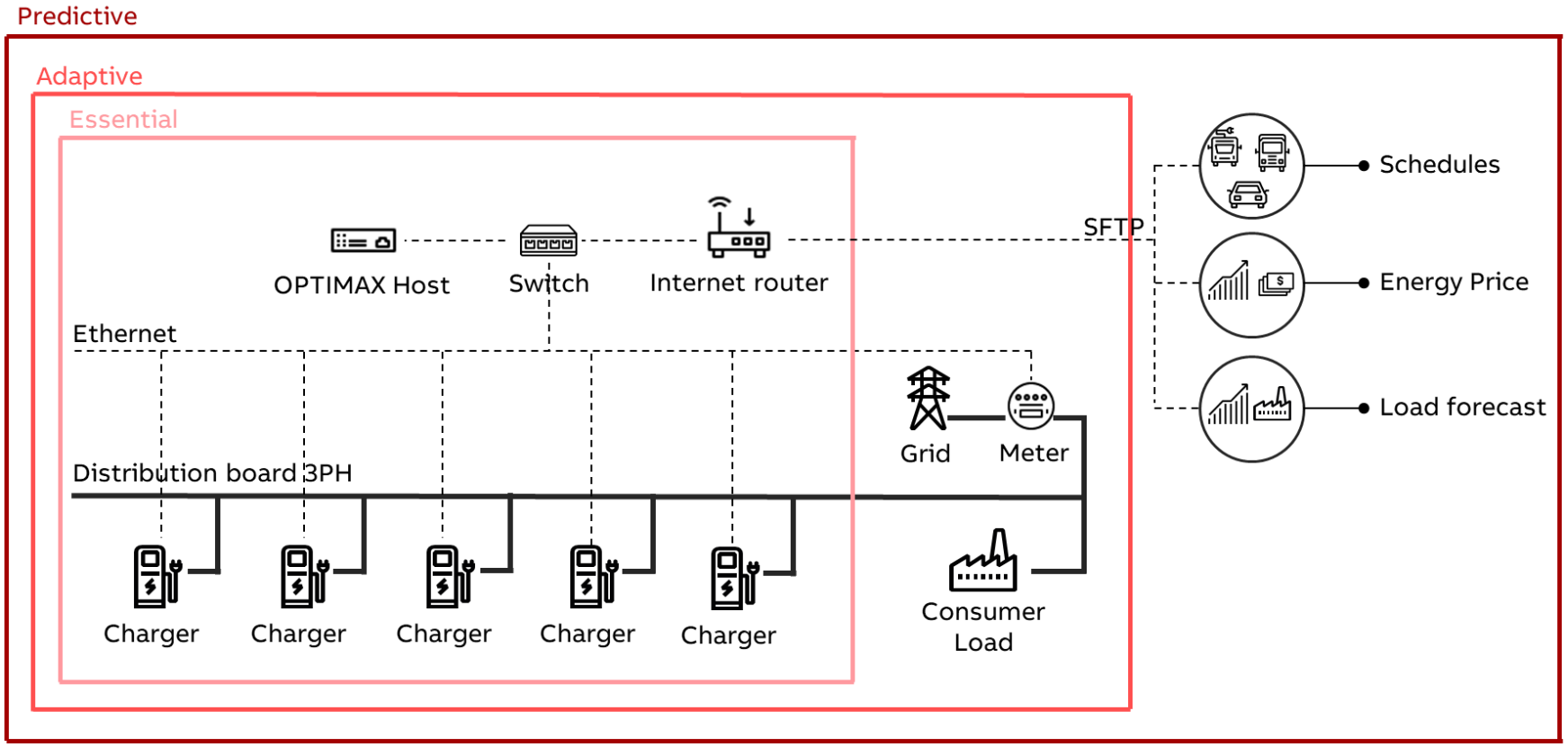
OPTIMAX for Smart Charging – System Architecture



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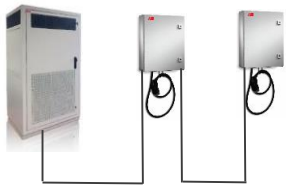
OPTIMAX® for Smart Charging – Integrate charging Infrastructure with OPTIMAX Smart Charging

Interfaces to charging infrastructure — RestAPI, OCPP 1.6, OPC UA

Overnight Charging → **Opportunity charging**

3-22kW AC Wall box	24kW DC Wall box	50kW All-in-one	100kW-150kW with sequential charging	150kW-350kW with liquid cooled cable	150kW-600kW with Automated Connection
					

Grid Integration — Compact substations, transformers, switchgear

Service & maintenance — Global service, spareparts, maintenance & training

OPTIMAX® for Smart Charging – Case Studies

- Opportunity Charging in Leiden, NL
- Audi Retailer – Adaptive Smart Charging, Krefeld, DE
- Service Car Fleet at Allgäuer Überlandwerke, DE
- Mission to Zero – ABB Busch-Jaeger Factory

OPTIMAX for Smart Charging – Essential Module

Reference Project: Arriva Leiden, NL
Enabling maximum utilization of available power for opportunity bus charging

Challenge:

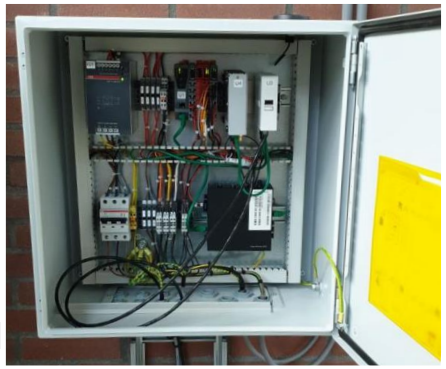
Grid connection is smaller than the capacity of the opportunity chargers.

CAPEX Savings: No need to increase grid connection

Solution:

OPTIMAX actively decides how much power each charger and therefore each bus receives per charging session:

- If one bus is charging with full power, the other will only receive the leftover power (**100kW**).
- After first bus is fully charged and stops the charging session, the second bus will be able to charge at full power.



OPTIMAX Control Box

Easy and safe integration of charging infrastructure into sites with constraints while allowing optimal usage.

OPTIMAX for Smart Charging – Adaptive Module

Krefeld – Audi retailer Project overview
Integrating charging infrastructure by dynamically adapting to real time values

Challenge:

Power supplied by the grid is too small to allow all charge points to operate with full power.

