9 Session 7: Energy Saving Performance Contracts: Forms and Financing Options

Overview of Activities Related to Energy Efficiency Improvement in Finland.

Presenter: Mr. Jorma Pietilainen. VTT, Finland.
**Title:** Energy Saving Performance Contracts: Forms and Financing Options

**Performing Organization:** Carrier Corp.

**Supplementary Notes:**

**Distribution/Availability Statement:**
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THE MOST IMPORTANT DECISION MAKERS, FINANCERS AND PERFORMERS OF RESEARCH IN THE PUBLIC SECTOR

Parliament of Finland

Science and Technology Policy Council of Finland

Council of State

Ministry of Education

Ministry of Trade and Industry

National Technology Agency (Tekes)

Other ministries

Sitra

Other research institutes

Universities

Motiva

Global \( \text{CO}_2 \) emissions (\( \text{M} \text{tCO}_2/\text{a} \)) 1900-2100

Birth of global market

Collapse of communism

Kyoto climate conference

Oil crisis

World wars I and II

Annex I countries

Non Annex I countries

WEC perspectives to 2050 and beyond
Environmental threats:

Energy Conservation Programme

- Launched in 1992
- Revised and intensified in 1995
- Intensified in 2000
  (as a part of preparing the National Climate Strategy)
- Updated 2002
The key elements of Energy Conservation Programme:

- Development and commercialisation of energy efficient technology
- Economic means of steering
- Building regulations (e.g. new EU Directive)
- Voluntary energy conservation agreements
- Energy audits and ESCO activities
- Information, training and motivating activities
Technology program themes, and development activity focuses and application areas

Themes:
- ICT
- energy
- lifecycle

INNOVATIONS INTERNATIONALITY
LIFECYCLE MANAGEMENT
- economy, sustainable development, environment
- energy use, commissioning

PROCESSES AND SERVICES
- networking, CRM, partnership
- implementation, use, maintenance, development

SYSTEMS
- ICT platforms, reporting real estate
- other technical systems, components, materials

Advanced, modern lifecycle economical, functional premises for users and owners

Application areas
- Working premises, conditions and services
- Housing
- Services and technology
Objectives by focus area and application

Development application areas

- Work premises
  - Lifecycle economic, competitive, productive work environments with good services
- Housing premises
  - Lifecycle economical, functional, secure and pleasant living environments

Development focus areas

- www.tekes.fi

Lifecycles management

Methods used to define lifecycle attributes, set standards and identify compliance with standards

Systems
Building services products enabling the required conditions and services for premises

VTT IN BRIEF

Units:

- VTT Electronics
- VTT Information Technology
- VTT Industrial Systems
- VTT Processes
- VTT Biotechnology
- VTT Building and Transport
- VTT Information Service
- VTT Corporate Management and Services

Staff: 3 012

- Turnover: 214 M€
  - Basic govern, funding to R&D on VTT's own initiative 84 M€
  - Jointly funded projects 92 M€
  - Commercial activities 38 M€

Staff by location:

- Oulu: 323
- Oulu: 37
- Jyväskylä: 12
- Tampere: 2 150
- Espoo: 21
- Total: 3 012
Support for National Climate Strategy

VTT has prepared a report for the Finnish Ministry of Trade and Industry on the technological development outlook for the control of greenhouse gas emissions. The report is intended to support decisions concerning the National Climate Strategy.

VTT has also participated in studies of the economic effects of reducing greenhouse gas emissions.

Development of Low-energy houses

Heating energy consumption less than half of conventional buildings => reduced emissions

Good indoor air and demand controlled, i.e. adjustable ventilation

Reduced life-cycle costs
Tools for managing life-cycle costs and environmental requirements

- VTT Building Technology has developed tools for calculation of life-cycle costs and for management of environmental requirements, such as a method for classifying life-cycle cost calculation methods, a system for assessing the life-cycle costs of technical systems and EcoProp system for management of environmental requirements.

