Why Use Load Management

Load Management improves the Economic and Technical Operational Management of the Whole Electricity Network

Load Management is a:

Valuable Tools for Demand Side Management

Economic Advantages of Load Management

- Allows Flexible Tariff Structure
- Increases Profitability
- Influences the Customer Behaviour
- Optimises the Daily Load Curve, leading to a Reduction in Expensive Peak Energy
- Cost Reductions by Deferring Investment

Advantages of Load Management

Electricity Costs Reduced at Certain Times (Time of Day Tariff)

Reduced Consumption of Fossil Fuels

Reduced Dependence on Imports

Less Pollution

Technical Advantages of Load Management

Central Access to Consumer Groups

Complete Coverage with Coded Messages

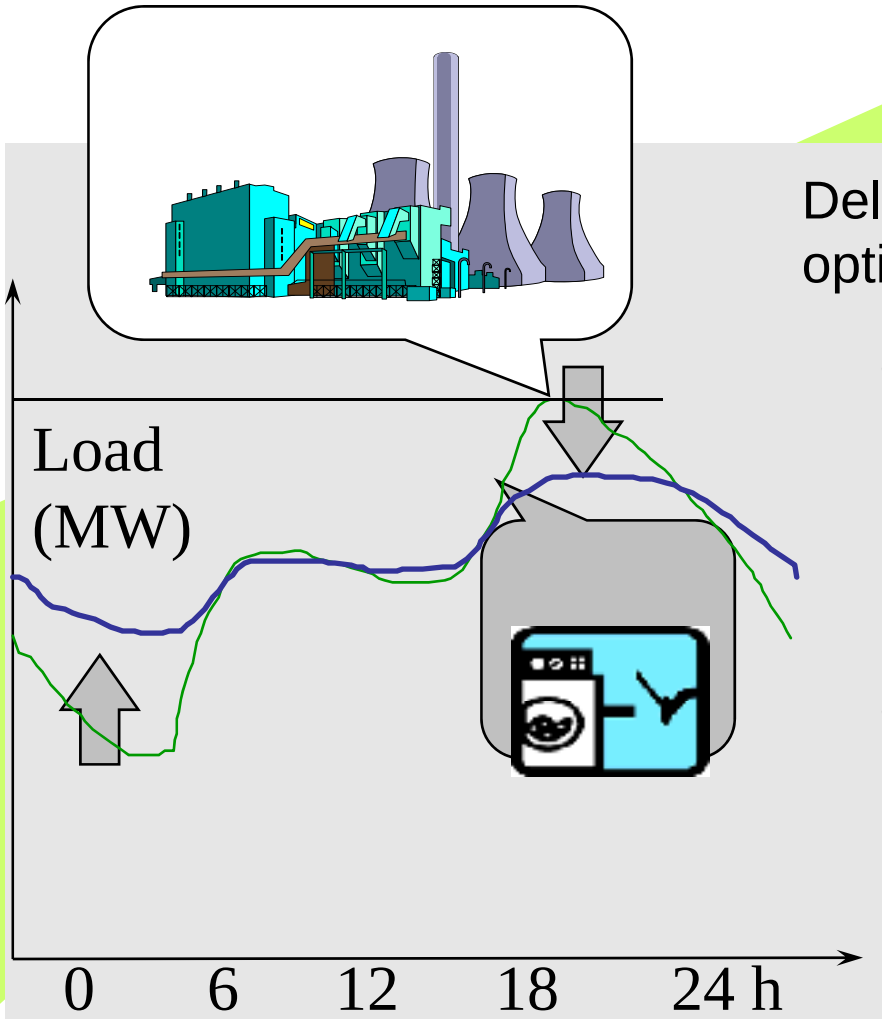
Load Shed before Network Collapse

Cold Load Pick-up

Economical Control of Objects

Reduces Technical Losses

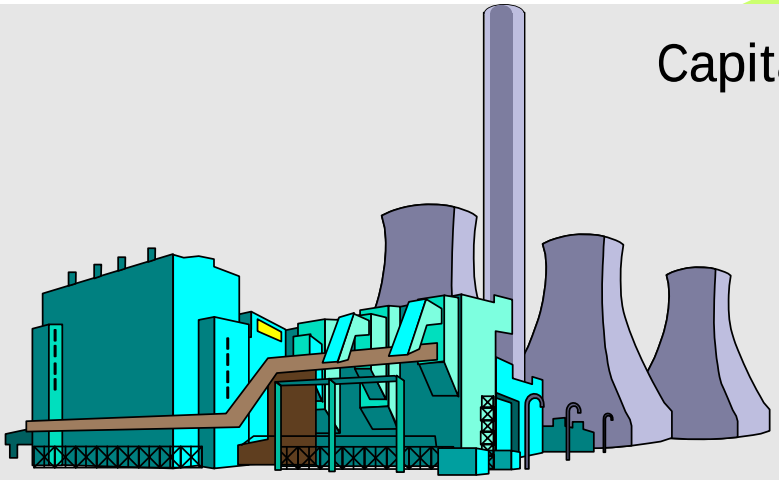
Customer Process Optimisation
Less Investment thanks to Negawatts



