

# WWF Workshop on Solar Heat in Agri-Processing

## Large-scale Solar Thermal Systems in South Africa and SOLTRAIN III

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17 November 2016, STIAS, Stellenbosch

# Agenda

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1. Large-scale Systems Database
2. Analysis of CBC Tender
3. SOLTRAIN III Project
4. Barriers and Recommendations

# Interesting Plants in SA



## Xtrata Elands Platinum Mine: DHW and SPH for change house



- 500 m<sup>2</sup> evacuated tubes, 60 m<sup>3</sup> storage
- Installed 2011
- Caters 1500 workers daily
- 90 % of demand for heating of 100 m<sup>3</sup> shower water up to 60 °C
- 10 % of produced heat used for laundry

Source: [Blackdotenergy.co.za](http://Blackdotenergy.co.za)

# Interesting Plants in SA



## Solar process heating and cooling



BMW Manufacturing, Pretoria, SA:  
Heating of paint with 200 m<sup>2</sup> evacuated  
tubes and 24.2 m<sup>2</sup> of storage

Source: [Blackdotenergy.co.za](http://Blackdotenergy.co.za)



© Dinter

MTN, Johannesburg, SA: Solar cooling  
with 484 m<sup>2</sup> Fresnel coll., 180 °C, 16 bar

# Large-scale ST Systems Database



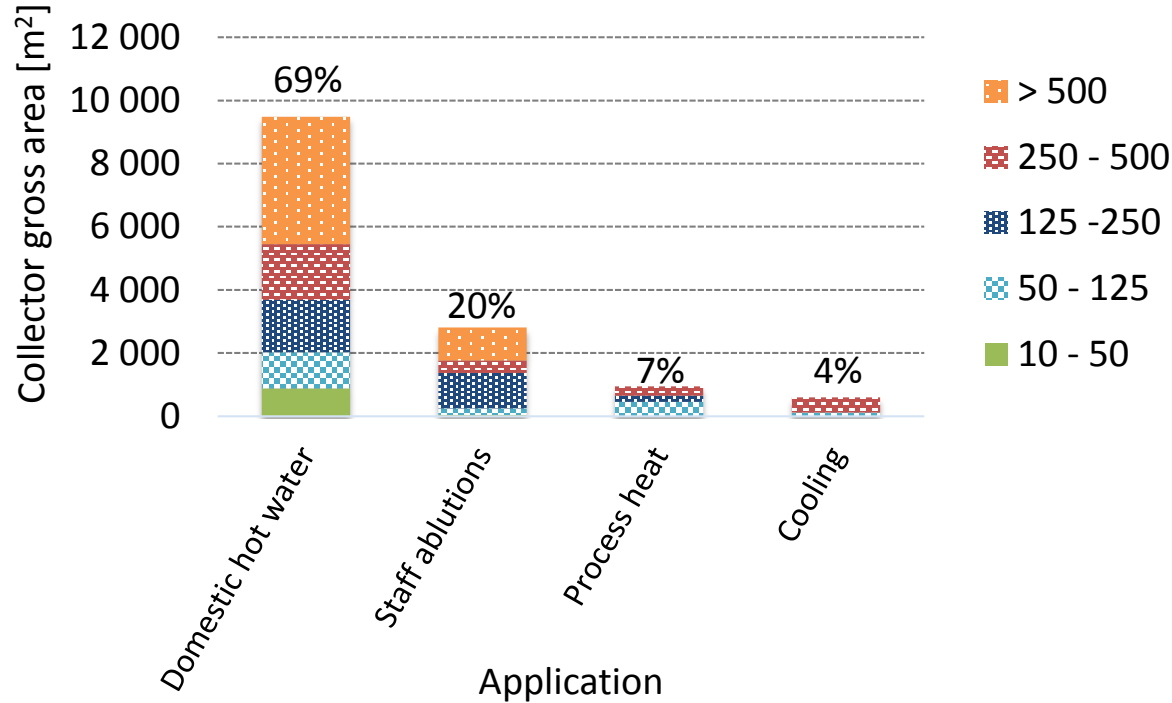
## Database:

- Stationary systems  $> 10 \text{ m}^2$
- Whole SA, installed between 2007 and 2015
- Sources: Blackdot Energy, Soltrain 1&2, installers, etc.