- EcoProp can be used to numerically define the performance characteristics and environmental characteristics of a building on the basis of the needs of the property owner and occupants, and design solutions can be developed to meet the set targets; the inclusion of life-cycle costs quickly reveals whether the desired level of requirements is in conflict with the cost targets.
PromisE - environmental classification for buildings:

- **Human Health**
  - Ventilation: 35%
  - Other Indoor Air Risks: 15%

- **Use of Natural Resources**
  - Moisture Risks: 30%
  - Emissions from Materials: 35%

- **Ecological Consequences**
  - Emissions from Materials and Finishing Material Types: 20%
  - Other Indoor Air Risks: 10%

- **Environmental Risk Management**
  - Ventilation Rate: 20%
  - Procedures for Avoiding Moisture Damages: 50%
  - Procedures for Identifying Structures with Moisture Damage Risk: 50%
  - Emissions from Materials and Finishing Material Types: 100%
  - Radon: 20%
  - Outdoor Noise: 40%
  - Outdoor Air Pollution: 40%

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VIT Building and Transport

- **Human Health**
  - Heating Energy Consumption: 35%
  - Electricity Consumption: 25%

- **Use of Natural Resources**
  - Energy Management Procedures: 40%

- **Ecological Consequences**
  - Water Consumption: 50%
  - User Specific Measurement and Invoicing: 50%

- **Environmental Risk Management**
  - Service Life Design: 20%
  - Adaptability: 40%
  - Procedures for Systematic Maintenance Planning: 40%
OIWA, web-based O&M Manual

- Up to date information to all partners
- User feedback and maintenance history utilised continuously
- Transparent QA

User Interface for House Manager

Feedback from clients and their handling

Situation of maintenance tasks
Thermography in building commissioning

Moisture problems in the concrete sandwich panel
VTT develops effective tools for Energy

- Monitoring & Targeting
- Benchmarking
- Analysing
- Auditing
- Assessment
- Feedback
- Motivation

Monitoring = Basis for Everything!

- Reliable consumption data forms the basis for energy retrofitting and saving measures
- Verification of implemented saving measures is impossible without reliable consumption figures:
  😊 Energy Saving = Baseline Energy Use – Post Installation Energy Use

- Monitoring can be used to implement the Building Energy Certification schemes (see Energy Star of EPA/USA)
- Feedback for M&O personnel is the key (basis for motivation, training etc.)
- Statistics, etc. information, decision makers, designers, users, owners, authorities etc. etc. must be produced too
Support for several languages

- English, German, French, Italian, Greek, Swedish, Polish, Czech, Estonian

More professional tools for big organisations:

like Portable Bar Code Scanner

for effective meter reading and data collection e.g. in the Ministry of Defence in Finland!
Data from Existing Utility Meters

can be utilised effectively!

“Anomalies” can be found easily...

...and wasters, leakages, abnormal consumptions, etc. can be detected immediately.
Modern ICT will be utilised in collaboration with Finnish companies!
Power Quality Monitoring

Online monitoring
- Active, reactive and apparent power
- Voltage
- Current
- Frequency
- Harmonic distortion
- Zero and negative sequence components
- DC voltage component
- Power factor
- And more...

Enviromental monitoring system of VTT

Continuous assessment and improvement of activities
e³Portal:

☆ energy
☆ economy
☆ environment
Energy Management Strategies

Long Term Energy Management
Improving the energy efficiency by investing to the new technologies

Short Term Energy Management
Effective O&M of the existing techniques in Bldy

State of the Art

Setting Long Term Targets

Consump.
Monitoring

Targets for monthly consumption

Reasons for Anomalies

M&O improvements and feedback activities

Planning and implementation of retrofits

Analysing of Results

© Motiva

Energy Information and Benchmarking

ePortaalin tuotannon raportoin solamisen edellyttää kirjanmutusta.
Kirjanmutta edellyttää otokot on erotettu sensilla nuudelis ( ).

Kuinka mukaan ylennän:

Kysymykset:

Tulos:

OK


© JT
Benchmarking - an effective tool
Specific Consumption of Energy in some Schools of Helsinki

<table>
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<th>Total cons. year 1999 (kWh)</th>
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for Best Practice Dissemination!