Delays / Savings in Investment by optimum use of existing Infrastructure

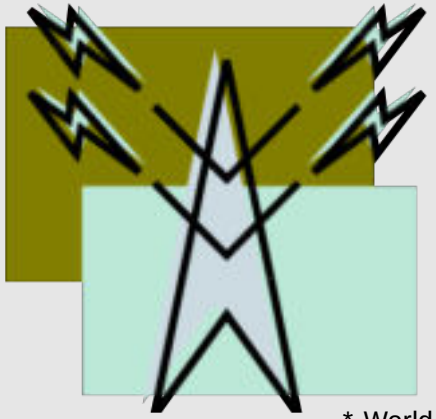
- **Energy Generation:**
  Megawatts
  - Base: 2.0 Mio $/MW
  - Peak: 0.75 Mio $/MW
- **Ripple Control:**
  Negawatts
  - 0.45 Mio $/MW
  - 2 … 5 times less investment

Cost of Additional Capacity



Capital Cost of Power Plants

- Nuclear* € 1,750/kW
- Coal fired* € 1,300/kW
- Gas fired* € 550/kW



Network Reinforcement € 200/kW

Total Cost € 1,950/kW [1)]

* World Nuclear Association: WNA Report: The New Economics of Nuclear Power 2005

1) for Nuclear plants

Cost of Additional Capacity

• Interest charges and amortisation Interest rate 8% Lifetime 30 years	€ 173.00
• Operation and Maintenance € 25/kWp.a	€ 25.00
• Fuel Buffer costing € 20/kW 10% of € 20/kWp.a	€ 2.00
• Network Operation and Maintenance € 4/kWp.a	€ 4.00
• Total [1)] /kW p.a	€ 204.00

Cost of Additional Capacity

Other Factors

- Power stations are build for 300+ MW
  Incremental cost € 600+ Millions.
- Network reinforcement made for 5+ MW
  Incremental costs € 1+ Million
- Power stations introduce more pollution
- New Power Plant needs 5 years to come on-line
- Local Capacity Problems need additional investment

Cost of Load Management

- Investment Costs of Injection Plant € 16.00/ a
- Investment Costs of Receivers € 8.00/ a
- Operating Costs € 20.00/ a
- Equivalent Annual Costs [1)] € 45.00/a

1) Source: Swistec Querdenker Edition 1/2004

Cost Of Load Management

Other Factors

- Injection plants are build to size
  Initial costs can be less than € 0,5 Million
- Network reinforcement not needed or can be deferred
- Load Management does not introduce pollution
- New Injection Plant needs less than 6 months to come on-line
- New Load Control can be added daily.
- Local Capacity Problems can be targeted locally
- Technical Losses can be reduced

Advantages of Load Management

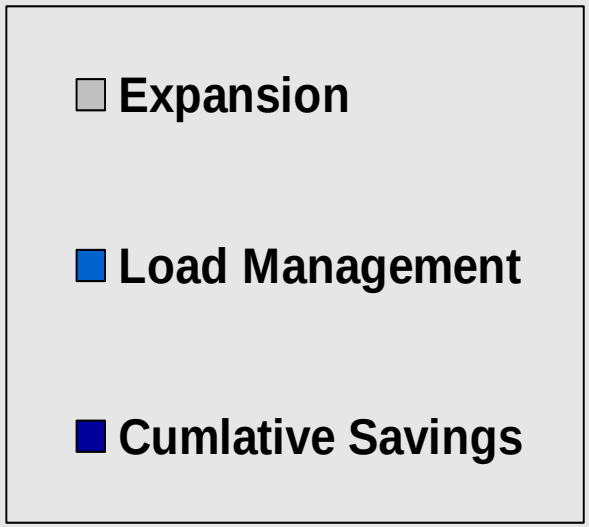
- Lower Annual Charges € 45.00 << € 204.00
- Faster Introduction
- Smaller incremental costs (one receiver)
  € 95.00 << Millions.
- No Pollution
- Improves Efficiency of existing Generation and Network
- Local Load Bottlenecks can be targeted

