Solar heating for industrial processes

- Assessing the potential role for SHIP in meeting energy demands of industry in developing countries.

Options in ECOWAS

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Outline

What is the current status of solar heating in the industrial sector?

How much energy does the industrial sector use for heat?

What is the general technical procedure for installing solar heating in industry?

What are the economic considerations?

Potential applications in ECOWAS.
Introduction – Why pursue solar heat for industry?

1. Demand for heat energy in industrial sector in developing countries

2. Matching appropriate energy source and technology with energy service

3. Benefits of solar thermal technology may contribute to solving several problems
   - Industrial efficiency and competitiveness
   - Climate change
   - Value addition at the local/decentralised level
   - Niche markets – bio products

4. Niche market for UNIDO to apply its expertise, services and networks
Methodology

Desk study
- Literature review
- Data collection
- Consultation within UNIDO
- Consultation with other partners
Current applications

Residential Sector
- Domestic hot water
- Swimming pools
  - 164,000,000 m²
  - 115,000 MW\textsubscript{th}

Industrial Sector
- Process heating
- Space heating
  - 33,991 m²
  - 24 MW\textsubscript{th}

Source: Aspen Core
Source: IEA
Question:

How much heat does the industrial sector use?

Figure 9. Solar system with heat storage.

Source: POSHIP
Industrial Energy consumption

Industrial Energy as percentage of total energy consumption

Non-Industrial Energy [TJ]
Industrial Energy [TJ]

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<th>Region</th>
<th>Non-Industrial Energy</th>
<th>Industrial Energy</th>
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<td>Asia (excl. China)</td>
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Industrial sector heat consumption

Industrial final use heat

- National Energy
- Indust. Energy
- Heat Energy
- Low temp. Energy

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<tr>
<th>Region</th>
<th>Total Electricity [TJ]</th>
<th>Total Heat [TJ]</th>
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Industrial Sub-sector Energy Consumption

Sub-sector energy demand in Non-OECD countries

- Food and Tobacco
  - Total Electricity [TJ]
  - Total Heat [TJ]
- Textile and Leather
- Machinery
Sub-sector low temperature heat demand

Estimated industrial heat demands by quality for EU25 + ACC4 + EFTA3 during 2003

...the potential in Non-OECD countries?

- **Industrial Energy**
  - **Electricity**
  - **High temp.**

- **Heat Energy**

- **Low Temperature**

- **Sub-sector focus**

6 % of total industrial energy
2,250,000 TJ
Distribution of solar resources

Existing SHIP experience

Matthias Loster, 2006

Σ = 18 TWe
Procedure for Industrial Solar Heat Integration

1. Conduct energy analysis
2. Energy efficiency measures
3. Heat recovery measures
4. Technical design
5. System integration

Energy efficiency

...then

Solar thermal energy
Economic Considerations

Cost-effectiveness

\[ = f(\text{Climate, Cost of conventional energy, Demand profile}) \]

0.04 – 0.12 €/kWh, payback period of 4 – 12 years in Iberian Penninsula

Economic impact

\[ = f(\text{Cost-effectiveness, Industry energy intensity, Industry contribution to GDP}) \]

1 new job for every 100 m² installed over the next 10 years.
Solar heating for industrial processes – Opportunities in ECOWAS.

1. SHIP in Agro-industries.

2. CDM/JI – Methodologies for industrial sub-sectors

3. South-South cooperation – technology transfer

4. GEF – UNIDO Comparative Advantage
1. Agro-processing

*Industrial heat demands by temperature quality and by manufacturing branch*

*Source: The European Heat Market, EcoHeatCool Working Package 1, 2006*
1. Agro-processing

Heat demand and temperature levels of processes in Austrian DAIRY Sector

Source: Joanneum Research Forschungsgesellschaft mbH, Graz, Austria
2. CDM/JI – Methodologies for industrial sub-sectors?

• Demonstrated interest in SHIP and CDM for industry.

• UNIDO’s experience can be applied in developing methodologies for specific sub-sectors.
3. South-South / North-South Cooperation

CHINA is the biggest market and producers of solar thermal technology in the world and there is demand in Africa. Demonstration projects, local manufacture & quality assurance, targeted research.

Distribution of the installed capacity by collector type

Glazed flat plate and evacuated tube collectors in operation in 2003 by economic region

Source: SOLAR HEATING WORLDWIDE - Markets and contribution to the energy supply 2003
4. SHIP in GEF – UNIDO’s Comparative Advantage

**Industrial Energy Efficiency**
- Industrial process heat efficiency
- Solar heat for hot water preparation
- Solar heat for direct process heat
- Solar heat for direct drying
- Solar heat for cooling & refrigeration

**Climate Change**

**RE for Rural Energy Service**
- Solar heat for small cottage industries (hot water preparation and direct drying).
- Our **trusted** solar dryers
- Others..
SHIP: Environmental, Social and Technological synergies

Technology
Solar hot water heating technology is a robust and well understood technology. NOT “complicated”. Easy assembling and production of some components.

Social
Employment and business creation.

Environmental
Developing countries – cottage industries and small facilities using biomass for water heating and drying processes.
THANK YOU

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