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Cost reduction and efficiency improvement of Short Rotation Coppice (CREFF)

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	<h2>Cost reduction and efficiency improvement of Short Rotation Coppice (CREFF)</h2> <p>on small field sizes and under unfavorable site conditions by focusing on high product quality and a product-oriented cooperative value chain</p> <p>ERA-NET kick-off meeting Potsdam, Germany, September 9, 2008</p>

	Introduction	WP1. Plantation management	WP2. Harvest and logistics	WP3. Conditioning of material	WP4. Economic evaluation	WP5. Business concepts	Results
	Context	Problem	Objectives	Organization	Results		
<p>Present geopolitical and environmental world context:</p> <ul style="list-style-type: none"> - Rarefaction of fossil fuels - Needs to reduce CO₂ emissions <p>➔ Promotion of renewable energy ➔ Biomass ➔ Short Rotation Coppice (SRC)</p>							
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<p>Up to recently, slow development in Europe due to non competitive profits as compared to non-energetic cultures</p> <ul style="list-style-type: none"> ▪ Expensive plant material ▪ Plant breeding and optimization of species-site matching needed ▪ High harvest and transport costs <p>➔ Necessity to reduce production and supply costs</p>							
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	Context	Problem	Objectives	Organization	Results		
<ul style="list-style-type: none"> ▪ At present, research results available for: <ul style="list-style-type: none"> - medium to good sites - for large field sizes ▪ Such conditions rarely found in many regions of Central Europe: <ul style="list-style-type: none"> - Good sites rare and expensive and used for demanding annual crops <ul style="list-style-type: none"> ➔ SRC on less favorable sites in terms of soil quality and forms (small stripes along creeks or forests) - Average sizes of fields and farms much smaller than in UK and south-Sweden <ul style="list-style-type: none"> ➔ SRC in small field sizes, at scattered locations and on unfavorable sites 							
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At present, research results available for:

- medium to good sites
- for large field sizes

 Such conditions rarely found in many regions of Central Europe:

- **Good sites** rare and expensive and used for demanding annual crops
 - SRC on less favorable sites in terms of soil quality and forms (small stripes along creeks or forests)
- Average **sizes of fields and farms** much smaller than in UK and south-Sweden
 - SRC in small field sizes, at scattered locations and on unfavorable sites

→ To promote the use of biomass from SRC, **optimized SRC value chains for unfavorable conditions have to be found**

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Approach:

- Initialization of intensive and early co-operation between producers and consumers
- Concentration of the SRC-production inside these co-operations to the requirements of industrial consumers
- Based on the known value chain structures, streamlining of all major processes like the production, harvest and logistics, and conditioning of SRC-products
- Design of improved local SRC value chains with help of real pilot co-operations of producer and consumer
- Evaluation of economic and socio-economic aspects of improved local SRC value chain scenarios

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Approach:

Farmer
Farmer
Farmer
Farmer

WP4 Economic analyses of value chains
 Evaluation of the value-chain models

WP1 Plantation management
 Production optimization: species-site matching, spacing, rotation

WP2 Harvest & Transport
 Improvement of harvesting systems and transport logistic

WP3 Conditioning of wood quality
 Consumer-oriented production and conditioning

WP5 New business concepts
 Overcoming of implementation problems with the help of producer-consumer cooperations

Wood & energy industry

establish early and intensive cooperation between producers and consumers

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A complementary consortium:

WP4 Economic analyses of value chains

WP1 Plantation management
WP2 Harvest & Transport
WP3 Conditioning of wood quality

WP5 New business concepts

establish early and intensive cooperation between producers and consumers

INRA
FA
IER
VEOLIA ENVIRONNEMENT
UPM
GESA
STORAENSO
Schellinger

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General results:

- Development of strategies allowing a major cost reduction and a higher efficiency even for areas in Central Europe characterized by less favorable conditions for SRC-production
- Implementation of the results in the course of the project through the establishment of pilot cooperatives of SRC-producers and industrial consumers (show-cases for new efficient strategies fostering a wider implementation of SRC)