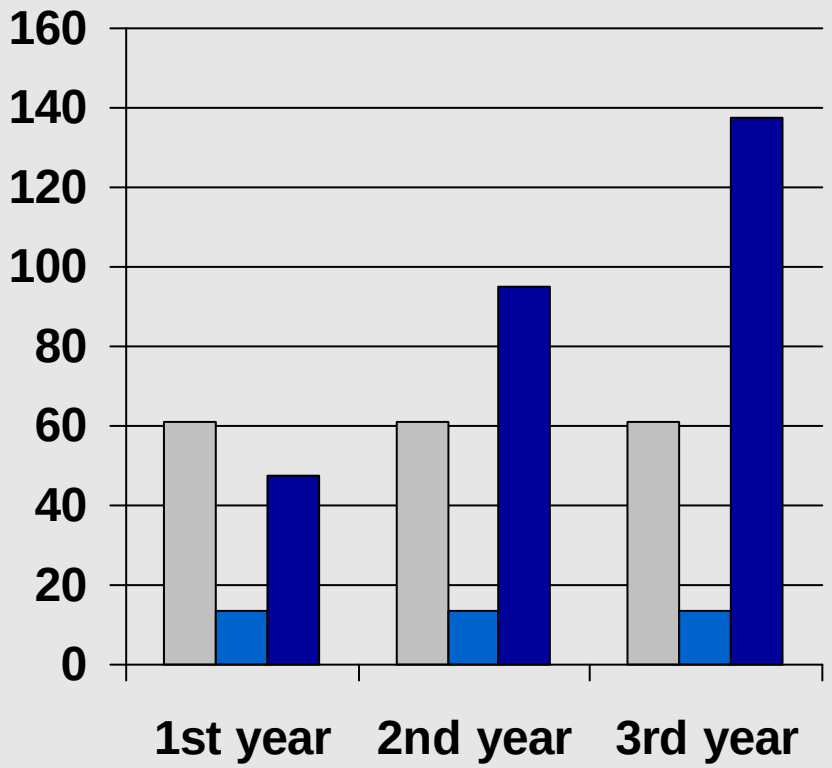
Cost Comparison

300 MW Expansion

Installing 30k Receivers per annum

Aver. load switched per receiver 1kW





Distribution Losses

Reduced Losses by increasing Load Factor

For same energy sales of 100MWh, losses for:

25MW for 4 hours = $Z * 25^2 \times 4 = 2500 * Z$ units

and for

50MW for 2 hours = $Z * 50^2 \times 2 = 5000 * Z$ units

Tariffs

Flexible Tariffs tailored to Customer Needs

Simple time changes without visit to site

Tariff changes due to energy suppliers, future holidays, life style changes, etc.

Uniform demand period reset

Interruptible tariffs

Dynamic tariffs

Tariff Examples

Night Tariff:

between 22:00 and 06:00 only for electrical storage heating

Block Tariff:

20h in 24 h

Interruptible Tariff:

Large customers reduce load voluntarily on receipt of a warning signal. Load reduction is evaluated later to calculate premium.

Dynamic Tariff:

Two or more tariff rates. Customer chooses to reduce load or pay more

Reducing the Peaks

- Hot Water Storage
- Storage Heater
- Air Conditioning Plants
- Stored Cooling Plants
- Local Generation
- Dual Heating
- Fresh and Waste Water Pumps
- Washing machines, Saunas, Swimming Pools, Filter Plants

Other Controllable Loads

Street Lighting

- Savings thanks to reduced lighting levels when traffic at a low level (01:00 to 04.30)
- Savings thanks to consistent lighting controlled from a central point

Capacitor Banks

- Savings thanks to control from a central point without expensive SCADA equipment

Automatic Reclosers

- Savings thanks to control of remote equipment which would need manual intervention

