GemaLogic Energy Flexibility platform – Virtual Power Plant (VPP) case study

Tomaz Buh, Solvera Lynx d.o.o.
Innovative EM system architect for technical fields in energy, manufacturing, infrastructure, and transport.

Provider of custom-made EM solutions based on state of the art products (software & hardware) developed in-house.

Technical pioneer, incorporating three pillars of modern energy practices: energy monitoring, energy efficiency, and energy flexibility.
The ComBox.L device is among the first to receive the LoRaWAN certificate.
Solvera Lynx becomes a member of the LoRa Alliance.

2002
Company foundation
Solvera Lynx d.d. (former Genera) was founded in Ljubljana, Slovenia
Development of the first ComBox energy and gas data loggers

2004
GemaLogic launch
Launch of the GEMA Energy Management information system
Launch of the GEMA.R railway Energy Management information system

2006
GemaLogic Gas Solutions launch
"Most entrepreneurial idea" in the young innovative companies category
Launch of the GEMA.PLIN gas management information system

2008
Rebranding
Reshaping into a limited company and renaming the company to Solvera Lynx

2014
Pioneer in LoRa technology
Solvera Lynx is among the first to begin developing the LoRaWAN protocol

2015
GemaLogic VPP launch
Launch of energy flexibility solution for smart grid and active demand response
ISO 50001 Certification of GemaLogic software

2016
ComBox.L launch
The ComBox.L device is among the first to receive the LoRaWAN certificate
Solvera Lynx becomes a member of the LoRa Alliance

2018
GemaLogic transformation
Launch of modular design of GemaLogic product with solutions for Monitoring, Efficiency and Flexibility
PRESENTED COUNTRIES

Slovenia

Germany
**SOLVERA LYNX MARKET MAP**

**CORE BUSINESS ACTIVITIES**
- Software development (GemaLogic)
- Hardware development (ComBox, ICT, IoT, LoRa)
- Energy Management & Engineering
- Customer support & Installation

**FOCUS ON CUSTOM-MADE SOLUTIONS**
Our Energy Management solutions based on three pillars of modern energy practices
- Energy Monitoring (EM)
- Energy Efficiency (EE)
- Energy Flexibility (EF)

**APPLICATIONS**
- EM: Gas, Electric Energy, Railways
- EE: Industrial facilities, Buildings, Energy Audits
- EF: Virtual Power Plants, Smart Grid, Power Line Optimisation

**TECHNOLOGICAL PIONEER**
- 15 years of software and hardware development
- Certificates: TÜV SÜD, ISO certificates, LoRaWan certificate
- Among the first to certified Data Communication Devices by LoRaWAN standard

**EXPERTISE & STRONG R&D**
- The biggest interdisciplinary Energy Management team of experts in the region
- Systematic R&D projects in software, electronics and optimization in the field of Energy Management
FACTS & FIGURES

SOLVERA LYNX IN NUMBERS

1. Slovenian provider of custom-made Energy Management solutions


15. Years of experience in Energy Management

30. Countries covered with our EM solutions

50+. Best interdisciplinary Energy Management experts (IT, ICT, Energy Management)

100+. Satisfied clients and innovative GemaLogic Software installations

3000+. Total installations of our state-of-the-art products ComBox.L and ComBox.M

20000+. Measuring points connected to our GemaLogic software platform
USE CASES & REFERENCES
GemaLogic Flexibility

Use-case: „Virtual Power Plant“

Functionalities

- System Balancing – manual Frequency Restoration Reserve (mFRR)
- Market Balancing
- Aggregation
- Forecasting
- Optimization (control and scheduling)

Sources

- Distributed Energy Resources (DG, Gas, etc.)
- Renewables (PV, CHP, Wind, Hydro, BIO gas, etc.)
- Flexible loads (Industry, commercial and residential buildings)
- Conventional sources and storages
GemaLogic Flexibility – Virtual Power Plant

GemaLogic Flexibility Industry
GemaLogic Flexibility small commercial and residential buildings

Distributed Energy Resources, Flexible loads
GemaLogic Flexibility

Use-case: „Commercial and residential buildings“

Demand Response Control System (DRCS)
- integration based on CIM (IEC 61968-100) with distribution management system, meter data management, notifications (e-mail, SMS), HEMS, LoRa

Functionalities
- Billing data collection
- Automatic LV network topology setup
- Forecasting models for commercial and residential buildings
- Demand Response potential
- Direct Load Control
- Virtual Power Plant integration
GemaLogic Flexibility