## Currently:

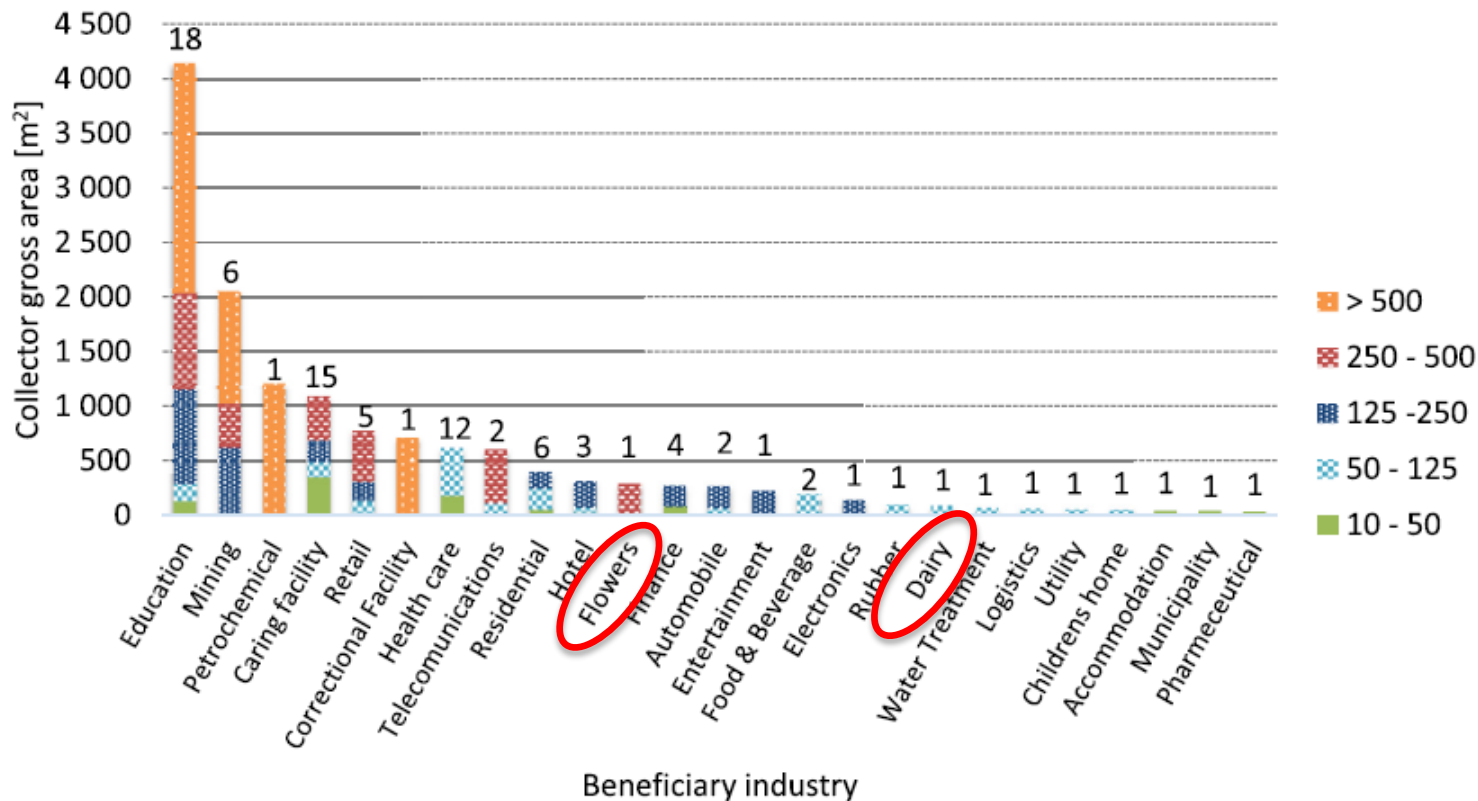
- 89 systems  $> 10 \text{ m}^2$
- Total gross area  $13\,894 \text{ m}^2$
- Confidence level: high  $> 50 \text{ m}^2$ , low  $< 50 \text{ m}^2$

# Applications



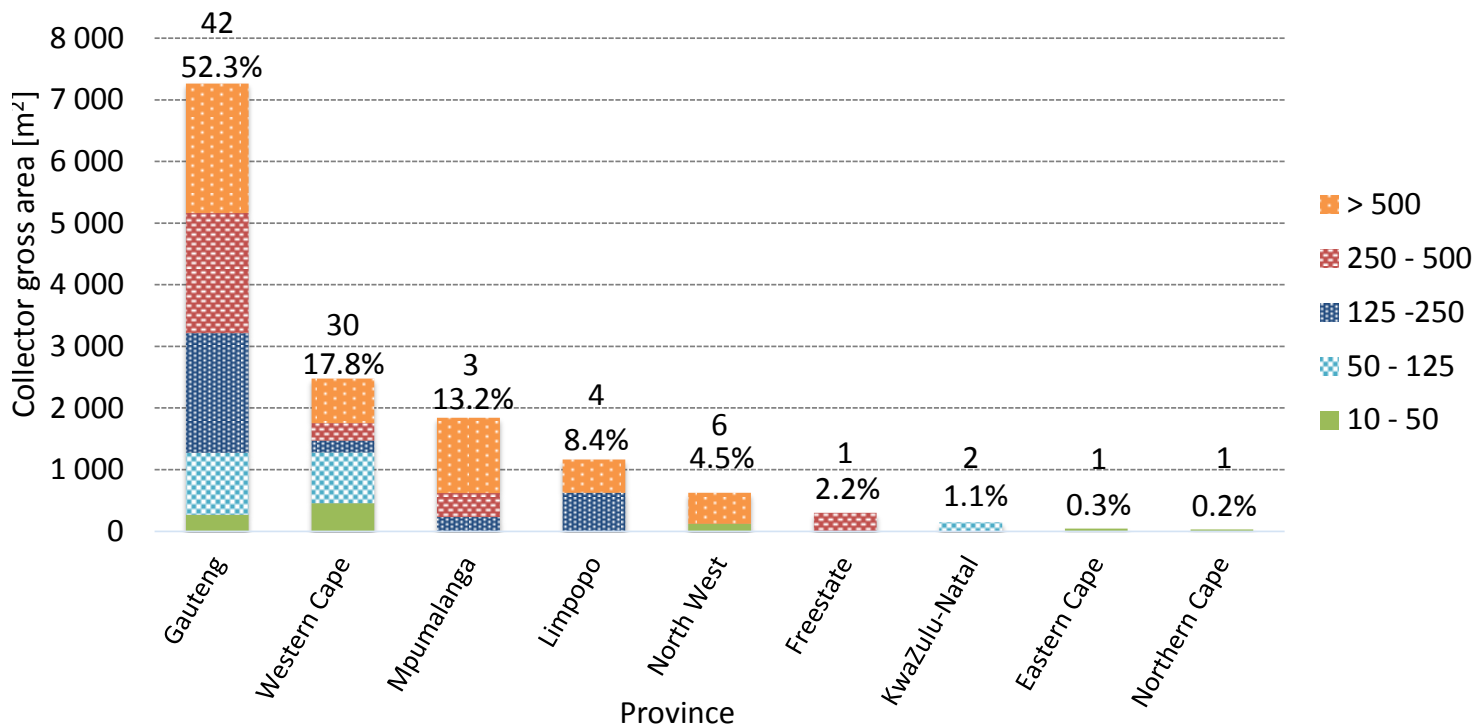
Large-scale SWH systems in SA per type of application (gross collector area > 10 m<sup>2</sup>). Domestic hot water 66 systems, staff ablutions 14 systems, process heat 7 systems, solar cooling 2 systems. Legend units are m<sup>2</sup>.