Traffic Signals

- Savings thanks program changes depending on different traffic patterns

Alarms

- Savings thanks broadcasts heard without radio/television

Case Story: Minnkota Power USA

Customer

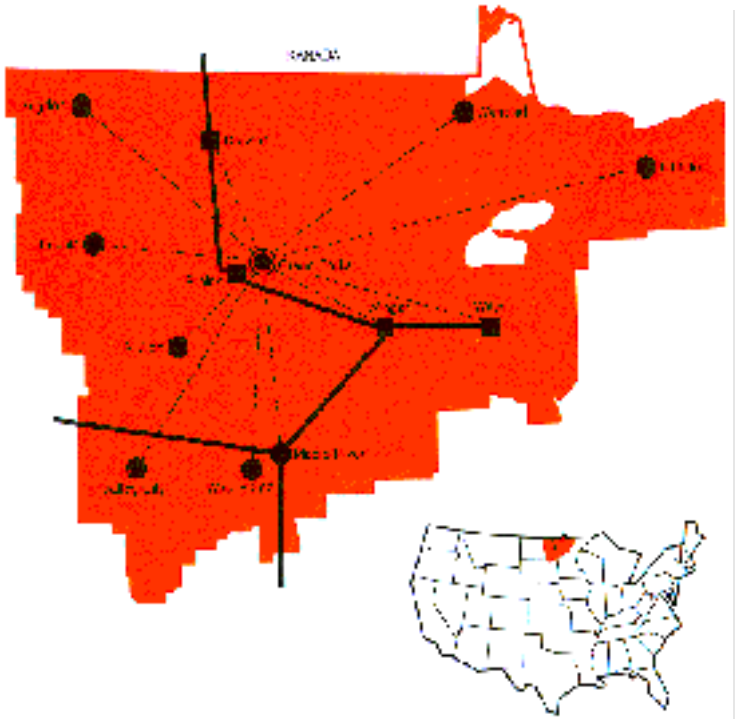
Market environment

Problem analysed

Solution

Investments

Customer’s benefit



Case Story: Minnkota PC / USA

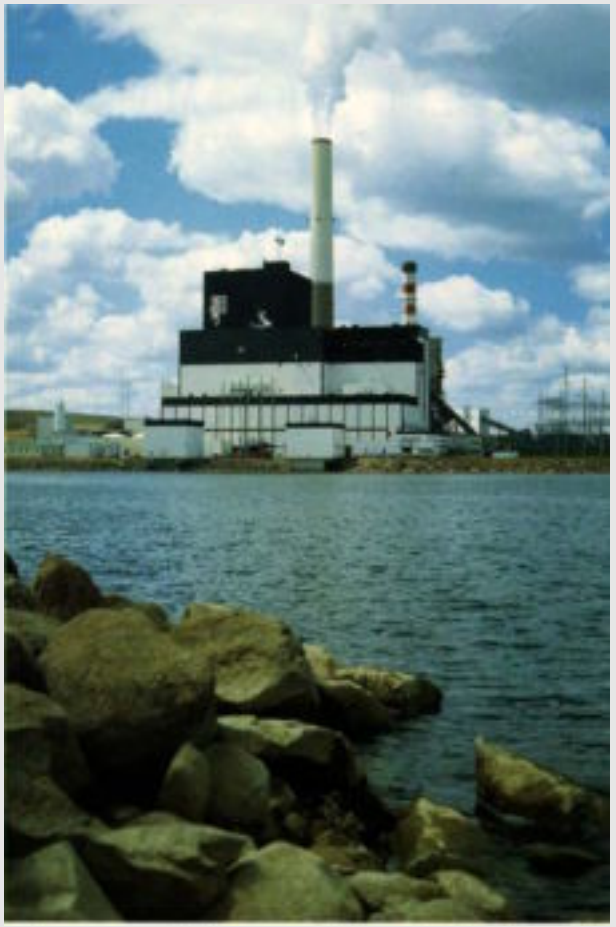
Customer

- Cooperative of 24 Electric Utilities
- Peak demand 750 MW
- Reduction of up to 340 MW in winter[1]
- 90,000 km^2 area
- Mixed fuel economy

Market environment

- Radio load management widely used
- Ripple control nearly unknown in USA

1 http://www.minnkota.com/Documents/AnnualReports/mpc_06_ar_final.pdf



Case Story: Minnkota PC / USA

Problem analysed

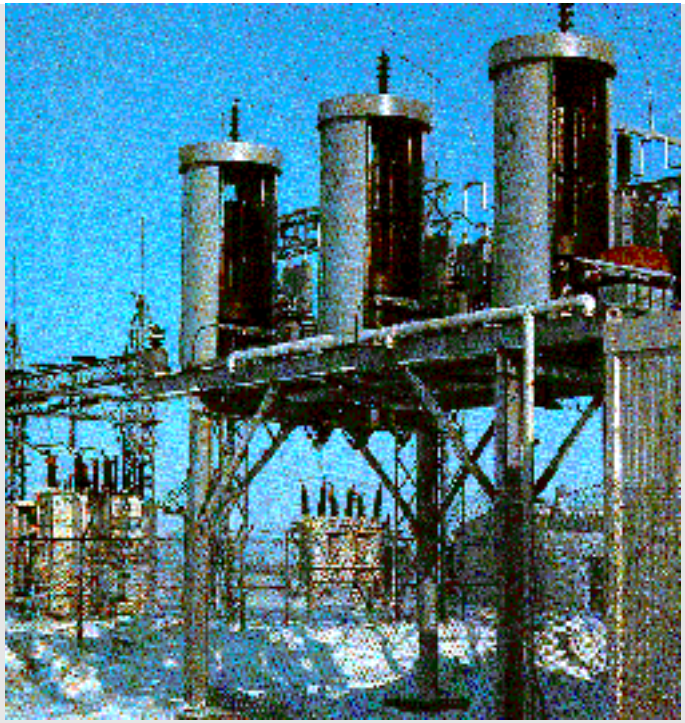
- Oil crisis in 1970's led to need for peak reduction
- System choices; Radio/Ripple or Wait

Solution

- Four 115 kV injection plants
- Nine 69 kV injection plants
- Integrated Control Centre with SCADA
- 40,000 receivers
- Two extensions at 69kV

Investments

- Total investments approx. $ 10 millions



Case Story: Minnkota PC / USA

Customer's Benefit

- Total savings over $ 80 Millions by 1994 due to reduced peak power purchases
- Increase income due to selling load reductions back as spinning reserve
- Unquantifiable fuel saving
- Pollution reduced (old power station closed)
- Pay-off period less than 3 years
- No new generation until 2000
- Internet platform for customer information

