

CLEEN

Cluster for Energy and Environment

Strategic Centre for Science, Technology and Innovation
Energy and Environment
CLEEN Oy

Tommy Jacobson
CLEEN Oy

4th of November, 2009

CONTENTS

CLEEN Oy - SHOK for Energy and Environment

- Introduction
- Objectives and emphasis
- Operations
- Programmes

CLEEN

Cluster for Energy and Environment

Limited Liability Company (reg. 16.7. 2008, own equity 2.5 M€)

Unique set of shareholders (28+15)

New practises in wide cooperative research

Governmental mandate (SHOK-status)

Extensive resources, experience and knowhow

Continuity

OBJECTIVES

CLEEN OY

- ⇒ Wide cooperation between industry and research institutes
- ⇒ Enhanced industrial guidance of fundamental research
- ⇒ Transfer of knowhow from research institutes to industry

- ⇒ Novel methods to develop and execute joint research activities

SHAREHOLDERS

CLEEN OY

Companies (28)

ABB Oy
Fortum Oyj
Foster Wheeler Energia Oy
Helsingin Energia
Kemira Oyj
Kuusakoski Oy
Lassila & Tikanoja Oyj
Metso Oyj
Neste Oil Oyj
Stora Enso Oyj
Vaisala Oyj
Wärtsilä Finland Oy
Vattenfall Verkkö Oy
ÅF-Consult Oy

Andritz Oy
Ekokem Oy Ab
FCG Planeko Oy
Gasum Oy
Hollming Oy
Kumera Oy
Outokumpu Oyj
Outotec Oyj
Pohjolan Voima Oy
Rautaruukki Oyj
The Switch Engineering Oy
UPM-Kymmene Oyj
Vantaan Energia Oy
Vapo Oy

Research Organisations (15)

University of Helsinki
University of Jyväskylä
University of Joensuu
University of Kuopio
University of Oulu
University of Vaasa
Åbo Akademi University
Helsinki University of Technology
Lappeenranta University of Technology
Tampere University of Technology
Finnish Forest Research Institute
Finnish Environmental Administration
Finnish Meteorological Institute
Centre for Metrology and Accreditation
Technical Research Centre of Finland

BOARD OF DIRECTORS

CLEEN OY

Directors (7+2)

Kimmo Forsman (ABB Oy), chair
Mikko Hupa (Åbo Akademi University)
Kari Larjava (VTT)
Markus Lehtonen (Helsingin Energia)
Lars-Peter Lindfors (Neste Oil Oyj)
Petra Lundström (Fortum Oyj), vice chair
Matti Rautanen (Metso Oyj)
Antero Vattulainen (Kuusakoski Oy)
Christoph Vitzthum (Wärtsilä Oyj)

Deputies

Pekka Erkkilä (Outokumpu Oyj)
Jarmo Partanen (Lappeenranta Technical University)
Riitta Keiski (University of Oulu)
Jari Niemelä (Pohjolan Voima Oy)
Marjaana Luttinen (Stora Enso Oyj)
Arto Nivalainen (Lassila & Tikanoja Oyj)
Arto Hotta (Foster Wheeler Energia Oy)
Matti Vattulainen (Ekokem Oy Ab)
Ari Meskanen (Vaisala Oyj)

INSTRUMENTS

CLEEN OY

Strategic Research Agenda(SRA)

- ⇒ Objectives
- ⇒ Scope
- ⇒ Focus
- ⇒ Shareholders guidance

Research Programmes

- ⇒ SRA realisation
- ⇒ Consortium's targets, resourcing and commitment
- ⇒ Co-operation and networking