Benchmarking Services:

Specific Consumption of Heating in selected Schools (kWh/m³)
School n:o 12 (ranking 54/64)
Specific Cons. (kWh/m³) in Schools according to the year of construction

Energy Auditing

Energy auditing is a process that assesses the energy performance of a building or system. It involves the identification and analysis of energy waste and inefficiencies in the building's design, operation, and maintenance. The goal of energy auditing is to improve energy efficiency and reduce energy costs.

Energy auditing typically follows these steps:

1. **Energy consumption analysis**: This involves measuring and analyzing the energy used by the building or system. This step helps to identify areas of high energy consumption.
2. **Energy performance evaluation**: This step involves comparing the building's energy performance to energy standards or benchmarks. This helps to identify opportunities for improvement.
3. **Energy conservation measures**: Based on the findings of the energy analysis, specific conservation measures are recommended. These measures can include retrofits, upgrades, and operational changes.
4. **Implementation and monitoring**: After implementing the conservation measures, the energy performance of the building is monitored to ensure that the expected savings are realized.

Energy auditing is a valuable tool for organizations looking to reduce their energy costs, improve their environmental impact, and enhance their building's value.

Diagram:

- Specific Cons. (kWh/m³) in Schools according to the year of construction

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Motiva is an impartial service organisation promoting a market for renewable energy sources and efficient energy use.
Business Idea

Motiva implements
- the National Climate Strategy,
- the Energy Conservation Programme and
- the Action Plan for Renewable Energy Sources

by activating the market for energy conservation, energy efficiency and renewable energy sources.
What is an Energy Audit?

- With energy audits we mean a systematic procedure in existing buildings/sites/objects where the purpose is to
  - evaluate the existing energy consumption
  - identify the energy saving potential and find the potential of renewable energy sources
  - report and make detailed saving proposals

Energy auditing in Finland

- Energy saving potential
- Environmental requirements
- Kioto Protocol
- Government subsidies for energy auditing
  - Motiva Auditing Models
- Implementation of renewable energy sources, energy efficient technology and efficient energy use.
Subsidy policy

- Energy Auditing is voluntary
- Following the Audit Guidelines given by Motiva and MTI entities the client to apply for audit subsidies
- The subsidy is specified yearly
- In 2002 the subsidy is 40% of the approved auditing costs
- Subsidies for energy saving investments are available for companies etc. In Voluntary Agreements

Profitability of the proposed energy savings measures in the 1265 buildings reported during period 1996-2001 (total 8.0 milj. €)
Audit I project and Audit 1999 Conference

Motiva co-ordinated the first European level study on energy auditing during years 1998-2000. This SAVE II Programme project "Energy Audit Management Procedures (AUDIT)" was implemented in co-operation with IPE (Norway) and CIREN (Greece), also involved in energy auditing at national level.

The Final Report presents the first theories on energy auditing as well as national experiences on all Member States. Some 1000 copies of the Final Report have been downloaded from over 40 countries since the report was published in March 2000.

(AUDIT - Energy Audit Management Procedures, SAVE II Programme, Final report, draft) [Link]

Parallel to the AUDIT project Motiva hosted the first international conference on energy audits, AUDIT '99, in October 1999 in Finland.

Audit II Project

(April 2001 – March 2003)

The Goals

The AUDIT II project is the second comprehensive study on energy auditing in the Member States. The first study was carried out in 1998-2000. The main aim of the AUDIT II project was to start-up long-term and continuous EU-level co-operation in the area of energy auditing and broaden this co-operation to cover also the Central and Eastern European Countries as the second step. The main aim was to be met by the following project phases:

- Update the recently concluded analysis of Member State energy audit programmes (AUDIT project)
- Analyse horizontally (5 crucial topics e.g. auditors' software, training programmes, audit models) the collected information on the national energy audit programmes in order to find the replicable elements, ideas and concrete auditing tools already in operational use or under development within in existing programme schemes
- Explore the existing potential organisations in order to find a functional home base for a network of existing energy audit institutions
- Propose the basis for the future network

[Further details not visible in the image]
The Guidebook for Energy Audit Programme Developers