# Beneficiary Industry



Large-scale systems in SA per beneficiary industry. Legend units are m².

# Installations per Province



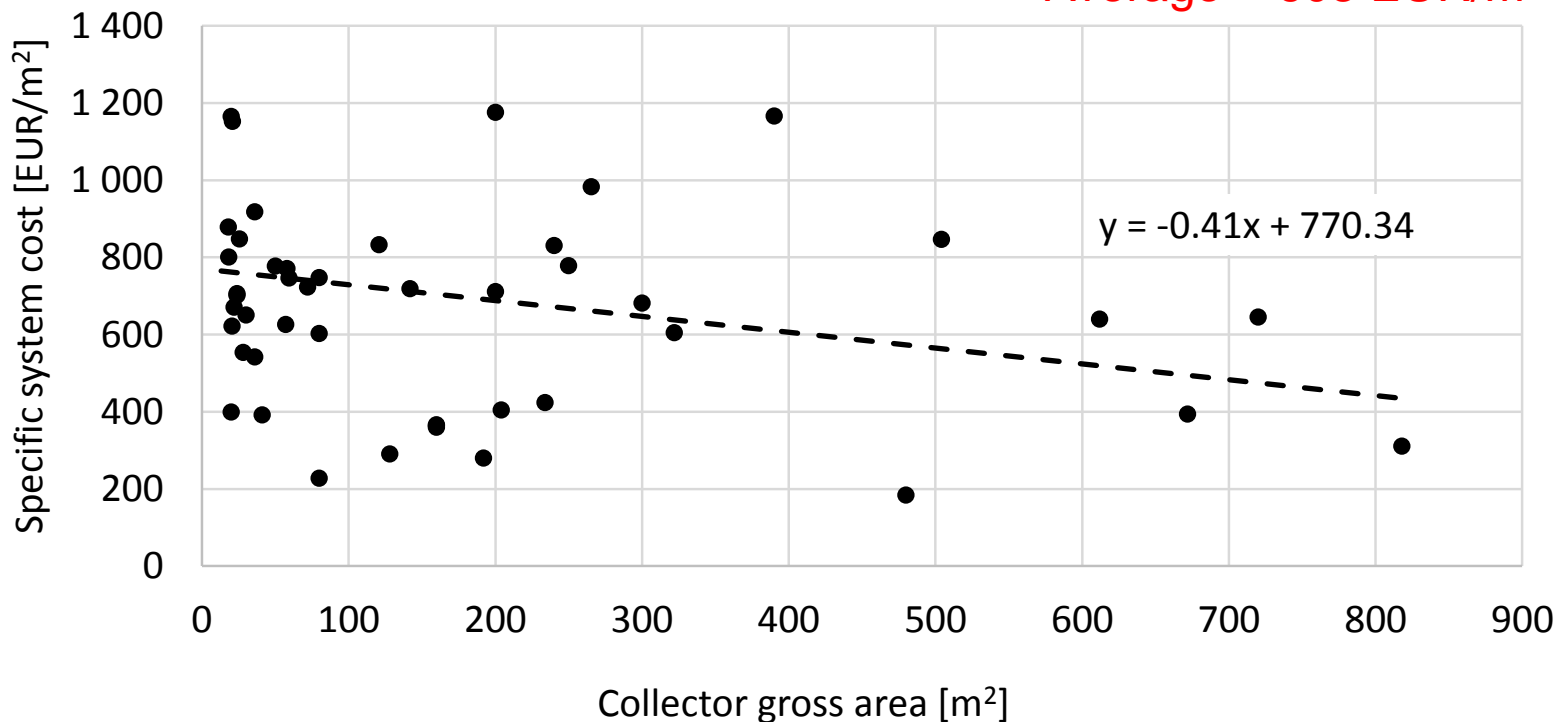
Large-scale SWH systems in SA per province (gross collector area > 10 m<sup>2</sup>).  
Number of systems and percentage contribution above bars. Legend in m<sup>2</sup>.



# System Costs



Average = 603 EUR/m<sup>2</sup>



Costs relative to collector area (data from Blackdot Energy, AEE Intec and personal communication with installers during 2014 - 2015). Exchange rate at date of installation was used ( $9.66 < \text{ZAR/EUR} < 15.3$  from 2007 to 2015).