Case Story: EAC Nicosia / Cyprus

Customer

Market environment

Problem analysed

Solution

Investments

Customer's benefit

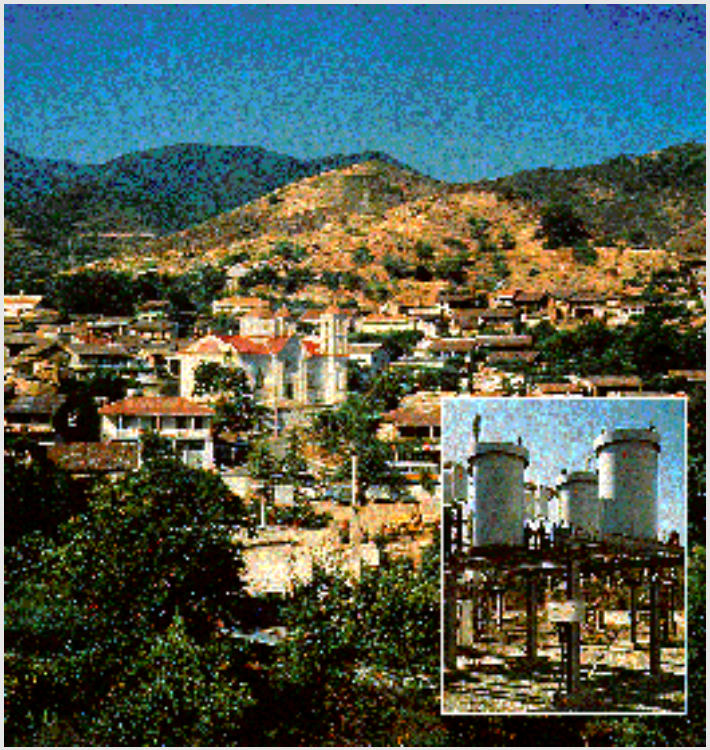
Case Story: EAC Nicosia / Cyprus

Customer

- Independent, non-profit-making Corporation
- Annual Turnover $ 200 Millions.
- 1,800 Employees
- Fuel Totally Imported

Market Environment

- World Bank Tender
- System for Whole Island
- Large Area under Turkish Occupation



Case Story: EAC Nicosia / Cyprus

Problem analysed

Energy saving project by consultants identified load management

Ripple control recommended over Radio and Mains Mark

Solution

Computer Controlled Central Station

Three 66kv Injection Plants

30,000 receivers

Two 132 kV Injection Plants (extension in 1992)

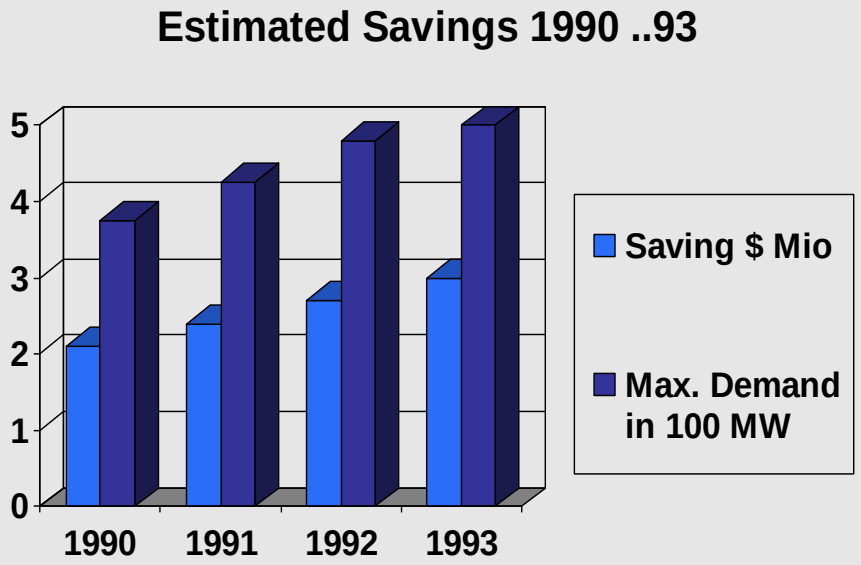
Investments

Total investments less than $ 4 Millions

Case Story: EAC Nicosia / Cyprus

Customer's Benefit

- Total savings over $ 12 Millions (first 10 years)
- Unquantifiable fuel saving
- Pollution reduced
- Pay-back period only 5 years



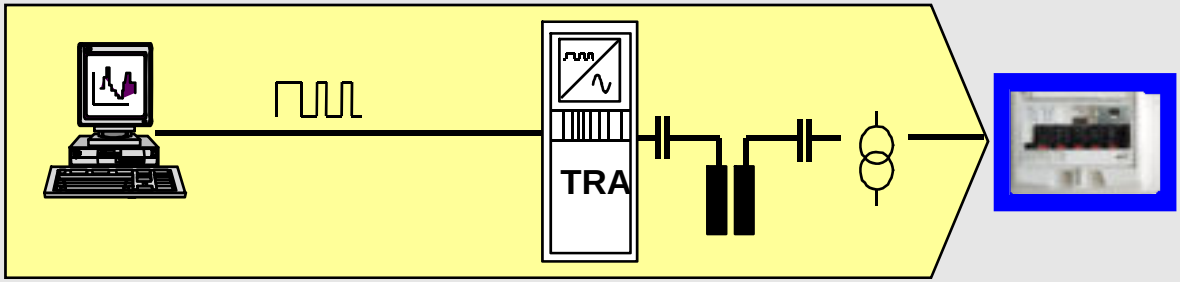
The two alternative ripple control principles

Ripple control is a broad-cast system to switch loads and tariffs.