Guidebook for Energy Audit Programme Developers

The Guidebook for Energy Audit Programme Developers

The Topic Reports

TR Monitoring and Evaluation: Published September 2002
(AUDIT II Topic Report, pdf, 221 kb)
TR Energy Audit Models: Published April 2003
(AUDIT II Topic Report, pdf, size 209 kb)
TR Training, Authorisation and Quality Control:
UPDATED September 2002
(AUDIT II Topic Report, pdf, size 241 kb)
TR Auditor's Tools: Published August 2002
(AUDIT II Topic Report, pdf, size 335 kb)
TR Implementing Instruments: Published September 2002
(AUDIT II Topic Report, pdf, 230 kb)

The Country Reports, Group I

CR Austria: Published August 2002
(AUDIT II Country Report - Austria, pdf, 264 kb)
CR Belgium: Published September 2002
(AUDIT II Country Report - Belgium, pdf, 247 kb)
CR Denmark: Published September 2002
(AUDIT II Country Report - Denmark, pdf, 245 kb)
CR Finland: Published May 2002
(AUDIT II Country Report - Finland, pdf, size 1.1 MB)
CR France: Published May 2002

AUDIT II

Country Report
GERMANY
(Draft Version)

Michael Sattler
Tools for auditors (Motiwatti-software, manuals etc.)

Profitability of the proposed energy savings measures in the 1265 buildings reported during period 1996-2001 (total 8,0 milj. €)
Implementing energy saving measures and investments

- Short pay-back times
  - audit customers normally implement and finance energy saving investments by themselves

- Longer pay-back times
  - suitable for ESCO companies
    - agreement periods normally 2...6 years
    - ESCO is responsible for the whole saving project (financing, saving guarantees, contracting, follow-up...)

Motiva's role promoting ESCO-business in Finland

- Energy users
  - Energy saving potential
  - Implementation plans

- Professionals for energy efficiency
  - Energy auditors
  - Energy producers

- ESCO's
  - Marketing
  - ESCO-deals
  - Supports

- Producers
  - Energy efficient products
  - Systems

- Ministry of Trade and Industry
  - Investment supports
ESCO-project register

- Target to promote ESCO-business
  - Contact information
  - Description of different kind and size of ESCO-projects
  - Following the ESCO-business volumes

- beginning: spring 2003

Situation in 9.6.2003

- Information got from three ESCO's
- Total number of projects 25
- Estimated total energy savings
  - Steam 42 400 MWh/a
  - District heat 18 400 MWh/a
  - Electricity 2 500 MWh/a
- Renewables
  - 220 MWh/a oil replaced by wood pellets
  - Electric heating replaced by heat pumps
Project examples

- heat recovery from industrial ovens
- heat recovery from exhaust air in industry
- improving the efficiency of a turbine
- replacing electric heating by heat pumps
- improving the control of a cooling systems in ice halls
- optimizing ice thickness in ice hall
- heat recovery from HVAC
- oil replacement by wood pellets
- many different heat recovery project in industrial processes

International collaboration, like IEA Annex36
Annex 40 (http://www.commissioning-hvac.org)

Commissioning of Building HVAC Systems for Improved Energy Performance
Annex 40
A research project within the framework of
The Energy Conservation in Building and Community Systems (ECBCS)

Energy Conservation in Building and Community Systems (ECBCS)
Program of the International Energy Agency (IEA)

Partnership and networking

Partners focus on their core expertise

Customer = Building owners and users focus on their core business and thus improve
- user friendliness
- operating conditions
- energy efficiency
- comfort
- productivity
- user service

Building service suppliers = Total accountability for building services
- good indoor environment
- healthiness
- information technology
- safety
- adaptability
- energy efficiency
- reportability

Cooperation
- partnership
- model agreements/game rules
- shared benefits
- lifecycle economics
- needs/conditions
- environmental friendliness
- image

Real estate industry expertise
Professional
The City of Espoo will purchase a functioning entity

- Efficient and diverse services
- High-quality productive conditions
- Elegant functioning design

The client’s process
Kuninkaantie Senior High School

First public and private sector partnership project in Finland

The City of Espoo:
• purchases maintenance and user services from the project company
• pays only for services provided
• 28-year collaboration model, 25-year service agreement
• with the objective of transferring an optimum amount of project risks from the city to the private service provider