Use-case: „Steel and glass industry“

Functionalities

▪ Monitoring
▪ Aggregation
▪ Forecasting (loads and renewables)
▪ Optimization (control and schedule)
▪ Demand Response potential
▪ Load Shifting
▪ Peak Shaving
▪ Virtual Power Plant integration

Integrations

▪ EMS – specific consumption,
▪ SCADA – management and control
▪ MES – production data
GemaLogic Flexibility

Use-case: „Commercial and residential buildings“

- 3-year Slovenian – Japan smart grid project „Premakni porabo“ – 2017-2020
- Automated Demand Response
- Active users divided into 3 groups:
  - Group A – only mobile messages (800)
  - Group B – HEMS (50)
  - Group C – DLC (50)

- Participants: 826
- Demand Response: 17-30%
GemaLogic Flexibility

Use-case: “Diesel Gensets control”

Connectivity

- OpenADR implementation
- Integration platform – Service Mix for backend information system integration:
  - Diesel Gensets
  - Asset management (IBM)
  - Alarming system
  - Meter Data Management System (MDM)
  - SCADA
- Connectivity platform for integrating industry and SCADA protocols:
  - ModbusTCP
  - ICCP – TASE.2
  - OPC UA
ENERGY FLEXIBILITY REFERENCES

PETROL
elektro gorenjska
ELEKTRO MARIBOR
NEDO
ELES
PREMAKNI PORABO
siJ ravne steel
ACRONI
SOLUTIONS PORTFOLIO
SOLVERA LYNX SOLUTIONS

**GAS**
- Monitoring of the conditions in the gas grid

**ELECTRIC ENERGY**
- Control and analysis of electric energy consumption

**RAILWAYS**
- Optimization of energy use on railway infrastructure

**INDUSTRY**
- Low costs, improve efficiency and safety, improve your carbon footprint

**BUILDINGS**
- Low costs, improve the effectiveness and safety. Offer extra to building tenants

**ENERGY AUDITS**
- The key step in efficient decrease in energy use

**VIRTUAL POWER PLANT**
- Utilize flexible energy from distributed energy resources and local flexibility platforms

**INDUSTRY**
- Provide demand response functionality & connect industry into responsive unit

**COMMERCIAL AND RESIDENTIAL**
- Demand response control system increase the ampacity of existing distribution network
PRODUCT PORTFOLIO
INNOVATIVE TOOLS FOR ENERGY MANAGEMENT
OUR OWN SOFTWARE, COMMUNICATION EQUIPMENT AND LORAWAN SOLUTIONS

GEMALOGIC
ADVANCED ENERGY MANAGEMENT SOFTWARE PLATFORM

COMBOX
INNOVATIVE DATA COMMUNICATION EQUIPMENT
GemaLogic Energy Flexibility Platform

VIRTUAL POWER PLANT, INDUSTRY, COMMERCIAL AND RESIDENTIAL

- **VIRTUAL POWER PLANT** - utilize flexible energy from distributed energy resources and local flexibility platforms.
- **INDUSTRY** - provide demand response functionality & connect industry into responsive unit.
- **COMMERCIAL AND RESIDENTIAL** demand response control system increase the ampacity of existing distribution network.
GemaLogic FUNCTIONALITIES

Resources overview
- Partners
- Resource types: Loads, Generators, Prosumers

Monitoring panel
- Actual load,
- Load forecast (48h),
- Calculation and presentation of adjusted forecast,
- Request for load curtailment from activation

Load optimization (automatic/manual)

Load forecast (prediction models):
- Machine learning methods (LR, NN, RT, SVM)
- For each resource – adaptive prediction models with different models e.g.: 48 h / 1min resolution
GemaLogic FUNCTIONALITIES

Activations

- Activation overview (history)
- Activation triggering (sent request,
- Example for tertiary reserve
  - 100% of offered power in 15 minutes from the request
  - Maximum duration of activation is 4 hours
  - Maximum unit non-availability time after finished activation is 10 hours

Settlement reports

- How many kW/time was successfully activated
- Availability time
- Comparison of data from system operator and measured data
Connectivity

END POINTS
- Modbus
- DI
- AI / AO
- Relays
- OPC
- IEC 60870-5-101
- IEC 60870-5-104
- Modbus
- IEC 61850
- IEC 61968
- IEC 61970
- ICCP - TASE.2
- Open ADR

CONCENTRATORS/ GATEWAYS
- COMBOX
- SOLVERA LYNX

APPLICATION SERVER
- GEMALOGIC
- Monitoring
- Efficiency
- Flexibility

API
- Online Data
- Control
- Trading
- Energy Markets
- TSO
- DSO
- Schedule
- Manual
- Energy Markets
- TSO
- DSO
ARHITECTURE

