Tariff and Load Management by wide area Long wave communication

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Overview

- Introduction
- Long-Wave System Architecture
- Physics of LV Propagation
- Applications and Market
- Company Structure and Business Model
- Perspectives for Florida (example)
Applications

- Connection of multi rate meters HT/NT switching
- Load management
- Connection and disconnection of load groups
- Connection and disconnection of power plants
- Control of lighting equipment
- Individual controls
Architecture

Customers send their control applications to the host computer via IP/X.25 or ISDN using the user control station. From there, the switch commands are passed on to the transmission devices. Control via the Internet has also been available to customers since 2005.
## Long-wave transmitter

<table>
<thead>
<tr>
<th>Transmitting power</th>
<th>Mainflingen</th>
<th>100 kW</th>
<th>TRAM 100 LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>(transmitter types)</td>
<td>Burg</td>
<td>100 kW</td>
<td>TRAM 100 LC</td>
</tr>
<tr>
<td></td>
<td>Lakihegy</td>
<td>100 kW</td>
<td>TRAM 100 LC</td>
</tr>
<tr>
<td>Carrier frequencies:</td>
<td>Mainflingen</td>
<td>129.1 kHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burg</td>
<td>139.0 kHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lakihegy</td>
<td>135.6 kHz</td>
<td></td>
</tr>
<tr>
<td>Type of modulation:</td>
<td>FSK (Frequency shift keying)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency swing:</td>
<td>+/-170 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telegraph speed:</td>
<td>200 Bd</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Antenna systems

- Antenna heights:
  - Mainflingen: 200 Meter
  - Burg: 317 Meter
  - Lakihegy: 320 Meter

- Antenna type:
  - Mainflingen: T-Antennas (Vertical antenna with capacity top)
  - Burg: Double cone antenna
  - Lakihegy: Single mast antenna

- Direction: Omni-directional antenna
SMART METERING

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317 meter →

→ 220 meter

Burg, Germany

900 meter →
Lakihegy, Hungary
320 Meter
Central Computer

- For communicating with the user stations and for addressing the long-wave transmitter using bus and control computers
- The data from the central computer (system parameters, users, transmission service et al.) are managed using a database computer
- The central computer causes the telegrams to be sent out at the right point in time. It regularly (approx. every 10 sec) sends out a time telegram for the purposes of synchronisation
- The computer is structured with full redundancy as a 2-computer system
- It conducts user management and checks the access rights of the system users. Comprehensive monitoring functions are integrated
User control station

- Standard PC, operating system: Windows XP or Vista
- Telegram database for composing and changing telegrams in a simple way
- Web server principle for linking up to 25 clients via an Internet browser
- Option of coupling external hardware via voltage-free contacts and integration into existing control technology via TCP/IP and HTML script
- Administrator functions for adapting to the company structure, issuing access rights, setting up divisions and processors
- Constant monitoring of the system status, comprehensive reporting, protocolling functions and much more
Internet access

- Static and mobile Internet access
- Password-protected Internet portal to generate telegrams in a simple way
- All standard commands, such as pulse or switching commands, or switching time entries, for example
- Single remote control and remote control to a small group of radio receivers
Communication with Central computer (XoT and XML)

Central Computer and Transmitter Station

Dynamic load
Control System

Controlling of load groups

Sub load group

Sub load group

Overall control time < 10 sec

EFR User Station

SCADA / Dynamic Load
IEC 60870-5-104

Communication with
Central computer (XoT and XML)

Central Computer
and Transmitter Station

Dynamic load
Control System
Radio receiver  
– technical properties

- Network connection as per EN61037, transformer with galvanic isolation
- Antenna integrated into housing, removable
- Programming using interpreter program and via optical interface as per EN 61107
- Data transfer: receiver frequencies: 129.1 kHz, 139.0 kHz, 135.6 kHz, modulation: FSK, radio transmission format as per DIN 19244, telegram formats: Semagyr-Top or Versacom, Receiving level >55 dBµV/m
- Relay: 1 to 6 bi-stable, potential-free relay *with two-way contact.*
  
  *Position indication and hand operation*

- Accessories: optical/acoustic alignment assistance, parameterisation database, parameterisation program
Longwave propagation - space wave

- Fundamental propagation of long waves as ground waves and space waves
  - Indirect reception by reflection at the D-layer of the ionosphere
  - Space waves can reach over long distances (depending on the angle of radiation and reflection)
  - Reflected space waves can be reflected again. Huge distances can be reached by multi-reflection
  - Propagation of the space wave is heavily influenced by the time of day and by the season
Longwave propagation - ground wave

- Only the ground waves are important for radio ripple control

- Waves radiated from the transmission system which are parallel to the earth's surface