The classic way:

Ripple control

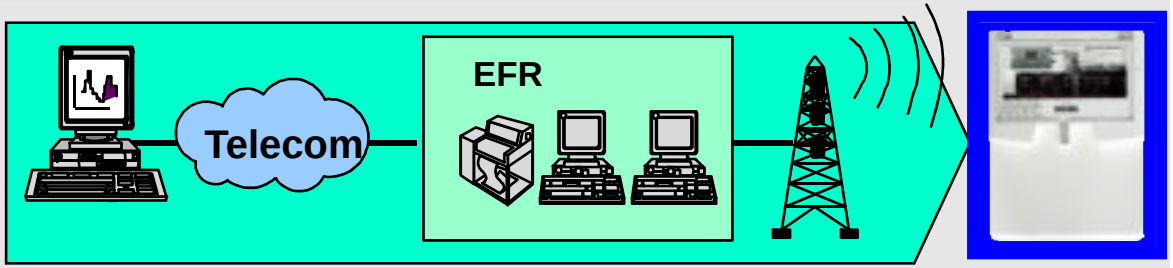
over Powerlines



The economical way:

Radio ripple control

by Radio



The **main applications** are:

- **tariff management** to break the load peaks and save investments
- active **load management** to break the load peaks and save investments
- **street lighting**

Why use the Conventional Ripple Control?

Benefits for our customers:

- **Lower initial cost** than radio ripple control system
- **Ideal for smaller systems**
- **Service area** well defined
- System size starting at **100 receivers**
- **Well proved** system
- Operates where **power line** connected

Controllers

Controller units

(placed in substation)

Type: RKS

Type: MPC

Transmitters

The seamless combination of robust power electronics and modern communications technology

Type: SFU-K (Enermet)

IGBT = Insulated Gate Bipolar Transistors

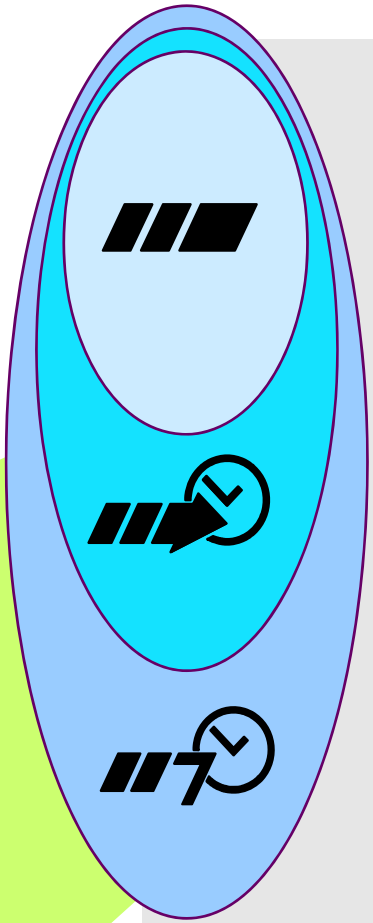
Coupling Products

Complete Coupling cells...

…for Indoor use up to 33kV

L+G Ripple Control Receiver

3 application profiles - 3 optimised solutions



BASIC:
Classic
Ripple Control

- Short introduction time due to reduced functionality
- Lowest cost

RCR 140

CHRONO:
Decentralised operation with true learn function, **Weekday Clock** & Transmitter outage detection

- Simple operation
- Increased operational security thanks to emergency functions

RCR 131 / 161

POWER:
Intelligent Receiver with **remote programming and calendar clock** maximum automation

- Greatest flexibility for new customised solutions in the liberalised market
- Time switch operation reduces loading of central

FTU

We have the complete portfolio and we are able to deliver at the right price!

Why use the RADIO RIPPLE CONTROL?

Benefits for our customers:

- **Ideal for large systems**
- **lower total cost** than traditional RCR system (see ew dossier 103)
- **no further investment** other than the receiver
- one long-wave transmitter is needed for an area of **400-500km radius**
- less than **100k receivers** are needed to set up a new transmitter
- **well proved** system working since 1996, today over 400'000 receivers installed in Germany
- operates also **underground** in cellars
- **no use of the power-line** for the data transmission

Radio Ripple Control Receiver from L+G

FTY263

FTY233

FTY262

FTY232

PROTOCOL

- Semagyr-TOP ®
- Versacom-TOP ®

129.1 kHz
135.6 kHz
139.0 kHz

Customer Segments

- Energy Management
- Street Lighting

The EFR-Service Provider

EFR (Europäische Funk-Rundsteuer GmbH, www.EFR.de)

is owned by E.On, EnbW and N-Ergie.