MODULAR

- User interface
- Business logic
- Data acquisition and aggregation
- Energy Monitoring, Efficiency, Flexibility

TECHNOLOGY

- MS SQL
- Java EE
- WildFly Application Server
- WebServices (REST, SOAP)
- Apache Service Mix
- Active MQ (RabbitMQ, Kafka, Artemis, JMS)
- TypeScript
- PrimeFaces
- OmniFaces
Overview

Internal System Boundary

- GemaLogic Module
  - GemaLogic DB
- Flexibility Module
  - Flexibility DB
- OpenAdr Module
  - OpenADR DB

External System Boundary

- Configuration API
- Alert API
- OpenAdr VEN
- OpenAdr VEN/VTN
Activation State

1. INCOMING

2. CHANGE REQUEST
   - SUCCESSFUL
   - FAILED
   - ENDED BY OPERATOR
   - CANCELED
## Activation Timeline

<table>
<thead>
<tr>
<th>warmup</th>
<th>Activation in progress</th>
<th>recovery</th>
<th>...</th>
</tr>
</thead>
</table>

- Announcement: INCOMING → IN PROGRESS
- Announcement: IN PROGRESS → SUCCESSFUL, FAILED
- Expiry: IN PROGRESS → FAILED
Flexibility Jobs

<table>
<thead>
<tr>
<th>GemaLogic Jobs</th>
<th>Flexibility Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Controller</td>
<td>Update OpenAdr status</td>
</tr>
<tr>
<td>Controller Report</td>
<td>Update SCADA status (*DEA)</td>
</tr>
<tr>
<td>Configuration</td>
<td>Configure resources</td>
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<tr>
<td>Potential Update</td>
<td>Calculate potential/forecasts</td>
</tr>
<tr>
<td>System Health</td>
<td>System health check</td>
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- Device Controller
- Controller Report
- Configuration
- Potential Update
- System Health

- Update OpenAdr status
- Update SCADA status (*DEA)
- Configure resources
- Calculate potential/forecasts
- System health check
Flexibility Configurator

**GemaLogic API**
- Data source importer
- Alarm importer

**GemaLogic EJB**
- Geolocations
- Leafs

**Flexibility Devices**
- Configure External Device
  - Import Datasources
  - Import alarms
  - Create geolocations
  - Create leaves (DS, geo)
  - Register Party (Adr)

**External**
- Configure device API (POST/GET)

**OpenAdr API**
- EiRegisterParty API
Flexibility Data Flow (IN)
Flexibility Data Flow (OUT)

GemaLogic EJB
Data engine

Flexibility Module
Controller
OpenAdrController

OpenAdr API
/reporting/upstream
/reporting/distribution
Flexibility Event Flow (IN)

GemaLogic API
Telemetry API

Flexibility module
Event Parser
Full Optimizer
Greedy Optimizer
Controller

OpenAdr API
EiEvent VEN
EiReport VTN
Flexibility Event Flow (OUT)

- GemaLogic Jobs
  - OpenAdr Controller
- GemaLogic API
  - /telemetry
- Flexibility
  - /jobs/update-devices
- OpenAdr API
  - /distribution/event
User management

- Business partner
  - validity
- JOB USER
- USER
  - Admin
  - Access
  - Managing
  - Control
- ADMINISTRATOR

Leaf
- DataSource
- GeoLocation
- Alarm
- Price list
System architecture

Application layer

Integration layer

External services

- Gema
- Flexibility
- OpenAdr
- Gema DB
- Flex DB
- ADR DB

- Alert API
- Config API
- Json DB
- REST
- SOAP
- Ver(Diesel)
- VEN/VTN(Scada)
- EIOpt(Diesel)
- EIRegisterParty

- Alarms
- Asset Mng.
- MDMS
- IOT Gateway
- KeyServerEX
- ModbusTCP
- OPC UA
- AX S4 ICCP
- ICCP
- SCADA
Dashboard

- Current available power,
- Measurements, Forecast, Corrected forecast and requested power
- Availability
- Activation request
Owners
Distributed Energy Resources
Configuration wizard
Optimization models wizard
Activation requests
Running activation
Dashboard
Report on Activation
Communication device
WHY SOLVERA LYNX?

**Custom-made solutions**
Complete Energy Management package based on SW and HW solutions.
Potential for full customization according to customer’s request

**Expertise**
The biggest interdisciplinary Energy Management team of experts (IT, ICT, energy management) with 17 year+ experience

**Partnership**
Long-term cooperation with customers after the implementation of the EMS (upgrade, maintenance)

**Quality**
Certification: TÜV SÜD, ISO, LoRaWAN
LoRaWAN member since 2015 to warranty data collection
THANK YOU!

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