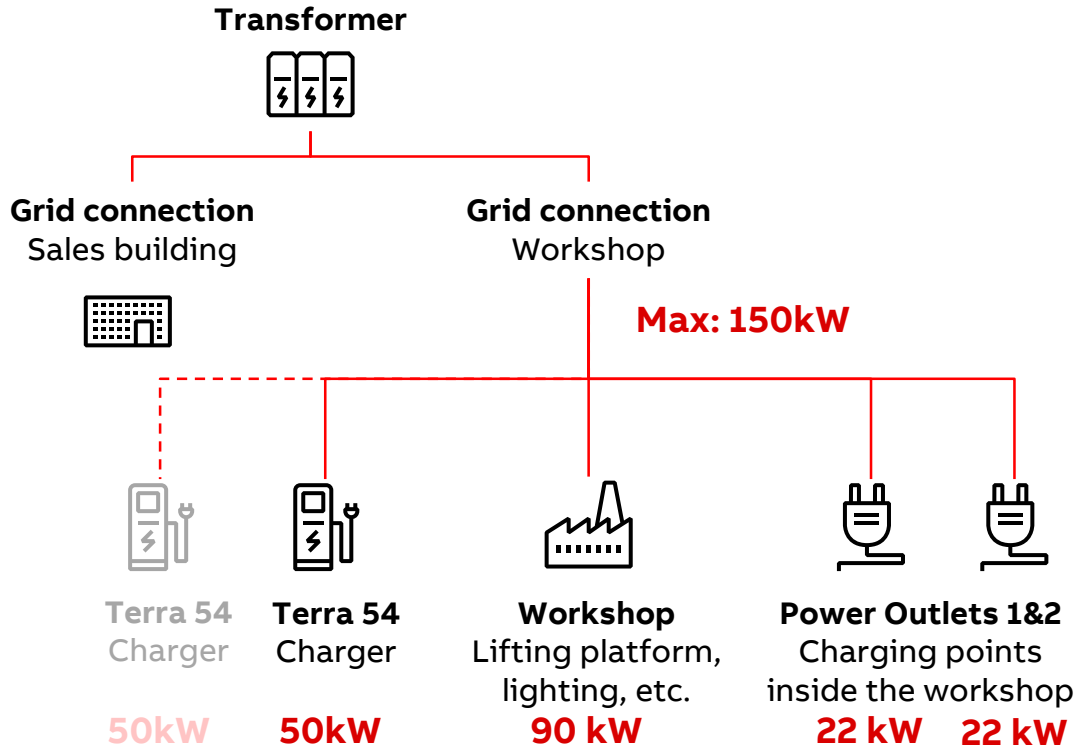
Power used by the body shop varies with the tools that are used.

To make sure fuse is not blown maximum possible power usage of body shop needs to be reserved all the time.

Adding more charging infrastructure makes it even less efficient because maximum power needs to be limited.

Solution:

OPTIMAX dynamically adjusts power for charging stations by calculating the available power with the help of a power measurement at the grid connection.



Enabling maximal use of available power by considering other consumers.

OPTIMAX for Smart Charging

Reference project: 3connect, Kempten DE

Limiting the power that can be drawn by a set of chargers

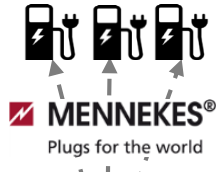
Challenge:

Combined maximum power of chargers exceeds the grid connection.

Solution:

Limiting the available power for all charging points depending on the information from the fleetster car booking platform.

Vehicle	Charging power	Available power per charge point
Smart electrive drive	3,6 kW (1-phase)	11 kW
BMW i3 Range Extender	11 kW (3-phase)	11 kW
Audi A3 e-tron	3,6 kW (1-phase)	11 kW
BMW i3	11 kW (3-phase)	22 kW
VW Golf GTE	3,6 kW (1-phase)	22 kW
VW e-Caddy	11 kW (3-phase)	22 kW
Other	Max. 22 kW (3phase)	22 kW



Car booking platform
fleetster

Bookings and plan

OPTIMAX for Smart Charging

Generating CAPEX savings by eliminating the need to increase the grid connection.

Gefördert durch:
Bundesministerium für Wirtschaft und Technologie
aufgrund eines Beschlusses des Deutschen Bundestages

OPTIMAX for Smart Charging

Reference project: 3connect, Kempten DE

Limiting the power that can be drawn by a set of chargers

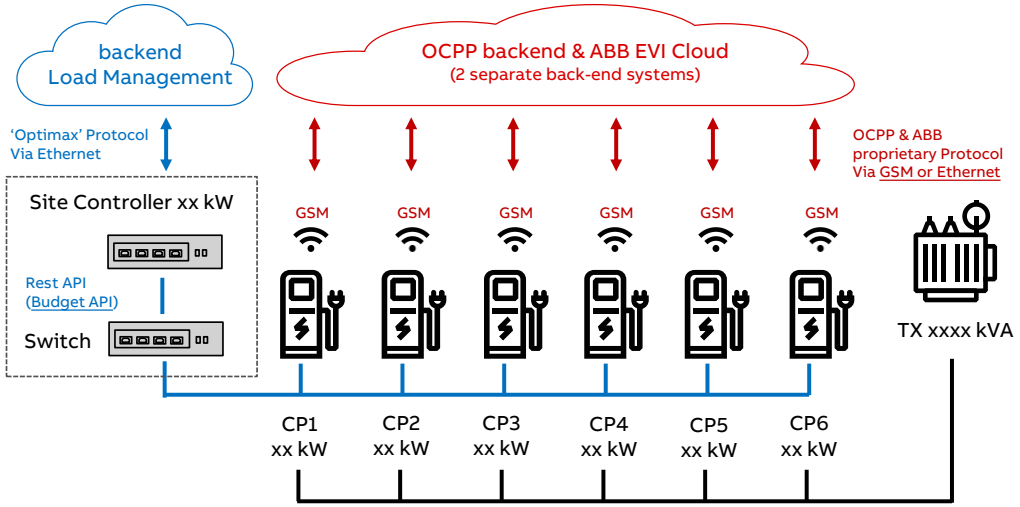
Essential Load Management

Situation: Newly installed DC chargers exceeds the grid limit

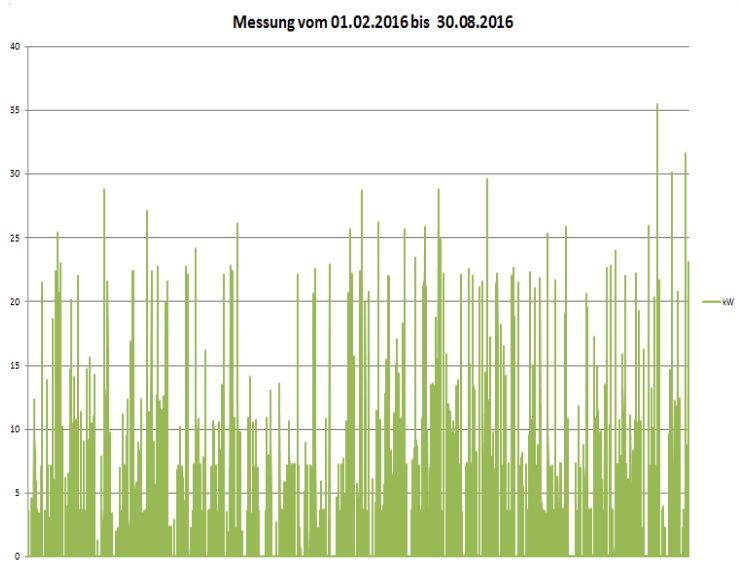
Solution: OPX manages the power available at the charging station