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WP1: Cost optimization through site adapted plantation management

Research structure:

Initial approach: establish cooperation and/or producer associations

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1. State of the art

SRC, a particular forest ecosystem

- Little biomass accumulation
- Regular young wood exportations, without residuals, implying a rapid soil depletion

→ Necessity to optimize and to sustain biomass production while preserving soil richness

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2. Problem

SRC, a particular forest ecosystem

Site conditions

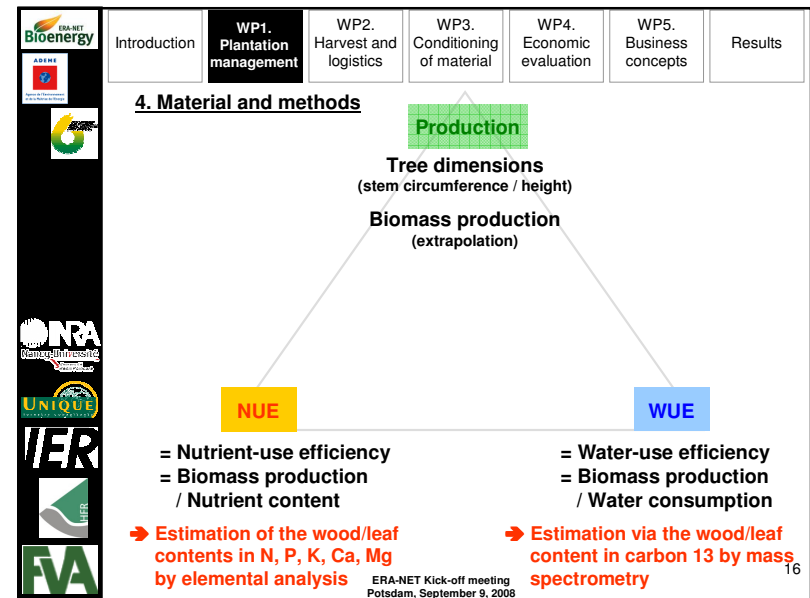
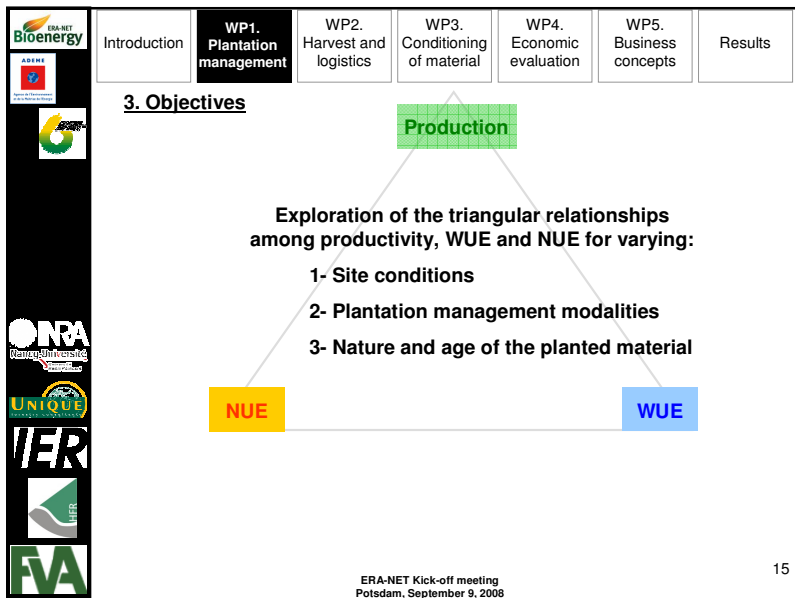
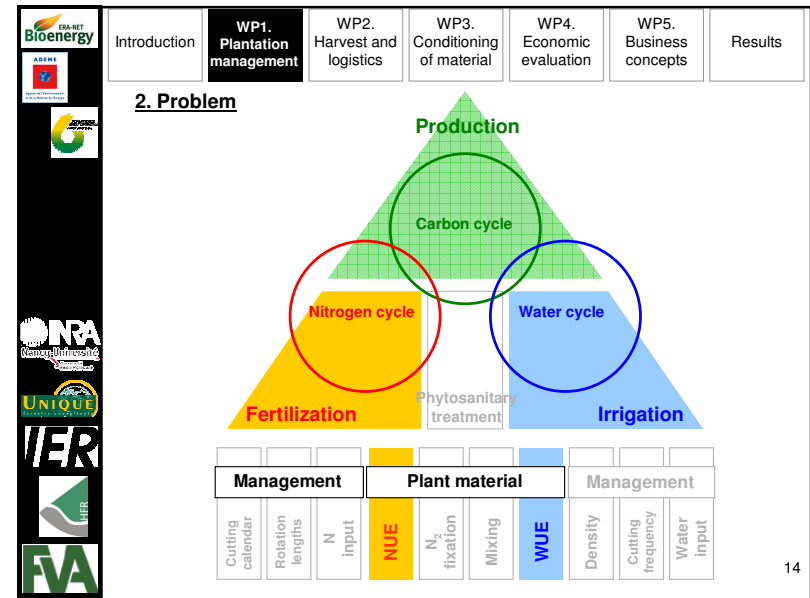
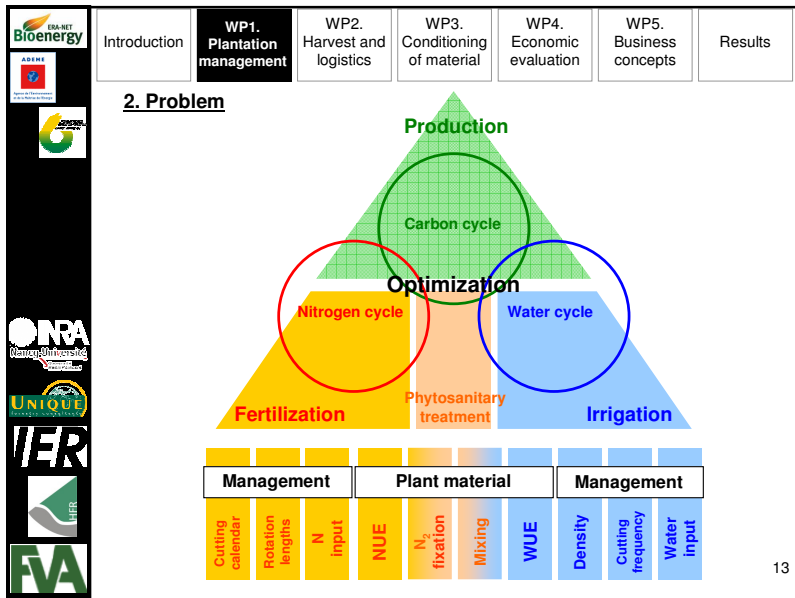
Plantation management ↔ Plant material