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# CBC Brewery, Paarl

[www.soltrain.co.za/](http://www.soltrain.co.za/)



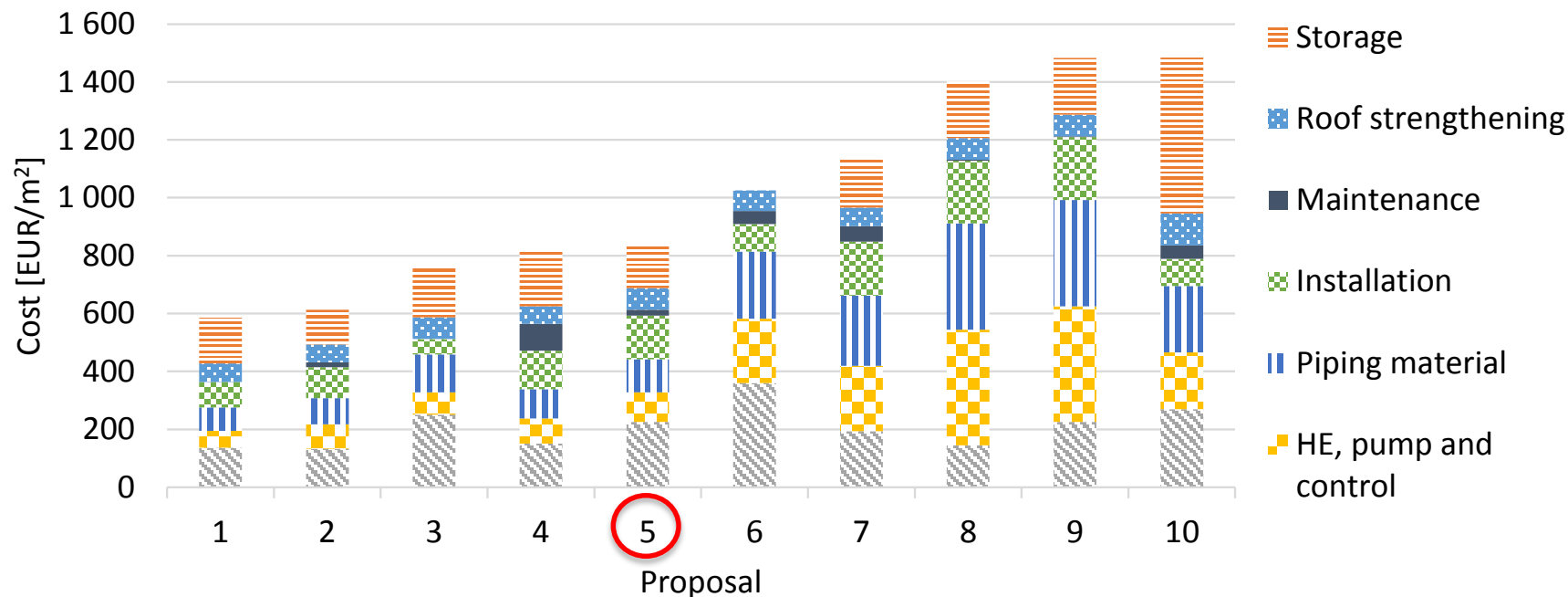
120 m<sup>2</sup> flat-plates, 10 m<sup>3</sup> storage tank, SF = 60 %  
<https://www.youtube.com/watch?v=JXANpox482k>



Pre-heating storage unit  
with stratified charging

# CBC Brewery, Paarl

## Tender evaluation

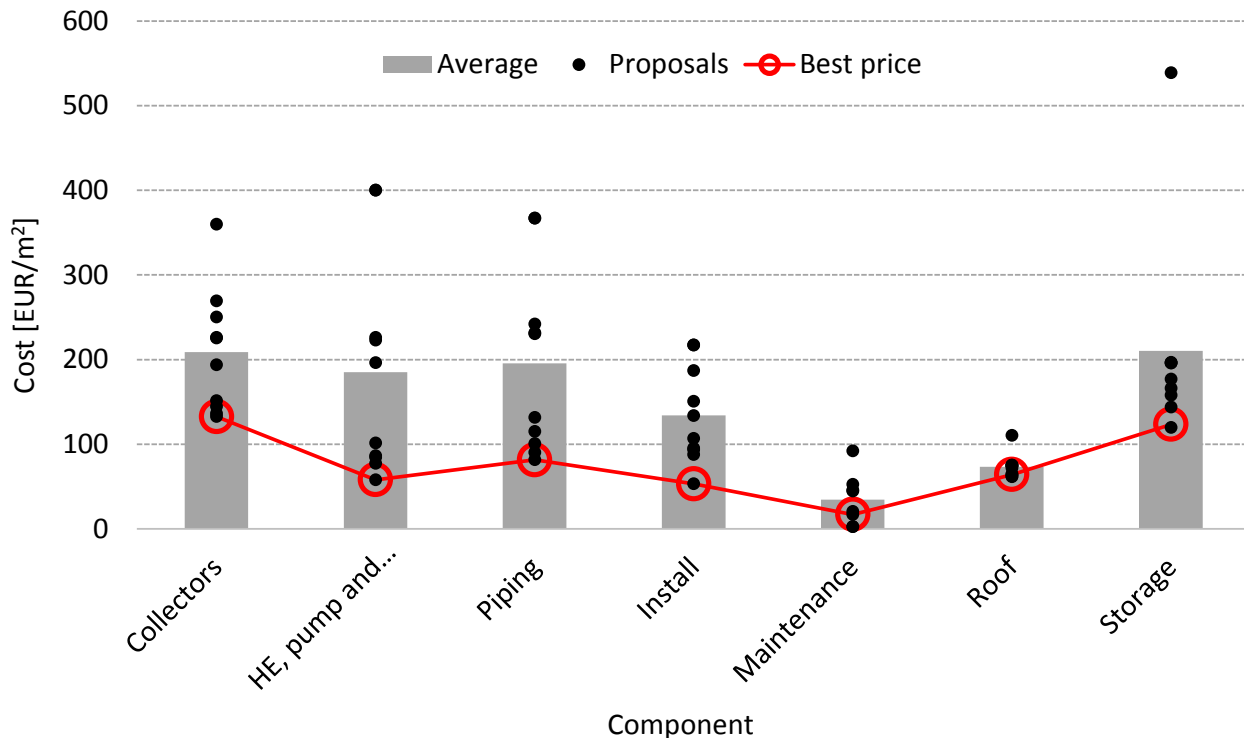


Proposal comparisons and component breakdown from the CBC tender (using September 2015 exchange rate of ZAR/EUR = 15.3)