Benefit: Enabling maximal usage of e-mobility while meeting the grid limits

Benefit: Avoid extension of grid connection and reduce waiting times for service cars



Results from the Field Test



Installed Capacity

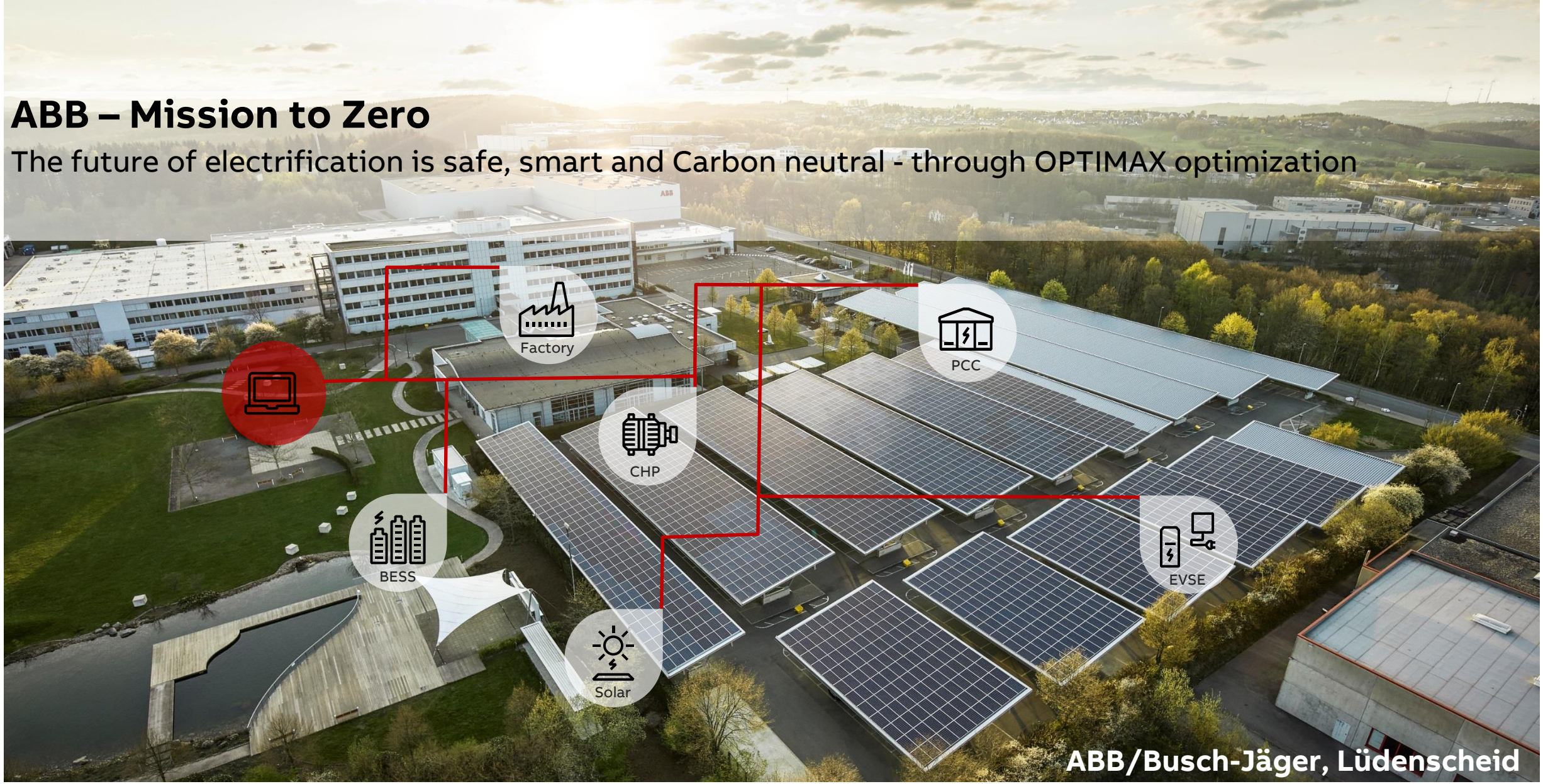
121 kW

Maximum Required Capacity

35 kW

ABB – Mission to Zero

The future of electrification is safe, smart and Carbon neutral - through OPTIMAX optimization



BESS: Battery Energy Storage System
CHP: Combined heat and power
EVSE: Electric Vehicle Supply Equipment
PCC: Point of common coupling

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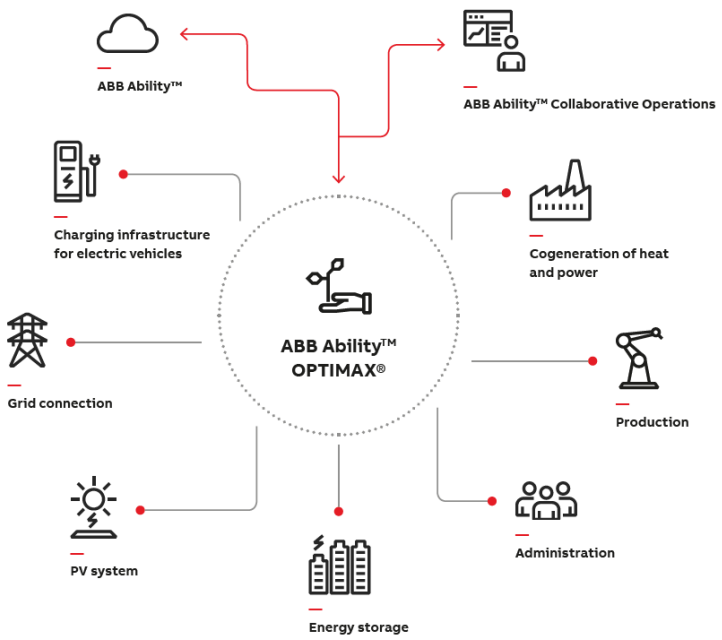
ABB Factory Busch-Jaeger Lüdenscheid – Mission to Zero

Fact Sheet – Mission to Zero



About the site

- **630** tons/year — CO_2 reduction
- about **1.100** MWh/year — Power generation
- **5.75** GWh/year — Energy requirements for administration and production
- **200** kW — Cogeneration of heat and power
- **1,250** kWp — PV system
- **200/275** kWh — Battery storage/capacity
- up to **50** kW — Charging infrastructure for Electric vehicles

Achieved with OPTIMAX

Create operational visibility

Have a clear picture of consumption versus energy prices

Track carbon emissions

Saved time
5 – 20h/m

Reduced CO_2
630 tons/year

Optimal utilization of the connected assets

Forecast loads and on-site generation

Reduced Cost
4,2% 1)