- The propagation of these waves is affected by obstacles such as forests, mountains and structures. The range of ground waves is limited by damping

- The ground wave also penetrates deep into the ground itself – the lower the frequency, the deeper the penetration. This means that receptions is also possible in basements!
Long-wave propagation

Field strength $\text{In dB} \mu \text{V/m}$

Maximum field strength (continuous wetness)

Minimum field strength (continuous dryness)
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Transmission sites and reception areas
Advantages of the system

- **Economical**
  through low investment and operational costs

- **Independent of network**
  without retroactive network effects, no effect on the voltage quality

- **Immediately available with blanket coverage**
  ease of installation
  flexible group and individual control options
References where is RRC technology used

Germany & Austria
Hungary
Czech Rep
Slovakia & Croatia

- 85 Companies, Municipalities, regional suppliers and major utilities
- Operating 760,000 Receivers
- Tariff switching, Street lighting, load management, Generation control (wind, biogas, photo voltaic)

Why are these major utilities changing from Audio to Radio Ripple?

- Speed
- Cost effectiveness
- Scaleability
- Independent to electrical network
Examples of companies doing Load / Generation control

<table>
<thead>
<tr>
<th>Customer</th>
<th>MW Controlled</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.on edis</td>
<td>450 MW</td>
<td>Wind Generation</td>
</tr>
<tr>
<td>e.on Avacon</td>
<td>600 MW</td>
<td>Wind Generation</td>
</tr>
<tr>
<td>WEMAG AG</td>
<td>25 MW</td>
<td>Wind Generation</td>
</tr>
<tr>
<td>energiequelle</td>
<td>230 MW</td>
<td>Wind Generation</td>
</tr>
<tr>
<td>e.on Bayern</td>
<td>2,500 MW</td>
<td>Heating Systems</td>
</tr>
<tr>
<td>Berlin.de</td>
<td>20 MW</td>
<td>Street Lighting</td>
</tr>
<tr>
<td>All Companies</td>
<td>500,000 households</td>
<td>Tariff Switching</td>
</tr>
<tr>
<td>envia NSG</td>
<td>900 MW</td>
<td>Wind Generation, Solar &amp; Biogas systems</td>
</tr>
</tbody>
</table>
Installed receivers

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**EAST COAST**

*Forecast*

Year


- Installed receivers:
  - 800,000 (680,000/150,000)
  - 850,000
  - 900,000
  - 830,000 (680,000/150,000)
  - 680,000 (610,000/70,000)
  - 566,000 (525,000/42,000)
  - 471,000 (461,000/10,000)
  - 388,000
  - 329,000
  - 282,000
  - 230,000
  - 158,000
  - 95,000
  - 40,000
  - 20,000
  - 150
  - 0

* Year 2008 is forecasted.*

*Source: spintelligent*
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Shareholder

E.ON Bayern AG
Regensburg
39.9%

N-ERGIE AG
Nuremberg
35.0%

EnBW Regional AG
Stuttgart
25.1%

E.ON Hungaria Zrt.
Budapest
25.0%

E.ON Česká republika s.r.o.
České Budějovice
12.0%

EFR GmbH
Munich
51.0%

EFR Central Eastern Europe Kft.
Budapest
12.0%

EFR Polska Sp. z o.o.
Poznan
100.0%

EFR South Africa Ltd.
Johannesburg
51.0%

South. Stream Energy Resources Ltd.
Johannesburg
49.0%

Západoslovenská energetika, a. s.
Bratislava
12.0%

EFR New Zealand Ltd.
Wellington
50.0%

METEC Metering Technology Ltd.
Wellington
50.0%

EFR Central Eastern Europe Kft.
Budapest
51.0%
Cooperation partners

Receiver Producers

- Wireless netcontrol
  - Dreieich
- Elster Messtechnik GmbH
  - Lampertheim
- LIC Langmatz GmbH
  - Garmisch-Partenkirchen
- Landis + Gyr AG
  - Zug/Swiss
- Prolan AG
  - Budapest/Ungarn

Operating company

- EFR GmbH
  - Munich
  - Coordination, consulting, project management
  - Central computer technology
  - System management

Transmission devices

- Telecom Company
  - Transmission technology
  - Maintenance of transmission devices

Service companies

- Installation companies
- Engineering companies
- Consulting companies
  - Sales support
  - Software development
  - Meter- and receiver installation
  - Fault-clearing service
Possible Long Wave Antenna in Florida?
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Smart-Metering-Concept

EFR radio link information transfer, time indication, fast load management

Backward channel

M-Bus

PLC

Meter data via RPLC, slowly
Thank you for your attention!

Contact:

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