# CBC Brewery, Paarl



Theoretical best price = 503 EUR/m<sup>2</sup>



Average costs and variance per cost category between all ten proposals of the CBC tender. Not all offers included costs for future maintenance and storage.

# Agenda

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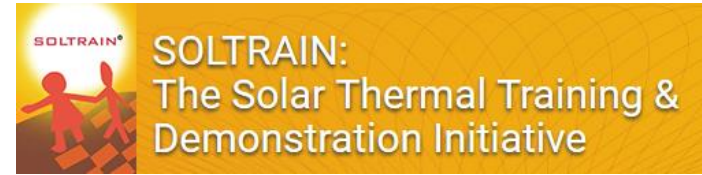


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# Soltrain III

Soltrain I and II (2008 – 2016)

Partners: Botswana, Lesotho, Mozambique,  
Namibia, South Africa, Zimbabwe



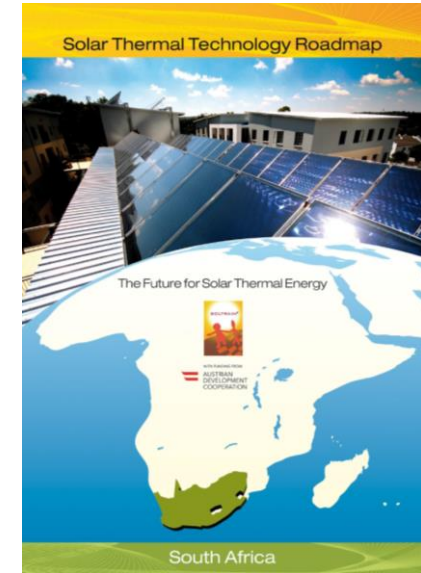
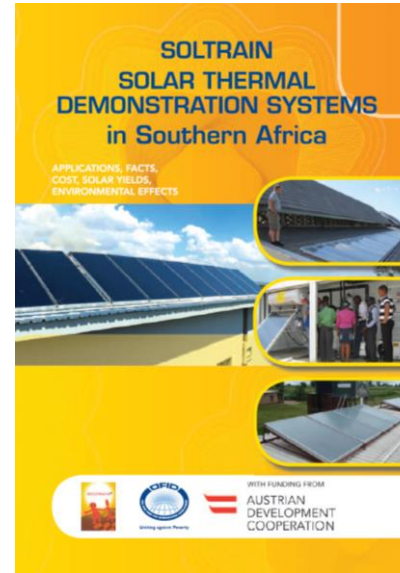
## Soltrain III targets:

- 500 persons trained in 22 courses on ST systems
- 12 policy workshops with 250 participants carried out
- 6 national ST Roadmaps implemented
- 6 ST market statistics available
- 70 ST demonstration systems installed, operating and checked

# Soltrain III

Results:

[www.soltrain.co.za](http://www.soltrain.co.za)



Support for demonstraion systems:

- System must be in „flagship district“, beneficiary SME
- Budget spent ca. 33 % on „roll-out“ and 66 % on „new applications“
- Installing company applies, up to 50 % of invest is funded
- Soltrain contact person Western Cape: [karink@sun.ac.za](mailto:karink@sun.ac.za)