Service production to be launched in the autumn of 2003.
Agreements and contracts

City of Espoo
- Service Agreement
- Partnership Agreement

Project Company ARANDUR Ltd
- Sub-contracting Agreements

Partners
- NCC Finland Ltd
- Stedexho Ltd
- ABB Ltd

Financing company ABB Credit Ltd
- Land Rental Agreement
- Agreement on Purchasing Rights
- Rental Agreement
- Payment Agreement

Contractors
- NCC and ABB

Sub-contractors
- NCC, Stedexho, ABB, ICL Invib, Elisa Communications

Thanks for your attention!
Thank you for your attention!

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Veli Mottonen (www.vtt.fi):
Pekka Huovila (www.vtt.fi):
Energy Savings Performance Contracts - Vehicles and Financing Options

Presenter: Mr. Buster Barksdale, SAIC

Contract Vehicles for Energy Contracting
Agenda

- Performance Contracts
- Contract Vehicles
- Financing

8 Oct 03  Facilitating Teaming  2

Performance Contracts

- ESPC
- UESC
- GSA

8 Oct 03  Facilitating Teaming  3
Retrofit Costs per Contract Option

ESPC

Utility Contract

Minimum

Proposal
Performance Guarantee
M & V

Maintenance

Cost of Money

Analysis
Equipment Installation Engineering

Lease/Purchase

8 Oct 03 Facilitating Teaming

Contract Vehicles

- USACE
- DOE
- GSA

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Contract Vehicles

USACE

- Types
  - 4 State
  - 46 State
- Access
  - USACE with basic funding
- Advantages/Disadvantages
  - Large Experienced Staff
  - Understands Army
  - Ties into USACE Infrastructure
  - Costs most to Installation
  - Slow Execution

8 Oct 03

Facilitating Teaming

USACE Contracts

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8 Oct 03

Facilitating Teaming
Contract Vehicles

DOE

- Types
  - Regional
- Access
  - Local CO
  - DESC
  - Other CO
- Advantages/Disadvantages
  - Lower Cost
  - Flexible Execution Through any CO
  - Faster Execution
  - Does not Speak Army
  - Need Facilitators

8 Oct 03  Facilitating Teaming  8

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8 Oct 03  Facilitating Teaming  9
## DOE ESPC

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## Contract Vehicles

**GSA**

- Types
  - Basic Schedule
- Access
  - Local CO
  - GSA Dallas Specialized CO
  - Other CO
- Advantages/Disadvantages
  - Fastest Execution
  - Least Cost
  - No Technical Support
  - Lack of Contract Vehicle Familiarity
  - Needs Facilitator

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Contract Vehicles
GSA

- ID/IQ Contracts offering a Wide Range of Products and Services at Commercial Prices
- Best Value
- Commercial Practices
- Contractors may team with other Schedule contractors to offer a Total Solution.

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Contract Vehicles
GSA

- Simplified Ordering Procedures
- Flexibility
- Maximum Order Provisions
- Price Reductions
- Blanket Purchase Agreements
- Teaming
- Purchase Card
- Socio-economic goals

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UESC

- A vehicle for developing, financing, and implementing comprehensive energy/water-conservation projects for federal facilities
- Utilities provide up-front project funding and agencies pay for the services over time on their utility bills
- Utilities have a long-term interest in their customers, and that's helped us get great deals that meet our needs.

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UESC

- Financing
- Minimizes time and resources required for procurement
- One-stop shopping for turnkey project
- Dealing with known entity
- Payment through utility bill
- Flexibility in contract terms
UESC

10 USC 2865 and 2866

- May enter into "sole source" procurement from gas or electric utilities to design and implement cost effective demand and conservation services
- May implement projects with a positive Net Present Value (measured over a period of 10 years or less)
- Can count water cost savings in their economic analysis

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Financing

- 3rd Party
- BPA
- Lease
- Enhanced Use Lease

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Summary

- Plenty of Options
- Need Facilitators Regardless of Option
- New Guidance will Help Process

8 Oct 03  Facilitating Teaming  18