Participation at energy markets

Enabled the participation at real-time markets

Use dynamic pricing schemes from the EaaS provider MVV

Increased revenues
2 – 5% 2)

https://new.abb.com/mission-to-zero/

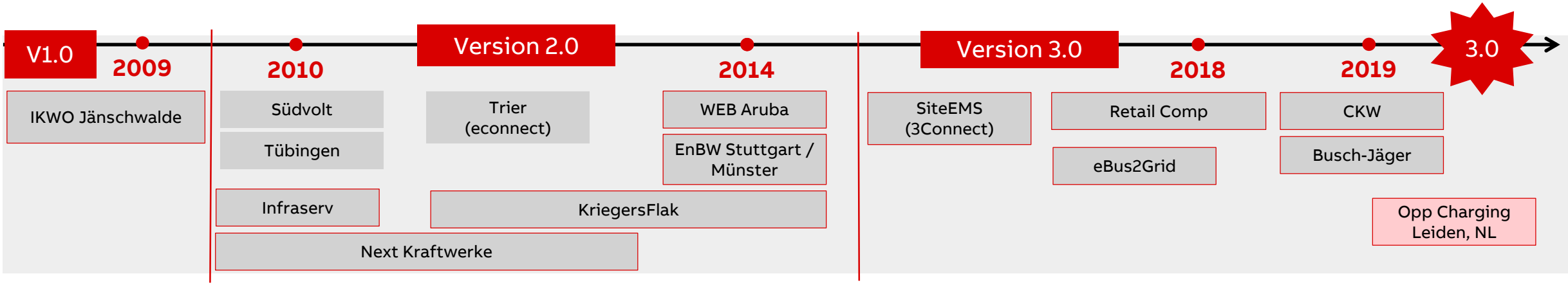
1) compared to non-optimized operation
2) Evaluation ongoing

OPTIMAX® for Smart Charging

Why ABB

ABB Dynamic Optimization development driven by project requirements

OPTIMAX – A modern and widespread energy management software



Scope Expansion
- Real-time energy optimization
- Multi-unit large-scale power plants (Jänschwalde 6 units, 3 GW)

DO v5.0

Scope expansion
- One of the world's first and by now largest VPP (Next Kraftwerke, 6.000 units, 6.800 MW)
- Industrial sites (Infraserv Höchst)

Technical Highlights
- Parallel Optimization (PARADOM)
- Fast In-Memory data base
- Implemented Protocol IEC 60870-5-104
- Schedule and call management with SPH

v5.1

Scope expansion
- Managing energy of island grids (WEB Aruba)
- CHP with district heating (EnBW Stuttgart)
- Master controller for high voltage grids (Kriegers Flak)

Technical Highlights
- New software design based on micro-services and software containers (Docker)
- Minimal Footprint installation with
  - Software Containers, Atomic OS, Web UI
- Automatic installation
- Modbus and OPC UA interfaces

v5.2

Scope expansion
- Energy management as integrator of ABB technology at industrial sites (Busch-Jäger)
- VPP with redundant Docker setup (CKW)
- Optimization for electric fleets and bus depot; optimization for a Smart Farm (3Connect)
- Energy management in the cloud (Retail Comp)
-)

Technical Highlights
- Subscription and SaaS Models
- Automatic Engineering
- New schedule and call management for VPPs

v6.0

Agile development model: Exploit market opportunities (transition of energy system),
Close interaction with pilot customers, R&D with partners, public, co-funding

OPTIMAX for Smart Charging

Leading software in Energy Management

Easily scalable and flexible

- Easily move to higher value service (Adaptive, Predictive, SiteEMS)
- Expand sites from 3 to over 100 chargers
- Expand over many sites

Plug & Play with ABB

- Plug & Play for a wide range of charging infrastructure
- T5x, HVI, THP, DC Wallbox, Opp & Depot Charging, AC Wallboxes

Deep energy expertise

Proven expertise with more than 30 years of experience in energy management in almost all energy industries

Superior technologies

The world's most modern and widespread used energy management software

Complete portfolio

We offer the most comprehensive range of energy management solutions.

OPTIMAX is managing your charging infrastructure

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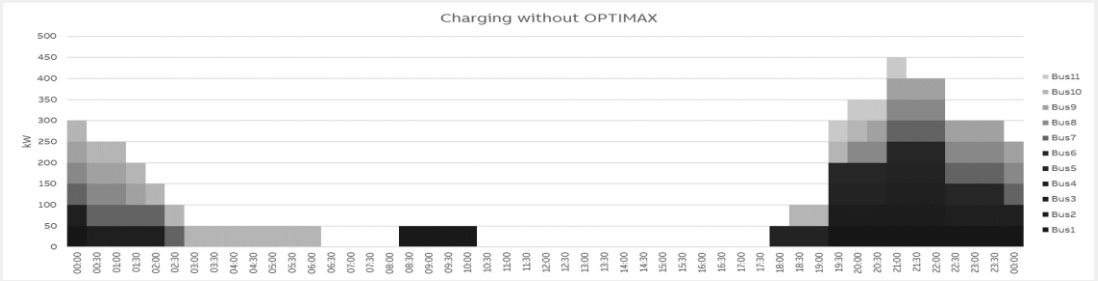
Let‘s calculate the value

Without optimization:
Charging of 11 vehicles @ 50 kW
Peak consumption: 450 kW

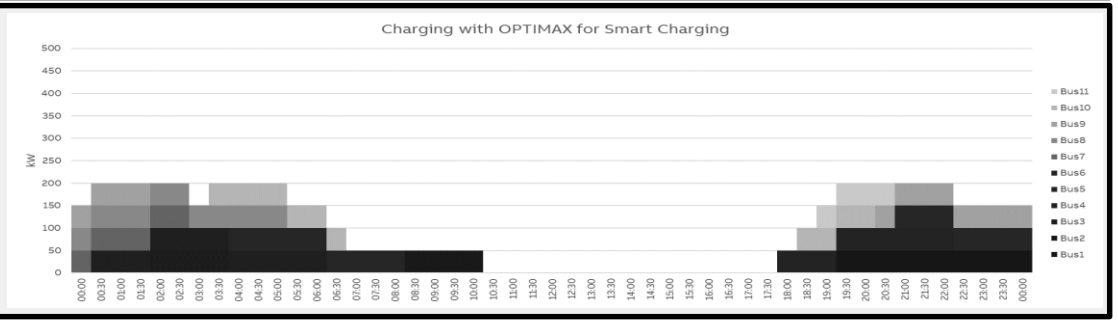
Annual Energy Cost: 31,500€



- 55 %

With OPTIMAX for Smart Charging:
Charging of 11 vehicles @ 50 kW
Peak consumption: 200 kW (- 55 %)

Annual Energy Cost: 14,000 €



CAPEX Savings	30,000 €	(~ new 300 kW transformer + construction)
OPEX Savings	17,500 €/year	(70 €/kW/year peak price)
ROI	< 1 year	(Smart Charging – Essential Package)