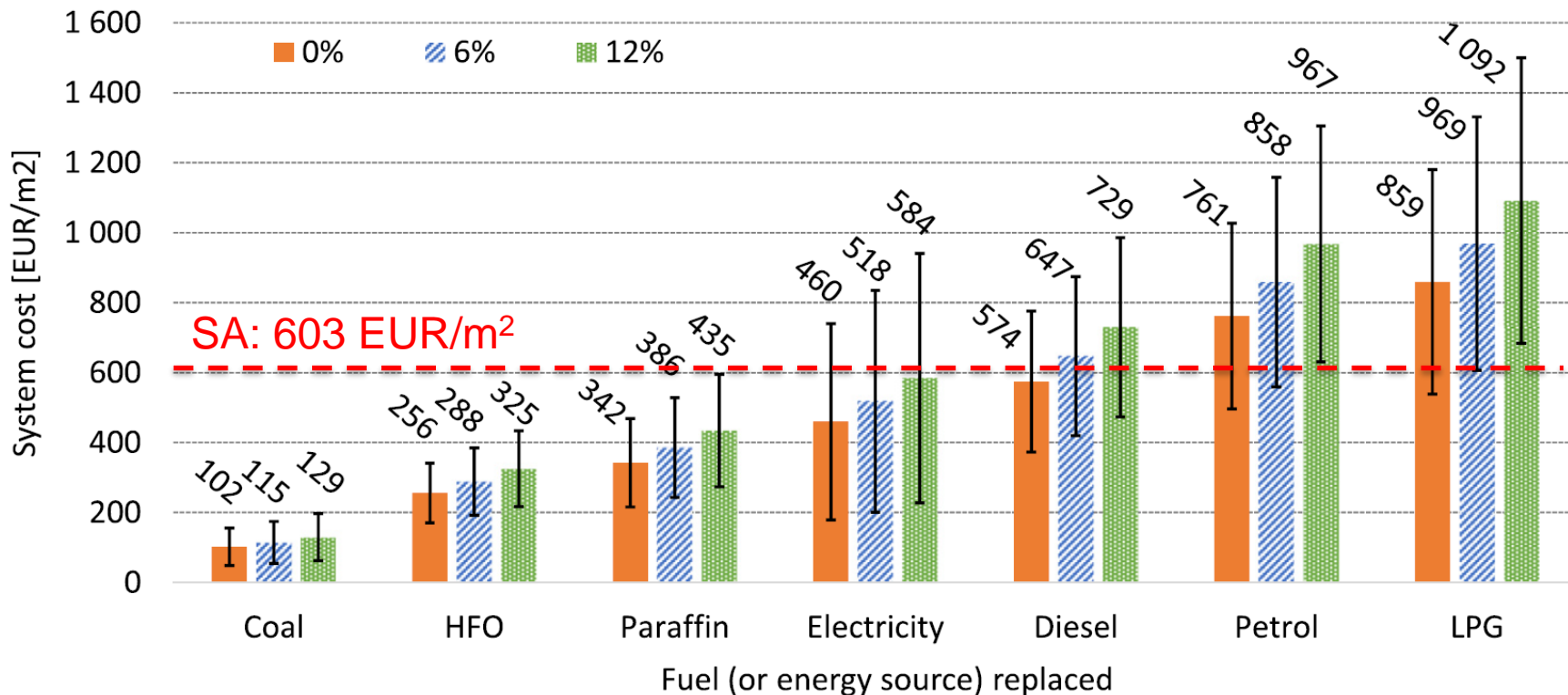
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# Specific System Costs



Required specific ST system costs to **break even after 5 years** in SA

# Way forward



## Solve long payback problem:

- Reduce investment: Standardized planning
- Contracting: Dedicated support?

## Increase competence and and build trust:

- Training seminars: Soltrain
- Publish best practice: Independent monitoring

## Push market diffusion:

- Identify low-hanging fruits
- Sector specific research projects (STEP-Bio for SA sugar industry)

# Thank you!

## Acknowledgements:

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Blackdotenergy

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visit us: [concentrating.sun.ac.za](http://concentrating.sun.ac.za)

# References

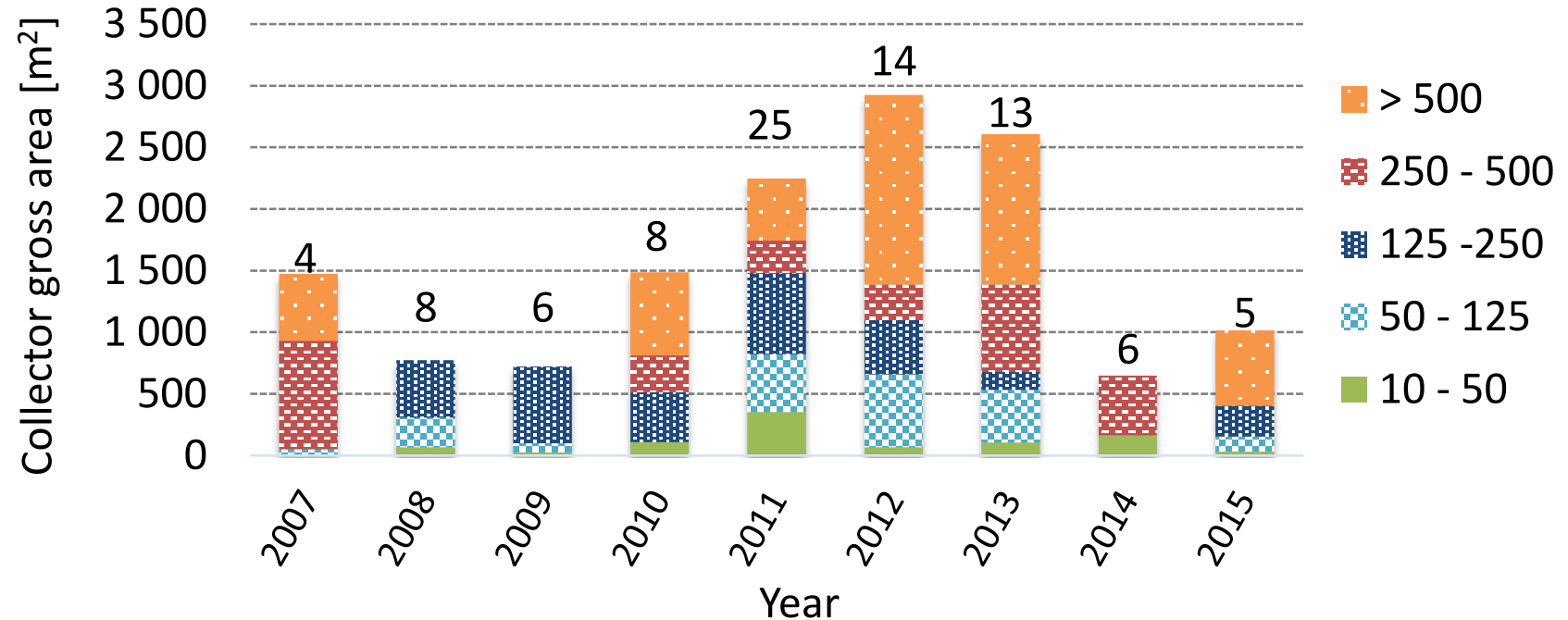
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Blackdot Energy n.d., *Documenting Commercial Solar Thermal in South Africa*. Available from: <http://www.blackdotenergy.co.za/>. [15 August 2015].

