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SOLAR THERMAL ENERGY RESEARCH GROUP

Existing knowledge at STERG
- future and strategic plans

Prof. Dr.-Ing. Frank Dinter

18 July 2013

Fakulteit Ingenieurswese
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Faculty of Engineering

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Existing knowledge on Solar Thermal Energy

Since June 2013 Prof. Dr.-Ing. Frank Dinter in STERG

- Former Technical Director of Andasol 3, Spain and Head of Solar at RWE Innogy, Germany

Andasol 3: Facts & Figures

- Owner: Marquesado Solar S.L.
- Location: Aldeire/La Calahorra (Granada, Spain)
- Capacity: 50 MW_{el}
- Forecasted electricity production: ~200 GWh/a
- Commissioning in autumn 2011
- Annual CO_2 savings: 150,000 tonnes
- Size of the collector area: ~ 500,000 m²
- Technology: Parabolic trough incl. 7.5h molten salt storage

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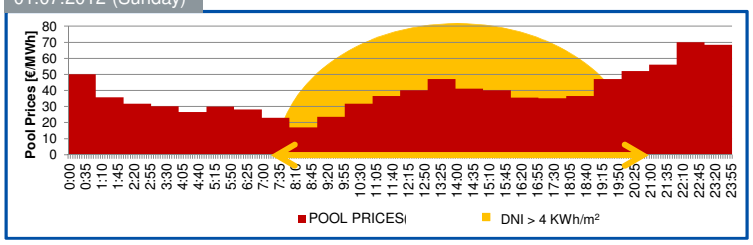
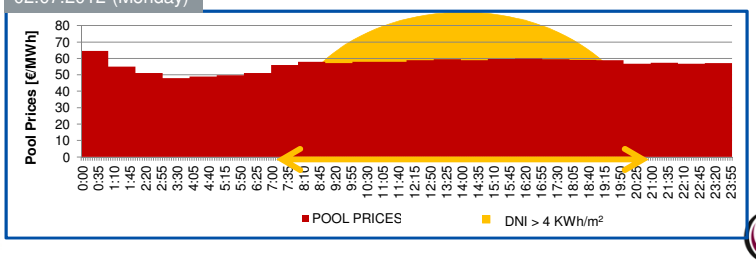
Economic value of CSP with Storage

01.07.2012 (Sunday)



02.07.2012 (Monday)



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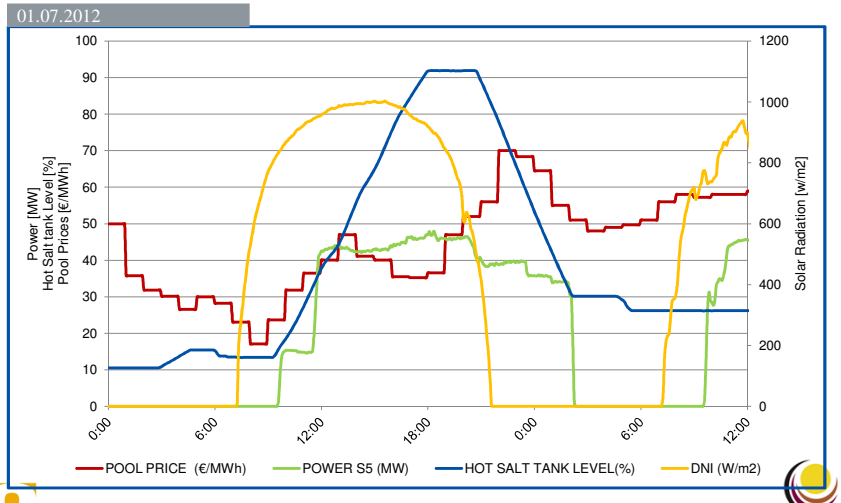
Economic value of CSP with Storage

01.07.2012



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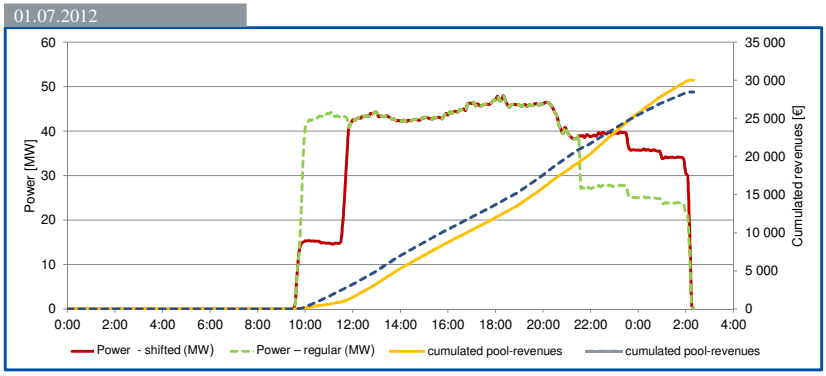
Economic Value of CSP with Storage