OPTIMAX® for Smart Charging

Demo

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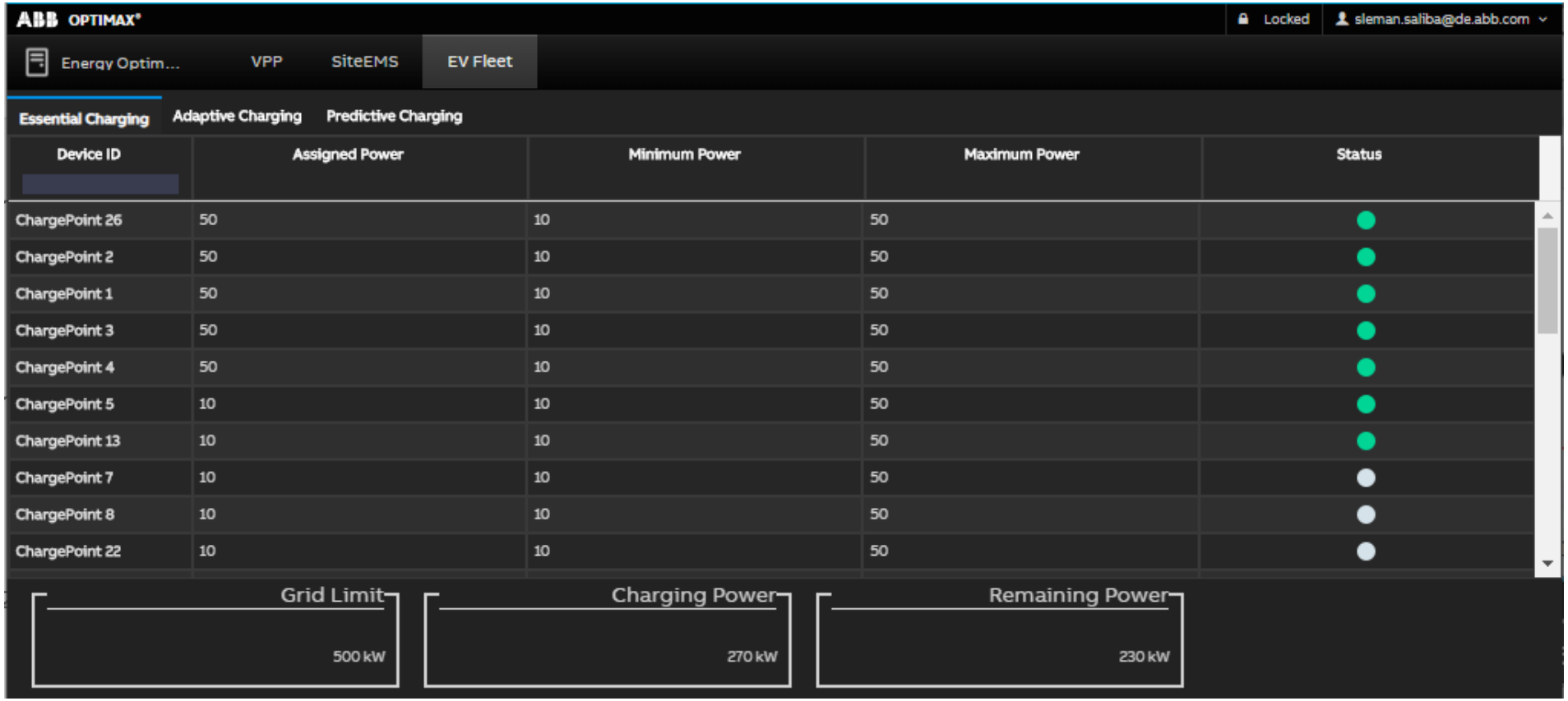
OPTIMAX for Smart Charging – Essential



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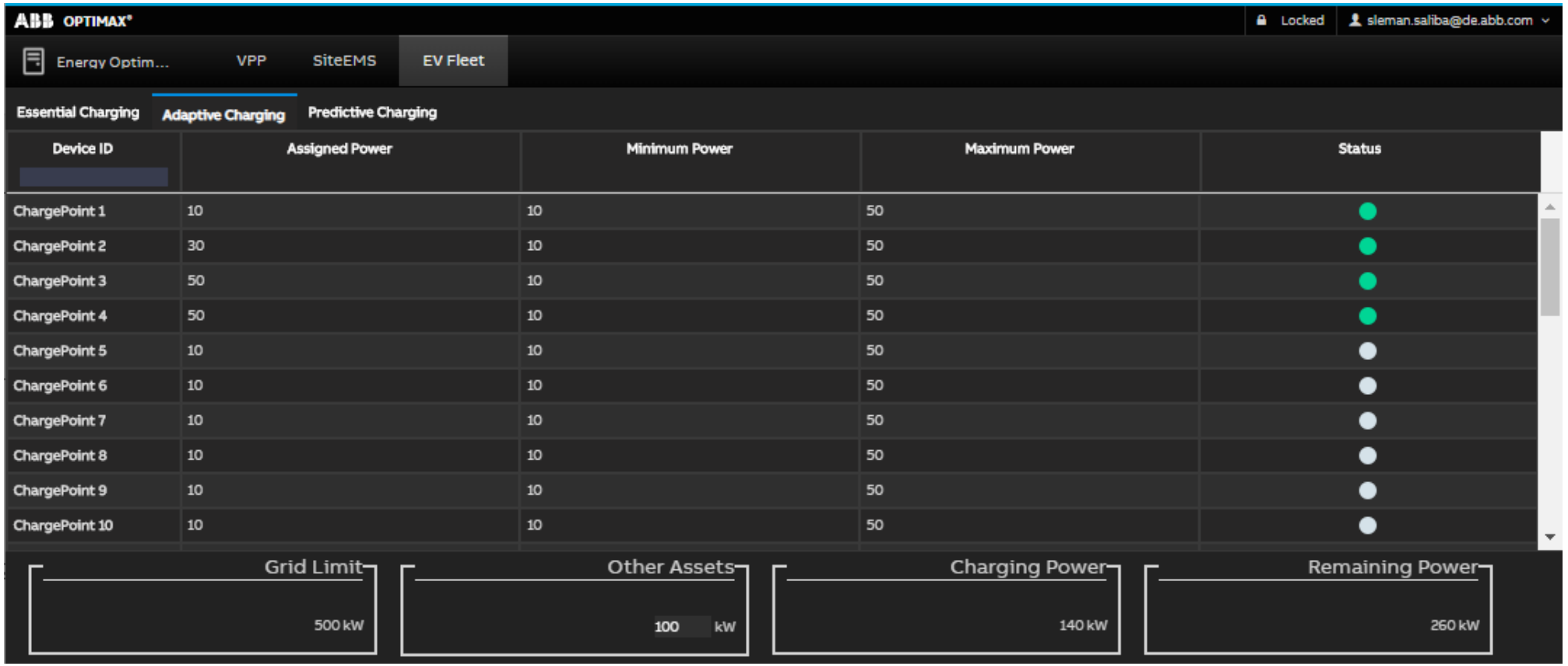
OPTIMAX for Smart Charging – Adaptive