Joubert, EC, Hess, S & van Niekerk, JL 2016. Large-scale solar water heating in South Africa: Status, barriers and recommendations. *Renewable Energy* 97: 809-822.

# Annual Installations

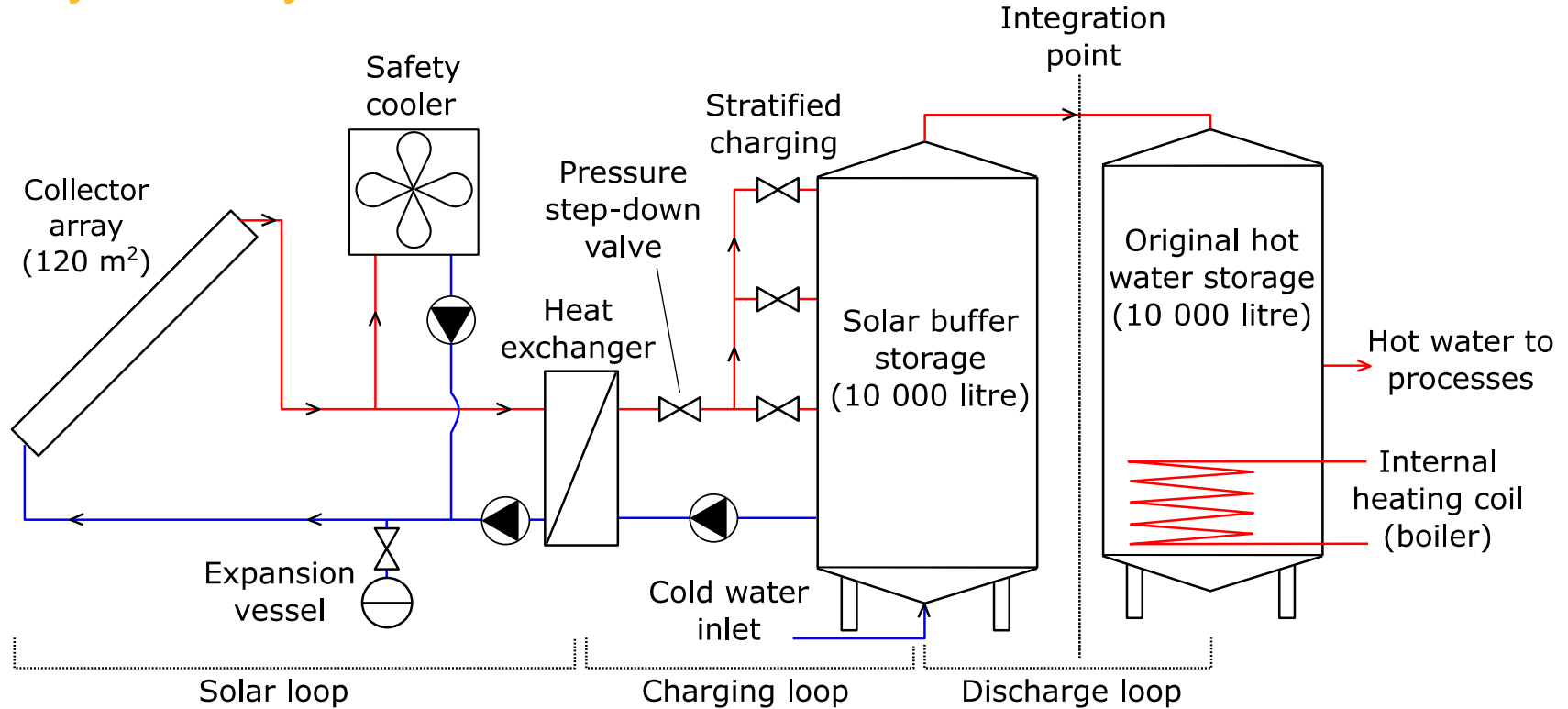


ST collector gross area ( $> 10 \text{ m}^2$ ) newly installed in SA in recent years. Total number of installations per year indicated above bars. Legend units are  $\text{m}^2$ .