Adequate / optimized matching

- Reduction of input needs
- Reduction of associated costs

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4. Material and methods

- Potential sites:
 - Germany
 - France
 - Austria



- Potential species:
 - Poplar - *Populus*
 - Willow - *Salix*
 - Black locust - *Robinia*
 - (Alder - *Alnus*)

➔ Inventory and selection

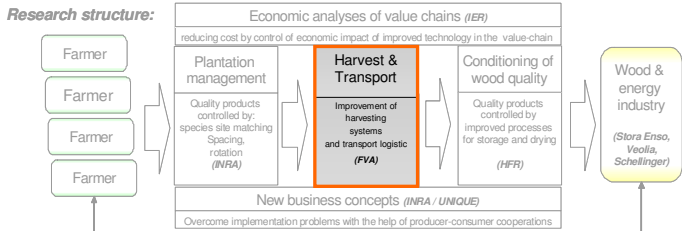
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WP2: Improvement of harvesting systems and transport logistic related to specific site conditions

Research structure:



Initial approach:

establish cooperation and/or producer associations

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1. Problem

SRC is often uneconomical!

→ Costs have to be reduced!

→ Harvesting & Transport can cause < 90% of total SRC costs

- especially on small field sizes, steep and wet areas
- full-mechanised harvesting is often not possible or uneconomical
- semi-mechanised or feller-buncher harvesting are often not cost-efficient enough so far and need to be improved
- scattered SRCs of a small field size need to be included in an effective logistic system to reach an economical SRC management



- cultivation & tendance
- harvest & transport
- clearing

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2. State of the art

- No large scale experience for harvesting systems so far
- Especially with harvesting and logistics of SRC products on small size fields and with longer rotation periods (> 5 years)
- Tests up to now mainly for forage harvesters; only few for semi-mechanised and motor-manual methods (Burger and Scholz 2004, Textor and Wilwerding 2003)
- Little experience with logistics for combined harvesting of several small scale plots.

Burger, F.; Scholz, V. (2004): Stand der Technik bei der Ernte von Energiewäldern. Holz-Zentralblatt 130 (46), 610-611.

Textor, B.; Wilwerding, A. (2003): Cultivation, allocation and energetic use of woody biomass. (Anbau, Bereitstellung und energetische Nutzung holzartiger Biomasse. Praxisversuch "Energieproduktion und Verwertung"). Versuchsbericht der FVA 2003/3.

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3. Objectives

“Development of improved and economically viable SRC harvesting and logistic systems which are adapted to the particular site conditions” (focus on small field sizes and unfavorable site conditions)

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4.1 Material and methods (1)

The three commonly used **harvesting systems** (forage harvester, feller-buncher, motor-manual) will be analyzed under different **site conditions** (steep, wet, small field size, etc.) on 50 SRC-plantations in Germany, Austria and France

Their **capacity** and **production cost** will be analyzed using **time-studies**;
the **quality** of the wood chips will be compared and analyzed in the **laboratory**.

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4.2 Material and methods (2)

Different **means of transport** of the SRC wood to its processing place will be analyzed under different **circumstances** (distance, reloading points, field storage, etc.)

New efficient logistic models will be developed using the results of all WP and with a focus on widely scattered small size SRCs.

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WP3: Value added conditioning of SRC raw material

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1. Problem

raw material from SRC often shows different properties in comparison to traditional wooden material, for instance:








- higher percentage of bark
- higher content of minerals

Aspects:

- very cost sensitive material
- quality parameters for different applications (e.g. pellet, pulp) are characterised and defined insufficient
- technical instructions are not existing (SRC material)
- losses of quality while raw material storing
- standardized conditioning methods must be developed for ... storage / dimensioning / drying ... of wood chips

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2. State of the art

- insufficient information on quality issues regarding utilisation in the energy sector or as fibrous raw material
- quality aspects are often excluded in the price formation process
- still unsatisfactory conditions for the storage of wood chips from SRC
- previous simulations could not simulate all the relevant conditions of storage
- inhomogeneous raw material because of the small SRCs

(LECHNER et al. 2004; CREMER et al. 2007; BÜCHELE 2007; MAHR 2001; SCHILL 2001; PELZ 2004; PELZ et al. 2006; KIRSCHBAUM 1998; SCHOLZ et al. 2006)

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3. Objectives

- identify and characterise conditioning technologies and processes, which increase the product quality in terms of different utilisation paths (energy-, pulp- and wood-industry)

Decision Support System








Technical Instructions

} for conditioning raw material

- simulation of storage:
 - different raw material qualities and storage possibilities under different material and climate conditions

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4.1 Material and methods

• tagging and systematise properties and quality parameters characterising important end product requirements