Practices and Processes

- ⇒ Programme development and execution
- ⇒ Shareholder value and guidelines

STRATEGIC RESEARCH AGENDA

CLEEN Oy

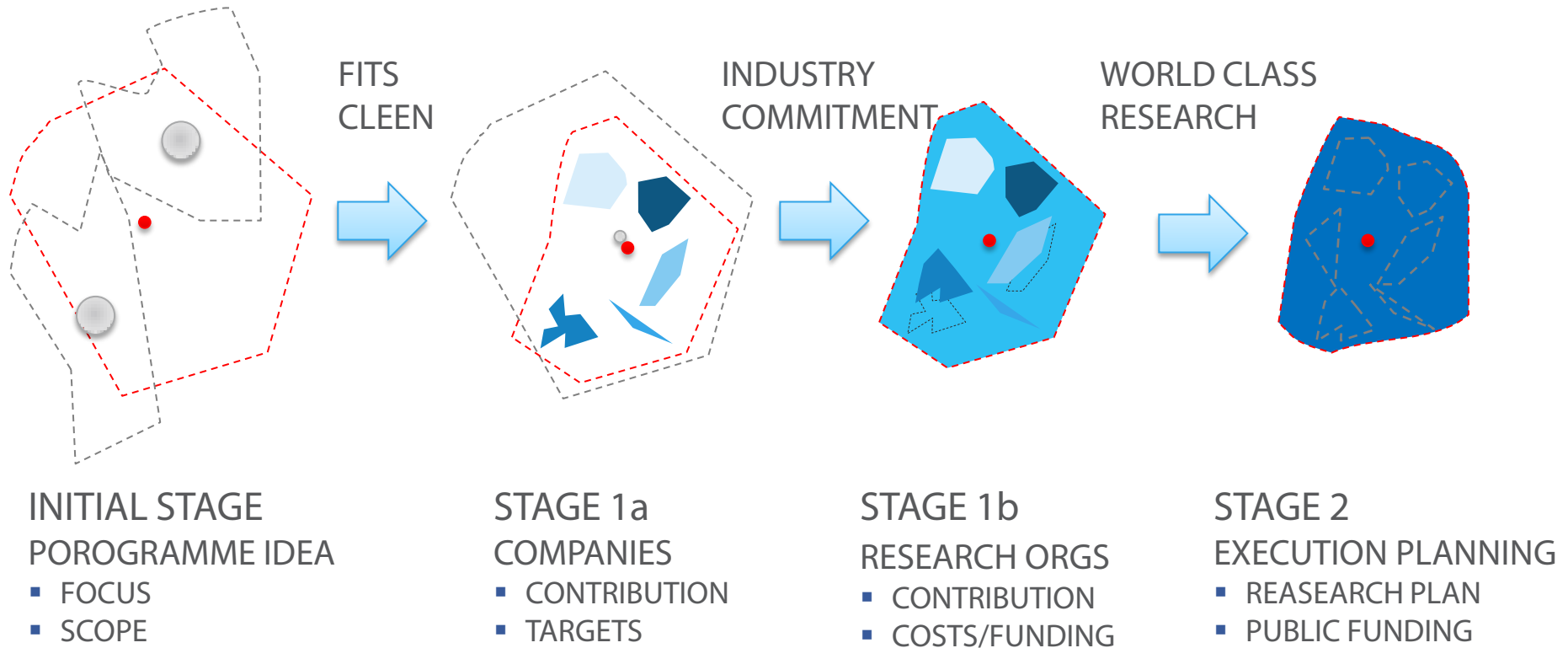
September 2009

- Carbon neutral generation
- Distributed energy systems
- Sustainable fuels
- Energy markets and smart grids
- Efficient energy use
- Resource efficient production technologies and services
- Material recycling and waste management
- Measurement, monitoring and environmental efficiency assessment