# CBC Brewery, Paarl

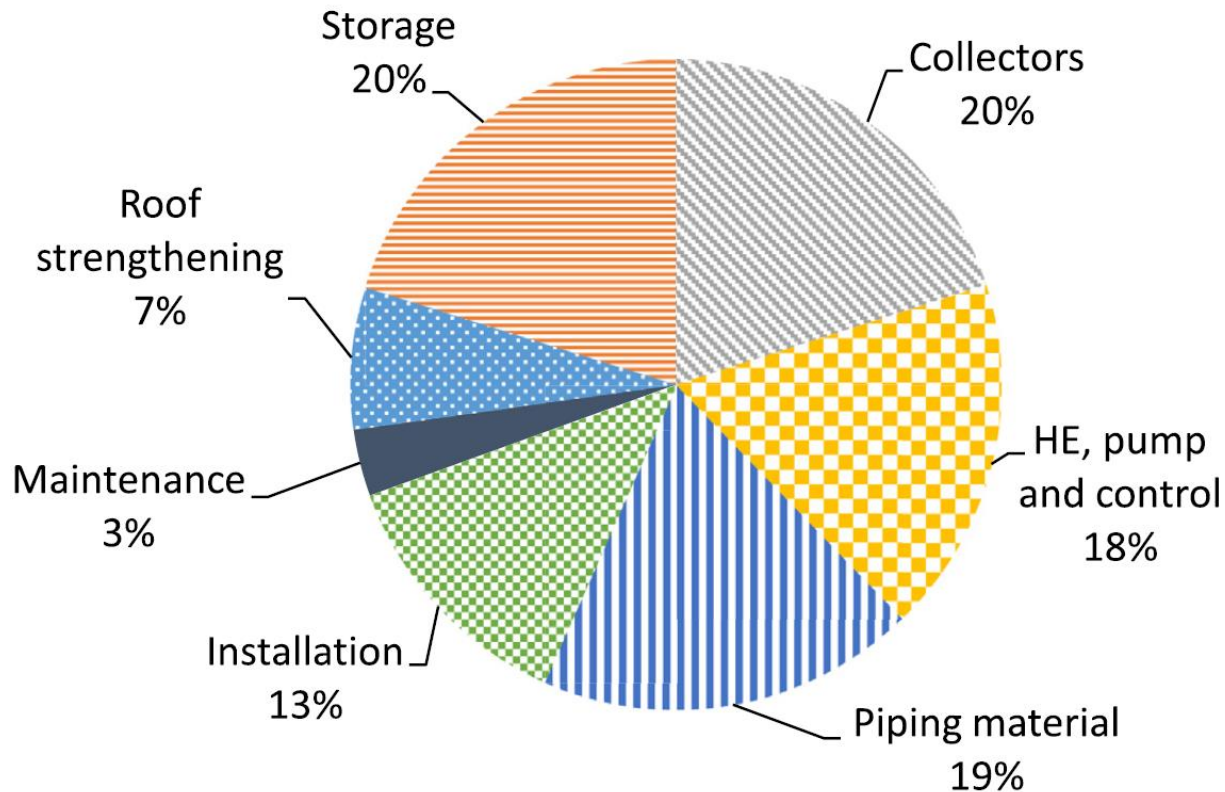
## System Hydraulics



Demand: 7 m<sup>3</sup>/d @ 85 °C

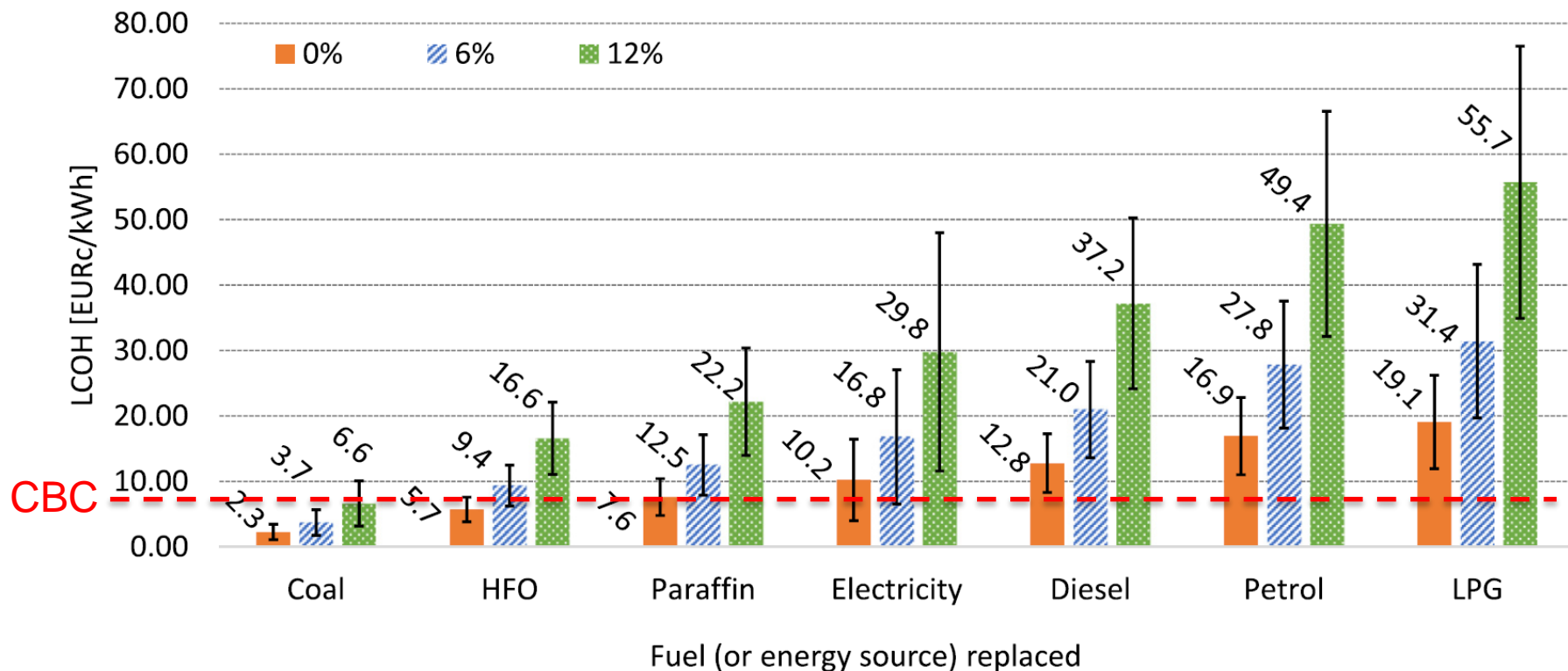
# CBC Brewery, Paarl

## Average component shares





# Levelized Costs of Heat (LCOH)



Current and future heat generation **costs from conventional fuels** in SA. LCOH values over 20 years with and price increase 0%, 6 % and 12 % respectively. Values in EUR/kWh.