↓

• developing a set of standardized evaluation methods for key parameters

↓

• design of a device to simulate the behaviour of wood chips under different conditioning scenarios

- workshops

- research background

- laboratory

- workshops

- research background

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4.2 Material and methods

- identifying and developing best practise methods of storage, dimensioning and drying wood chips
- detection of technical and economical constraints for productive and efficient technologies

- describing productivity and cost efficiency of different technologies
- compilation of a decision support model for storing and conditioning measures
- design of technical instructions (Quality Management System) with cost efficient assessment methods

- industrial experience

- research background

- inquiries

- pilot studies at installations of the industrial partners

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WP4: Economic and socio-economic evaluation of SRC-value chain

Research structure:

Economic values of the chains (IER)
reducing costs by control of economic impact of improved technology in the value chain

Farmer	Plantation management Quality products controlled by: species site matching, Spacing, rotation (INRA)	Harvest & Transport Improvement of harvesting systems and transport logistic (FVA)	Conditioning of wood quality Quality products controlled by improved processes for storage and drying (HFR)	Wood & energy industry (Stora Enso, Veolia, Schellinger)
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New business concepts (INRA / UNIQUE)
Overcome implementation problems with the help of producer-consumer cooperations

Initial approach: establish cooperation and/or producer associations

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Strong relations amongst the WP4 and the WP1 – 3 and 5

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1. Problem

- For an optimization of the supply chain for wood from SRC the different parts of the chain (production, provision and conditioning) have to be connected
- The costs of wood supply chains based on sites with non favorable site conditions (slope, quality, water and nutrition supply) is not well known

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2. State of the art

- A few studies and examinations about cost of parts or the process chain like the production (planting, management) or the provision (harvesting) exist
- No overall and comprehensive information about product oriented wood supply **chains** for CHP
- The aspect of product orientation as well as the aspect of non favorable field location and sizes cannot be found in the chain analysis

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3. Objectives

- the determination and the assessment of the costs of different options of wood production in short rotation coppice (SRC) and the development of market and prices of energy wood
- the analysis of the effects of area characteristics (location, area size a. o.) and other factors (work intensity, amount of pesticides, transport distance) on the feasibility of SRC
- the assessment of additional economic (added values through by-products) and socio-economic benefits (employment effects) of the most important value chains and frame conditions
- the estimation of mid-term developments and the cost optimization potentials connected to these developments
- definition of optimized production and provision chains with respect to costs and ecological aspects (GHG-emissions)

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4. Material and methods

Based on input from the WP1 – 3 about process chain related cost categories like machine hours and material flows (fertilizer, pesticides etc.)

- Definition and characterization of typical products (bundles or chips, high or low moisture content, etc.) and systems
- Cost balance of the different production and provision systems
- Emission balances and related environmental costs
- Balance of employment effects and other macroeconomic aspects (added values)
- Definition of optimum production and provision systems with respect to the costs and ecological aspects

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WP5: New business concepts for successful implementation of a consumer-oriented wood-fuel value chain from SRC

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1. Problem

- In many areas of central and western Europe the SRC-production is still in its infancy and a very "exotic" topic for farmers – explicitly in our main study area (South-West Germany and North-East of France).
- Biomass from SRC often seems not known or not accepted by wood fuel consumers or the wood industry.
- Even in the past two years with rising prices for wood and growing demand for wood, there are obvious many **constraints and problems for farmers to invest in SRC.**

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2. State of the art

- Lack of "implementation oriented" research along the supply- and value-chain with a focus on the implementation problems.
- Lack of research with a "case-study approach":
 - Meaning working with main stakeholders = SRC producer-consumer groups
 - trying to work-out optimal business concepts in close cooperation.
- Results from field-research are rare (i.e. Dendrom, Agrowood*) and missing for the specific conditions in our study-area (South-West Germany & North-east France).