Scope and focus of CLEEN operations defined by the owners

Reviewed and updated regularly

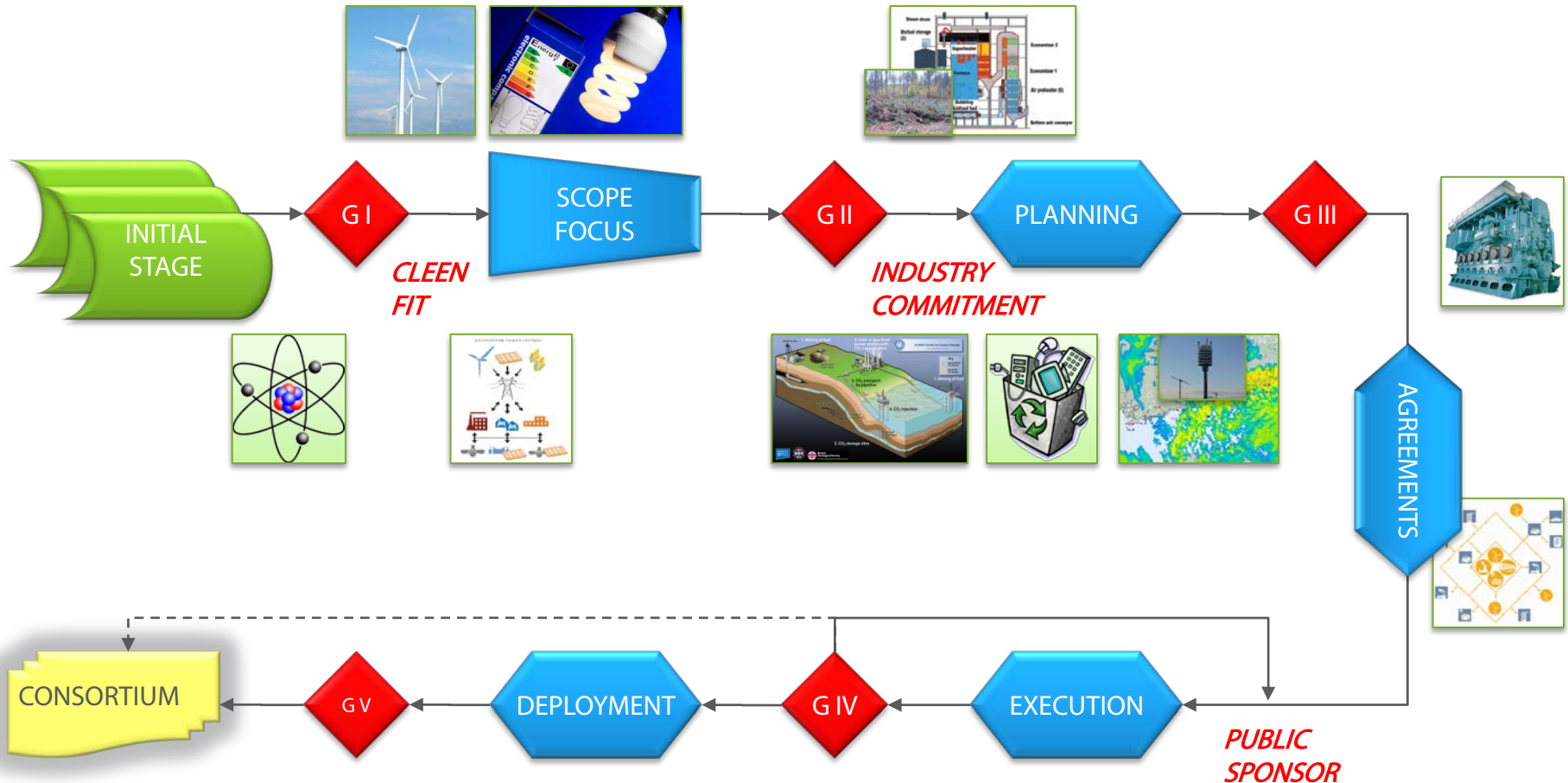
PROGRAMME DEVELOPMENT



~1 YEAR
>10 COMPANIES
>20 EXPERTS

PROGRAMME PORTFOLIO

NOVEMBER 2009





SMART GRIDS AND ENERGY MARKETS

STAGE III – RESEARCH (AGREEMENTS)

Scope

- 36 M€ for 5 years (2010-2014)

Contents

- Smart Grids architectures
 - › Relevance, Customers, Society, Migration, Demonstrations
- Future infrastructure of power distribution
 - › Cabling, Electronics, Microgrids, Substations, HV grids, Materials
- Intelligent management and operation of smart grids
 - › Smart Metering, Demand response, EVs, DG, Storages, Heating solutions
- Active resources
 - › ICT for network mngt, Protection, Network automation, Condition mngt, Strategic planning
 - › Energy market
 - › Business models, Active market participation of Customers, Market development, Service, Multi-utility

Consortium

- ABB, Fortum, Helen, Vattenfall Verkkö, Aidon, Areva T&D, Fingrid, Nokia Siemens Networks, Tekla, Vantaan Energia, The Switch, Elisa, Emtele
- TKK, UKU, LUT, MIKES, TUT, UWASA, VTT



FUTURE COMBUSTION ENGINE POWER PLANT

STAGE III – RESEARCH (AGREEMENTS)

Scope

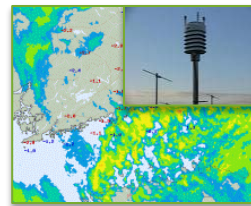
- 38 M€ for 3 years (2010-2012)