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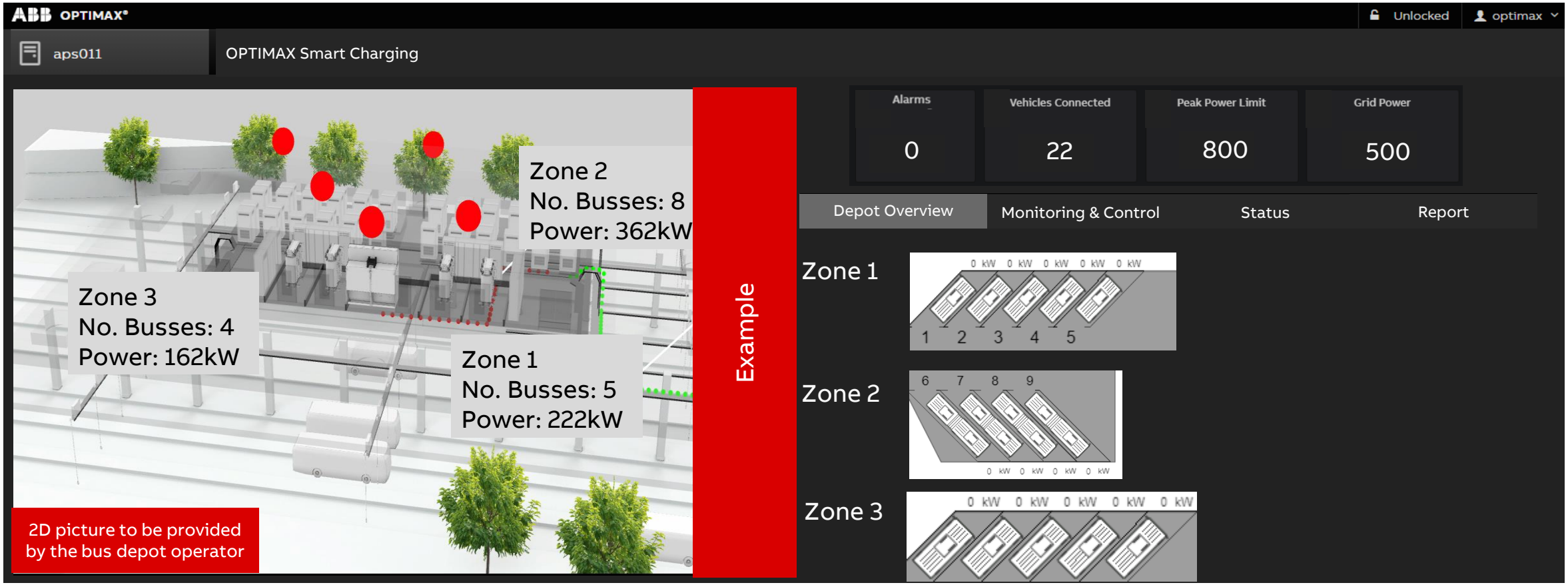
Predictive – User Interface for Smart Charging – Depot Overview



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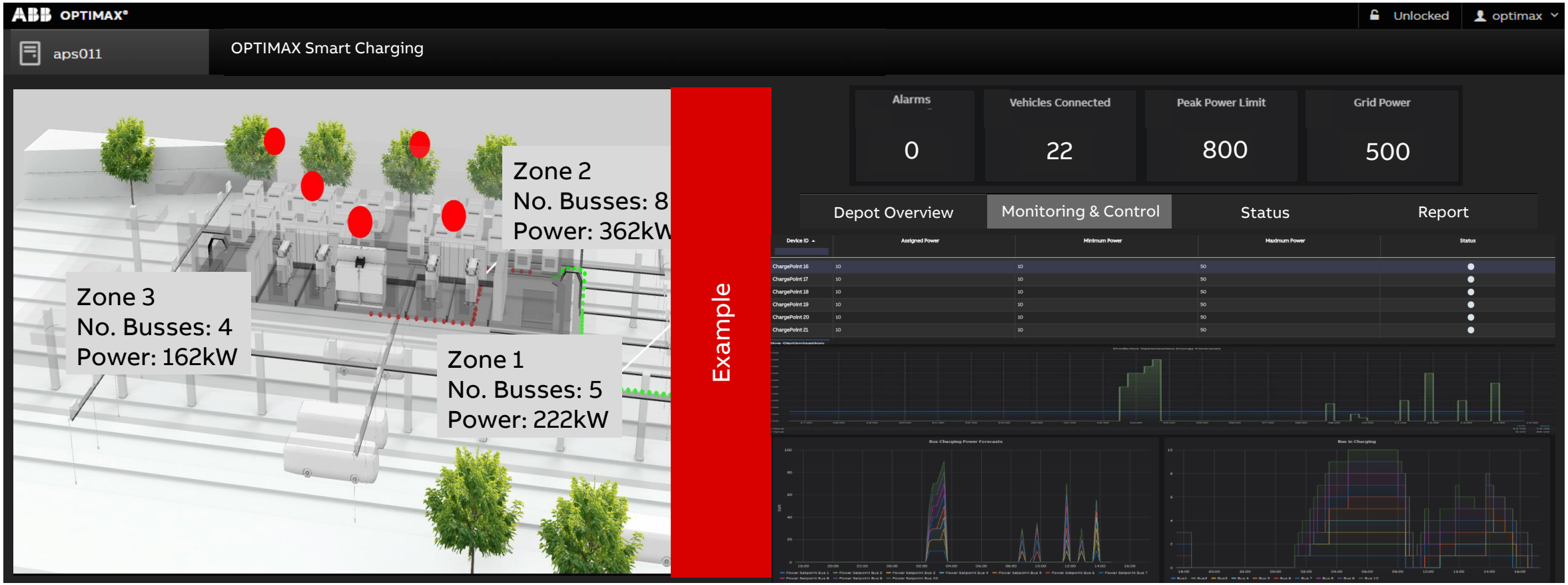
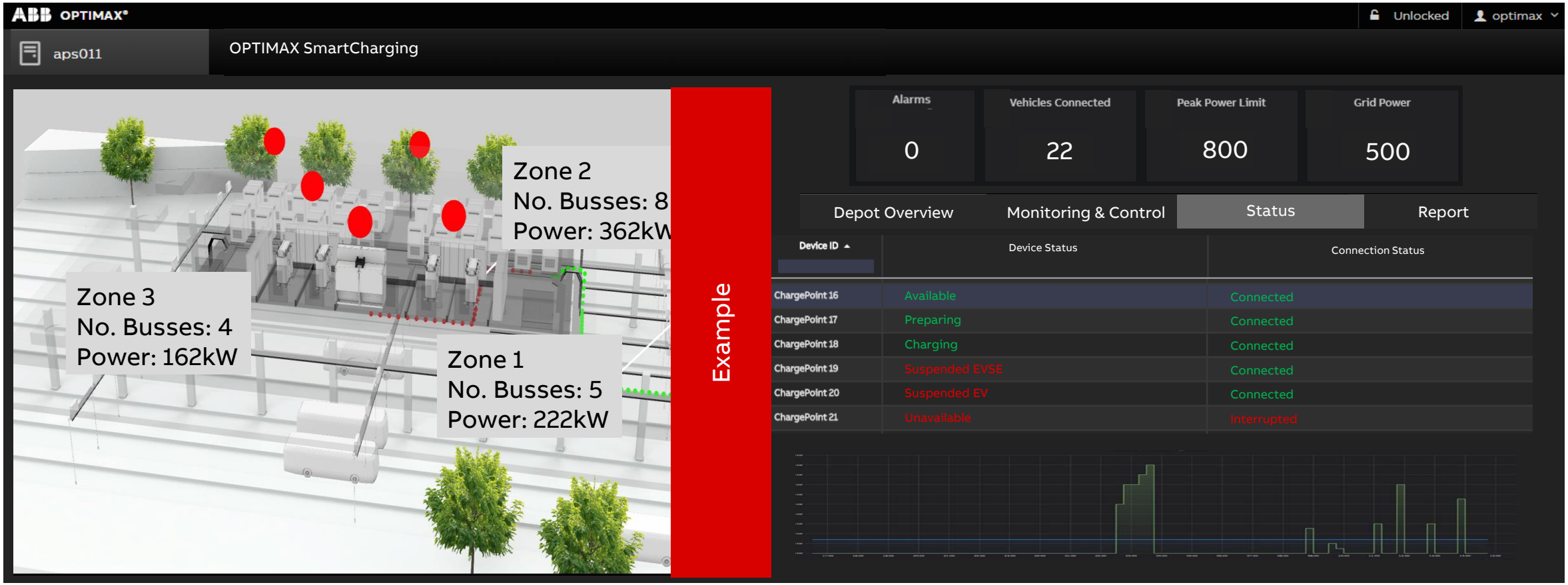
Predictive – User Interface for Smart Charging – Monitoring & Control