* Lit.:
Kröber et al.(2008): DENDROM, Beiträge zur 3. Fachtagung.
Skodawessely; Pretzsch (2008): DENDROM, Beiträge zur 3. Fachtagung.
Gerold et al.(2006): Anbau und Nutzung von Bäumen auf landwirtschaftlichen Flächen. Tagungsband.

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3. Objectives

- (1) Identify reasons, why farmers do not invest in SRC production. Hypothesis is:
 - The low level of implementation of SRC production is caused by
 - lack of knowledge amongst farmers, politicians, and other stakeholders,
 - lack of knowledge about SRC products (wood-chips / industrial wood) at industrial consumers,
 - undeveloped markets and unclear quality criteria for the final products,
 - unclear legislative framework for SRC production.
 - This complex - beside technical problems faced by WP1-WP3 - leads to low efficiency of SRC value chains and high production costs and
 - it ends in a unfavourable profitability level compared to competing agricultural products.
- (2) Test one potential approach to overcome the constraints. Hypothesis is:
 - Regional co-operations between producers & consumers can lead to optimised business concepts and more efficient supply- and value-chains.

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4. Material and methods (1)

- Initiate 3 "pilot co-operations" and implement case studies of co-operations between

Producer (Farmers) <=> Consumer (Bioenergy -, Pellet plants, Particle board - or Pulp industry)
- Initiate, moderate and guide an implementation-process, where partners name, define and discuss
 - SRC products (quality, quantity) ▶ link to WP3 Conditioning
 - Costs and price-restrictions ▶ link to WP4 Economic evaluation
 - Implementation problems for farmers (political-, market-, economical-) ▶ link to WP 2 Harvest & Logistics.
 - Procurement problems for consumers

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4. Material and methods (2)

- The "pilot co-operations" will serve as a **communication forum** for the
 - detection & eradication of production-related, institutional, social, and environmental constraints,
 - development of locally adapted **business concepts** and SRC value chains,
 - knowledge transfer.
- Methods:
 - Workshops and interviews to analyse the situation and to conceptualize and define solutions.
 - Economic model calculations ([link to WP4 Economy](#)) to evaluate, which constraints and barriers are relevant to restrict successful implementation.
 - Examination of the operational decisive behaviour of the farmers and the wood-fuel industry.

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Results

	Deliverables
WP1 Plantation management	- Guidelines for a better adaptation of plant material to the site to reduce irrigation and fertilization needs
WP2 Harvest and Logistics	- Guidelines with the most profitable harvesting method related to the specific site conditions - Advises for SRC-harvest machine constructors - Efficient logistic models for the transport of products
WP3 Conditioning of raw material	- Compilation of a decision support model for conditioning measures - Quality Management System design with cost efficient assessment methods - Compilation of a decision model for different storage techniques of raw material
WP4 Economic evaluation	- Economic model for SRC-value chains especially considering unfavorable conditions - Estimation of social and socio-economic benefits and drawbacks
WP5 Business concepts	- Compiled report on the implementation "experiences" in the pilot-co-operation - Guidelines for implementation strategies considering SRC producer-consumer co-operations

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Results

- Strategies to overcome the problem of unfavorable conditions = small field sizes at scattered locations on unfavorable sites by
 - Improvement of efficiency via a straight consumer-oriented quality production (WP3)
 - Definition of an optimal, locally adopted production system for farmers (WP1)
 - Co-operation for better information and optimized business models between producers and consumers (WP5) leading to
 - consumer-oriented production systems among producers,
 - improved harvesting techniques and establishment of efficient logistic systems between partners (WP2).

➔ **Overall cost reduction for the SRC-production (WP4)**

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Cost reduction and efficiency improvement of Short Rotation Coppice (CREFF)

on small field sizes and under unfavorable site conditions by focusing on high product quality and a product-oriented cooperative value chain

Thank you for your attention!

ERA-NET kick-off meeting
Potsdam, Germany, September 9, 2008

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