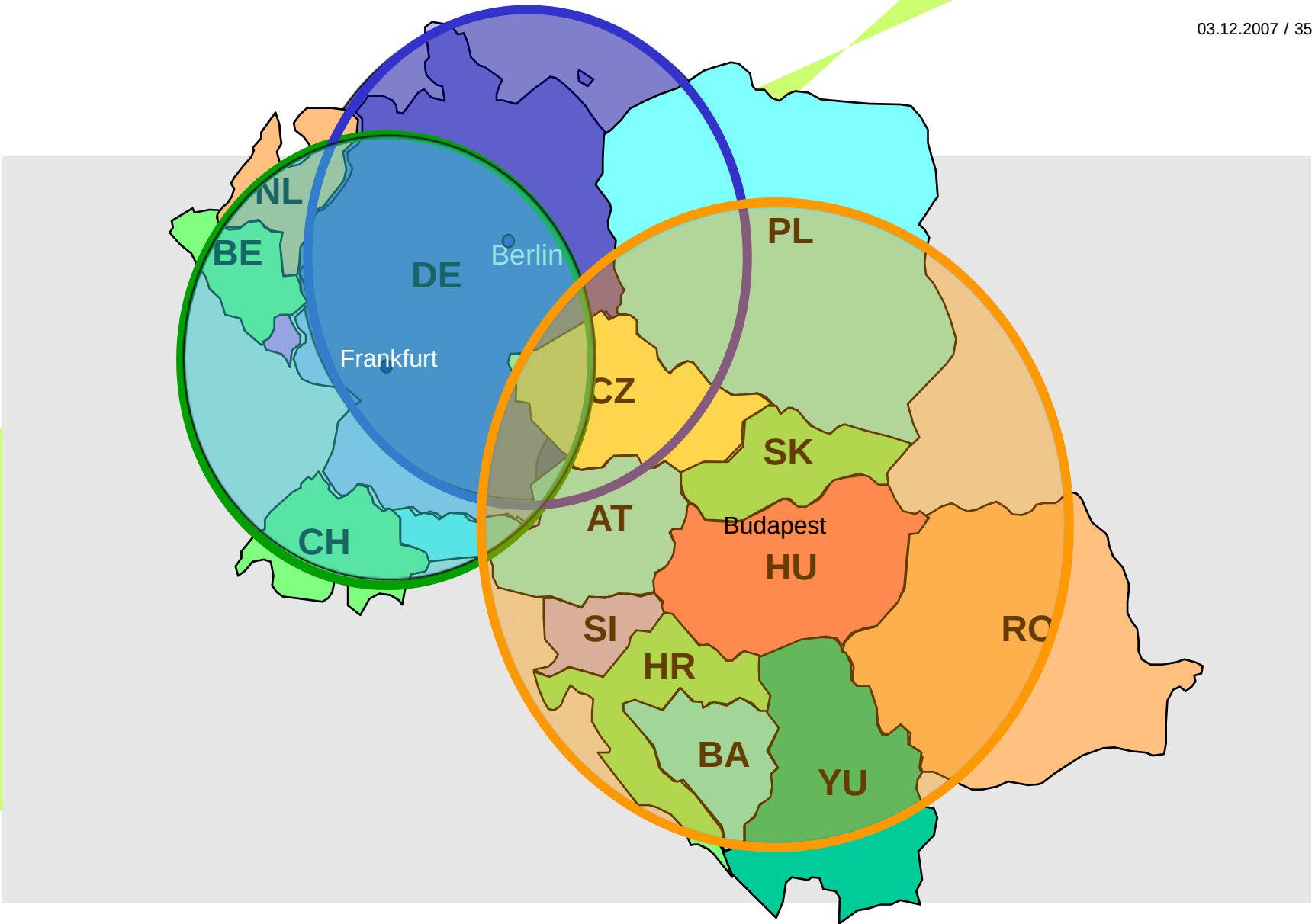
They create joint ventures in other countries.

Data of a typical transmitter:

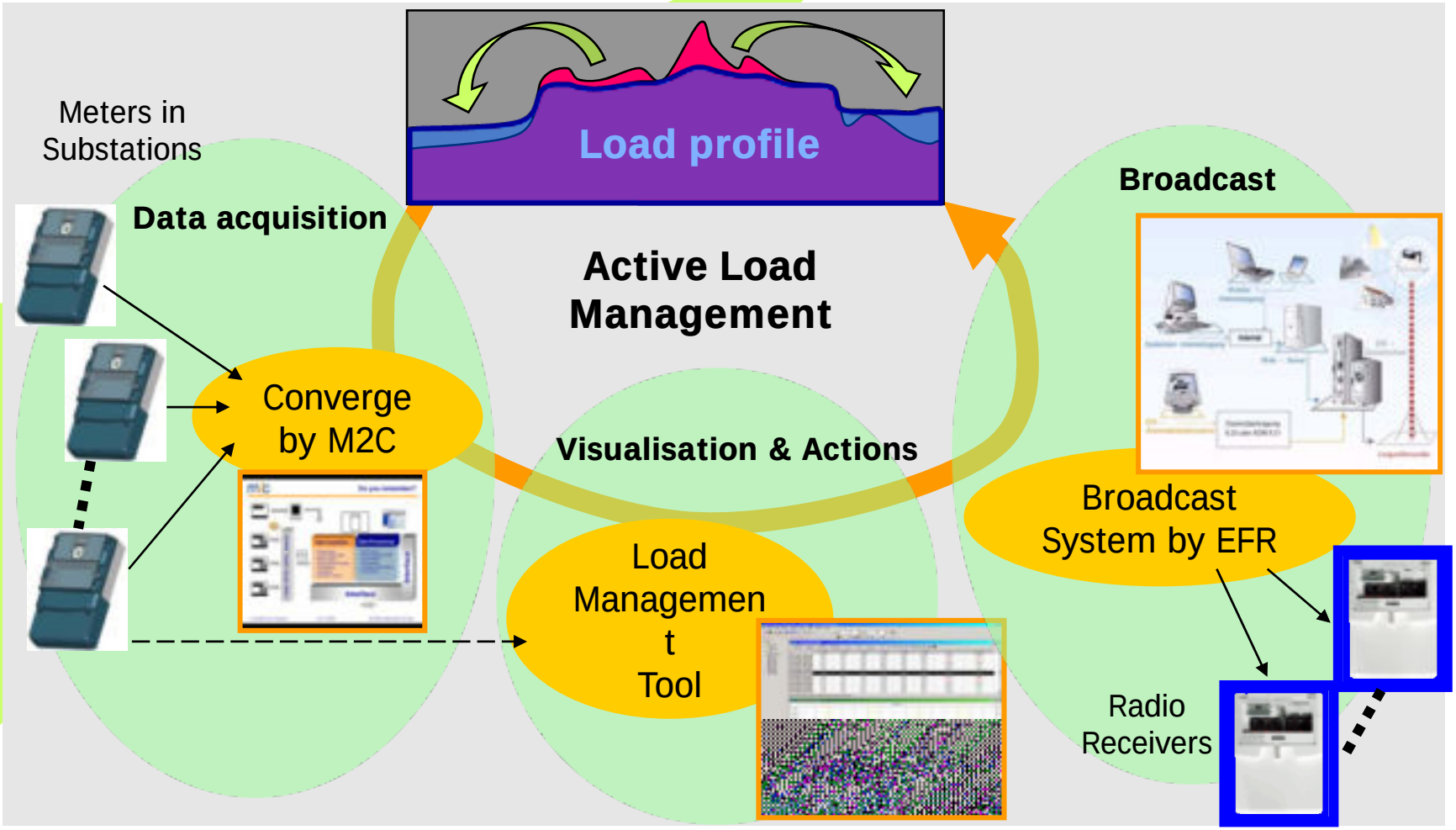
Antenna Mainflingen (Frankfurt)

Output:	**100 kW**
Frequency:	**129,1 kHz**
Modulation:	**FSK**
Operation time:	**24 h**
Hight:	**200 Meter**
Type of Antenna:	**T-Antenna**
Owner:	**Telefunken**
Time signal:	**app. 300 /h**

Reception areas 2006



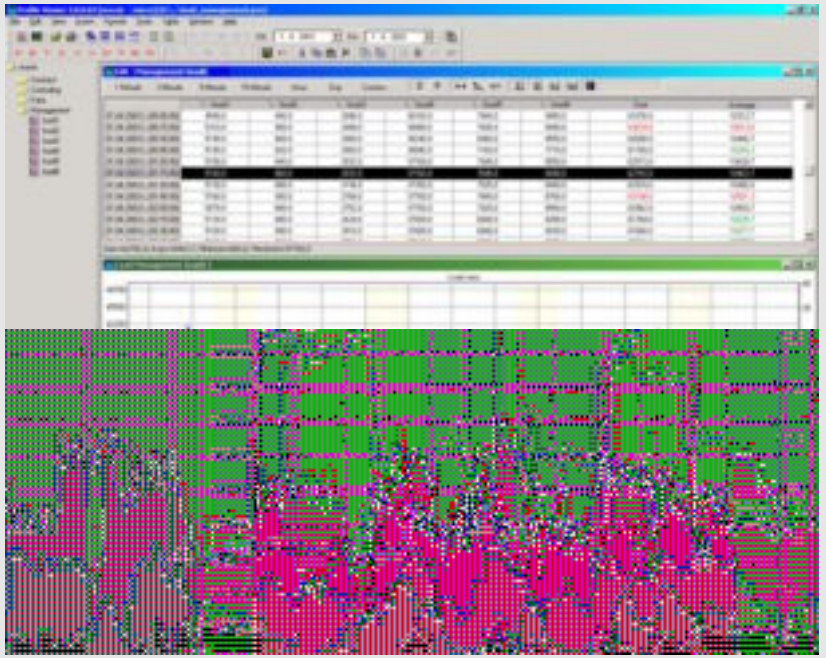
Active Load Management System with Ripple Control



Active Load Management with Ripple Control

Functionality:

- Real-time load profile
- DSM manual/automated
- Load profile (Presentation, Analysis)
- Load forecast
- Mathematical model
- Data import/export
- Meter data acquisition
- Connection to EFR



Consultancy, Project Definition und Project Management by Landis + Gyr with Partners