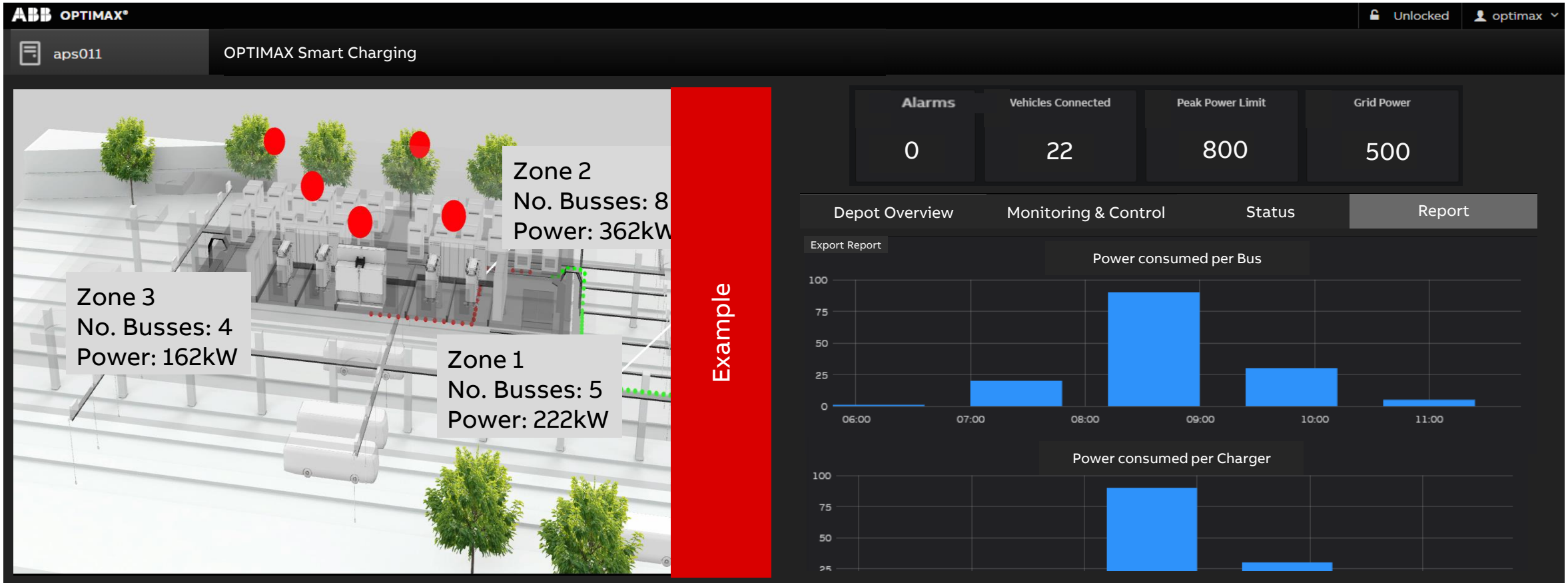
User Interface for Smart Charging

Predictive – User Interface for Smart Charging – asset health view



User Interface for Smart Charging

Predictive – User Interface for Smart Charging – Reporting Sections



OPTIMAX® for Smart Charging

Contact us

Contact information

Who to contact for further support

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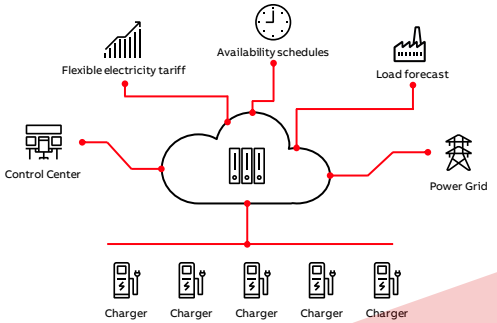
OPTIMAX® for Smart Charging - Smart Energy Management for EV Charging