Energy output	633 MWh	
Energy shifted	50 MWh	8.0 %
ΔRevenues	1.500 €	5.3 %

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CSP in general:

- Concentrating Solar Power (CSP) comes in different forms
- Solar radiation is concentrated and produces heat
- This heat can be stored so that electricity can be produced 24 h per day or when demand is high (dispatch-able energy)
- South Africa is one of the best places in the world for using solar energy

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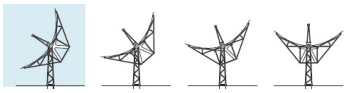
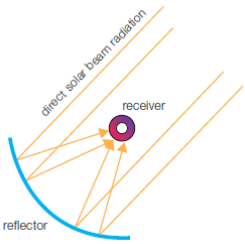
CSP technologies I

Parabolic Trough

- Uses parabolic mirrors to concentrate solar radiation on linear tube receiver
- Provides heat storage capabilities
- Is a long-term, commercially proven technology
- Has high maturity level, operational experience, modularity and a large number of providers



Source: Solar Millenium



Source: German Aerospace Center

Source: Energy Next

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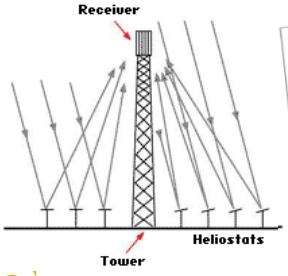
CSP technologies II

Solar Tower

- Concentrates solar radiation on a point receiver at the top of a tower
- Enables operation at high temperature level and provides heat storage capabilities
- Has high net solar to electrical efficiency and is a commercially proven technology



Source: European Commission

Source: Abengoa Solar

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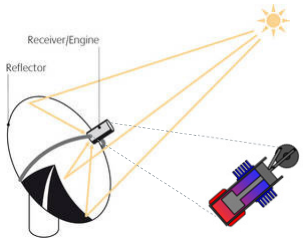
CSP technologies III

Dish Stirling

- Uses parabolic dish to concentrate solar radiation on a Stirling engine
- Has high net solar to electrical efficiency with low water consumption
- Is highly modular and suitable for both small stand-alone, decentralized off-grid power systems and large grid-connected power systems



Source: Stirling Energy Systems

Source: Stirling Energy Systems

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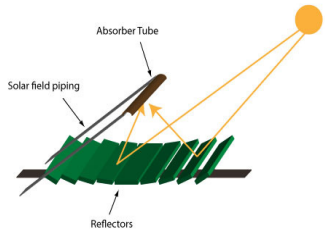
CSP technologies IV

Linear Fresnel

- Uses flat mirror design to concentrate sun, enabling simpler production and installation
- Enables other industrial uses such as steam processing
- Has high land-to-electricity ratio due to linear design and the usability of space below support structure



Source: Green Rihno Energy

Source: Novatec Solar

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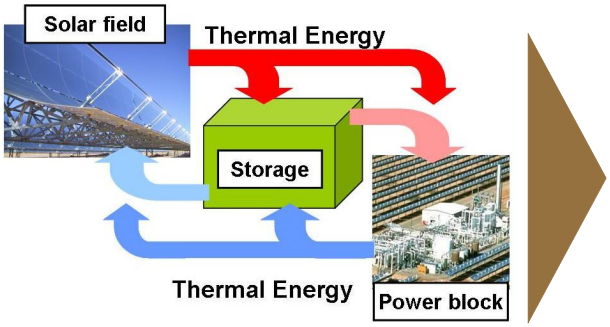
Existing knowledge on Solar Thermal Energy

Dispatch-able Energy

The main advantage of CSP technology against other RES as PV or wind power is the capability to provide dispatch-able power by storing solar energy through thermal energy storage



Source: DLR

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Strategic activities for STERG

STERG Group at SU

- A good base with own labs
- Moving forward by improving methods and understanding the technology more deeply
- Growing networking in SA and worldwide (SASTELA, SASEC, SolarPACES, DLR, Sandia, NREL, etc.)
- Reducing costs, increasing efficiency and reliability in CSP technology
- Strengthening our relationship to CSIR
- Joining and enabling other SA universities in doing more CSP R&D
- Supporting national solar R&D plans (roadmaps and centres)
- Contract R&D for clients and commercialization

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Potential future strategic focus areas

Specific technology focus on:

- Central Receiver Systems with different Heat Transfer Fluids (e.g. liquid salt, liquid metals and air)
- Parabolic Trough with liquid salt
- Thermal Energy Storage Systems with different HTF
- Component development in Solar fields (Heliostats and Trough)
- Optimization on Balance of Plant (Equipment and Process)
- Technical and economical evaluation of CSP technologies

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Outlook

View to the world:

- SA is one of the best sun spots in the world
- Current situation in Europe and US gives SA a chance to catch up
- CSP can deliver dispatch-able energy and support SA electricity production reliably
- Creating new jobs for new talents for a CSP rollout in SA and worldwide
- CSP awareness is improving in government

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Thank you for your attention

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