Contents

- Advanced Combustion
 - › Modelling, Optical methods, Extreme values, Single cylinder research
- Energy efficiency
 - › Flexible gas exchange, Turbo charging, FI, Recovery systems, Power conversion, Thermoelectrics, Carbon footprint, Power lines
- Emission control
 - › Catalyst for SCR, Hybrid scrubbers, Effects of bio-oils on SCR, Non-road emissions beyond 2014
- Fuel flexibility
 - › Biogas upgrading technologies, Prediction, Engine tests, Alternative fuels
- Intelligent Automation and Control
 - › Advanced control, Embedded intelligence
- Strategic research infrastructure
 - › New research infrastructure

Consortium

- Wärtsilä Finland Oy, Wapice, Ecocat, Agco Sisu Power, Metso, ABB Oy, Gasum
- TKK, MIKES, VTT, TUT, UWASA, LUT, ÅA, UO, TUAS



MEASUREMENT, MONITORING AND ENVIRONMENTAL EFFICIENCY ASSESSMENT

STAGE II – EXECUTION PLANNING

Scope

- 25 M€ for 5 years (2010-2014)

Contents

- Interoperable measurement systems
 - › Interoperable, QA controlled measurement and monitoring platform
- Management system for environmental efficiency
 - › Sector specific methods, Integration of assessment to monitoring and data mngt systems, data verification practices, decision support tools
- Remote sensing
 - › State of the art and future needs, Advanced RADAR technologies, LIDAR applications
- Emission monitoring technologies
 - › State of the art, Extreme conditions, Particles, High performance, Online monitoring, Low-cost optical sensor platforms, High temp LED spectroscopy
- CLEEN Test bed
 - › Demonstration in an extension of Helsinki Testbed (all relevant environmental data)
- Business cases
 - › Business models, Piloting, SMEs

Consortium (more than 50 including)

- Vaisala, Metso, Wärtsilä, Outotec, A-lab Oy, Dekati, Eigenor, Environics, Indmeas, Gasum, Harp Technologies, Luode, Neste Jacobs, etc.
- TKK, UKU, UO, LUT, TUT, HU, VTT, MIKES, FMI, SYKE, MTT, Greenet Finland, Measurepolis



RESOURCE EFFICIENT PROCESSES, RECYCLING AND WASTE MANAGEMENT

STAGE II – EXECUTION PLANNING

Scope

- 20 M€ for 5 years (2010-2014)

Contents

- Sustainable production technologies for water intensive processes
 - › Efficient water usage, by-product utilization,
- Sustainable effluent and sludge treatment
 - › Polluted areas and waters, Measurement, monitoring and C&A, New technologies, Biotechnology
- Advanced solutions for recycling complex and new materials
 - › Value chains for WEEE, C&D, C&I, MSW, ELV
- Refining concepts of wastes and by-products
 - › Solid residues from combustion processes, Fuels from organic waste streams of process industries

Consortium

- Kemira, Metso, Ekokem, Kuusakoski, Outotec, Helen, FCG Planeko
- TUT, LUT, TKK, UKU, UO, ÅA, VTT



SUSTAINABLE FUEL CHAIN COMBUSTION PLANTS

STAGE II – EXECUTION PLANNING

Scope

- 20 M€ for 5 years (2010-2014)

Contents

- Thermal Conversion
- Environment and Safety
- Measurements and Control
- Plant Optimization
- Solid Biofuels Production
- Quality and Treatment of Biomass
- Biomass Logistics
- Sustainability and Acceptability

Consortium

- Metso Power, Foster Wheeler, UPM Kymmene, Andritz, ÅF-Consult, Vapo, Neste Oil, PVO, Helen, Fortum, BMH Technology, Turveruukki, Kuopion Energia, Protacon Engineering, Outokummun Metalli, Firotec, MHG Systems
- ÅA, TUT, LUT, VTT, UKU, UJO, UO, UJY, Metla, MTT, SYKE

FURTHER OPPORTUNITIES

DEPLOY AND LEVERAGE

- + International co-operation
 - + SMEs
 - + Academia, prospecting
 - + Product development, demonstrations
 - + Spare IPR, Incubation
- ⇒ Full deployment of CLEEN resources and opportunities

THANK YOU

Jatta Jussila, CTO

+358 40 825 6500

jatta.jussila@cleen.fi

Tommy Jacobson, CEO

+358 40 828 2711

tommy.jacobson@cleen.fi

Additional information:

<http://cleen.fi/research/>