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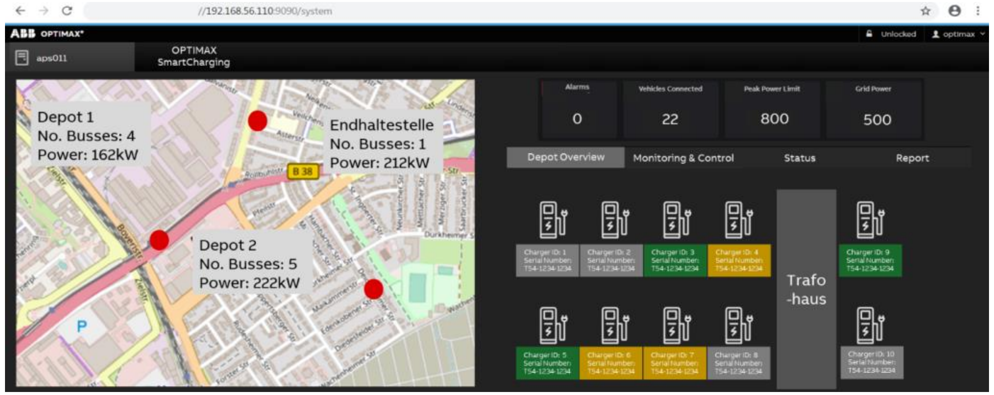
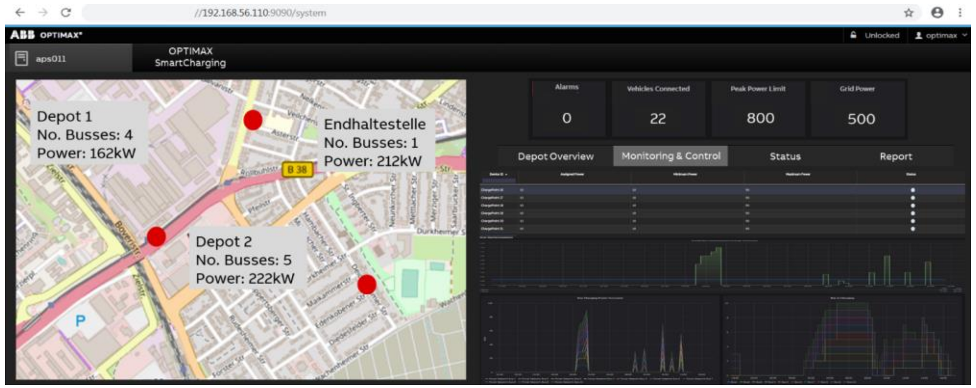
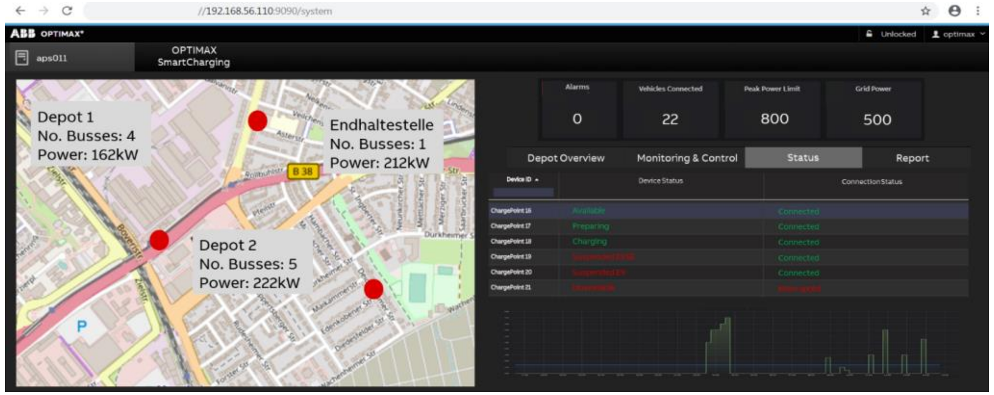
A solution to fit the needs of every charging application

Alternative Depot Layouts – project specific







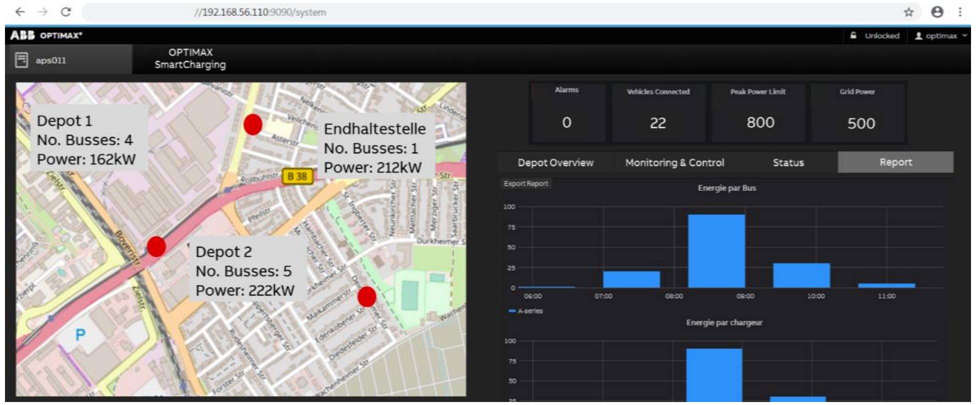



ABB OPTIMAX*
Unlocked
optimax
aps011
OPTIMAX Smart Charging
Zone 2
No. Busses: 8
Power: 362kW
Zone 3
No. Busses: 4
Power: 162kW
Zone 1
No. Busses: 5
Power: 222kW
Example
2D picture to be provided by the bus depot operator
Alarms
0
Vehicles Connected
22
Peak Power Limit
800
Grid Power
500
Depot Overview
Monitoring & Control
Status
Report
Zone 1
Zone 2
Zone 3


ABB OPTIMAX*
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OPTIMAX Smart Charging
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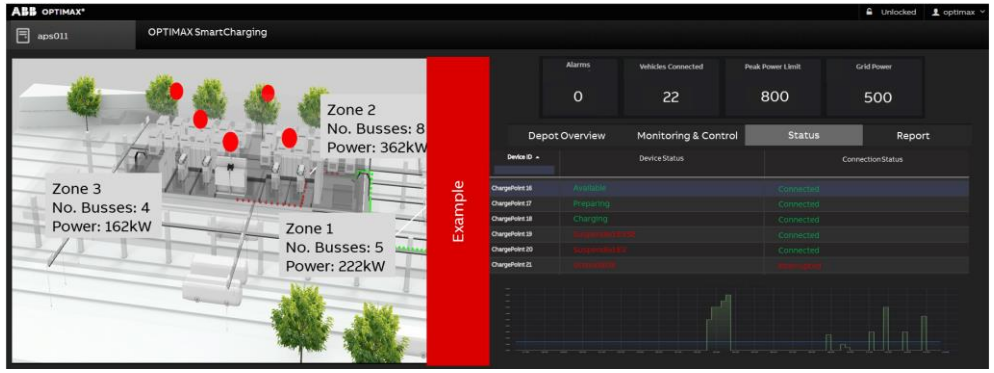
ABB OPTIMAX*
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Depot Overview
Monitoring & Control
Status
Report
Device ID
Device Status
Connection Status


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Example
Alarms
0
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22
Peak Power Limit
800
Grid Power
500
Depot Overview
Monitoring & Control
Status
Report
Export Report
Power consumed per Bus
Power consumed per Charger

ABB Ability™ – Energy Management for Sites

Expanding your site as you need it