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Towards Standardising Building Rural Clinics: Energy Requirements

Domestic Use of Energy Conference

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31March 2015, Cape Town

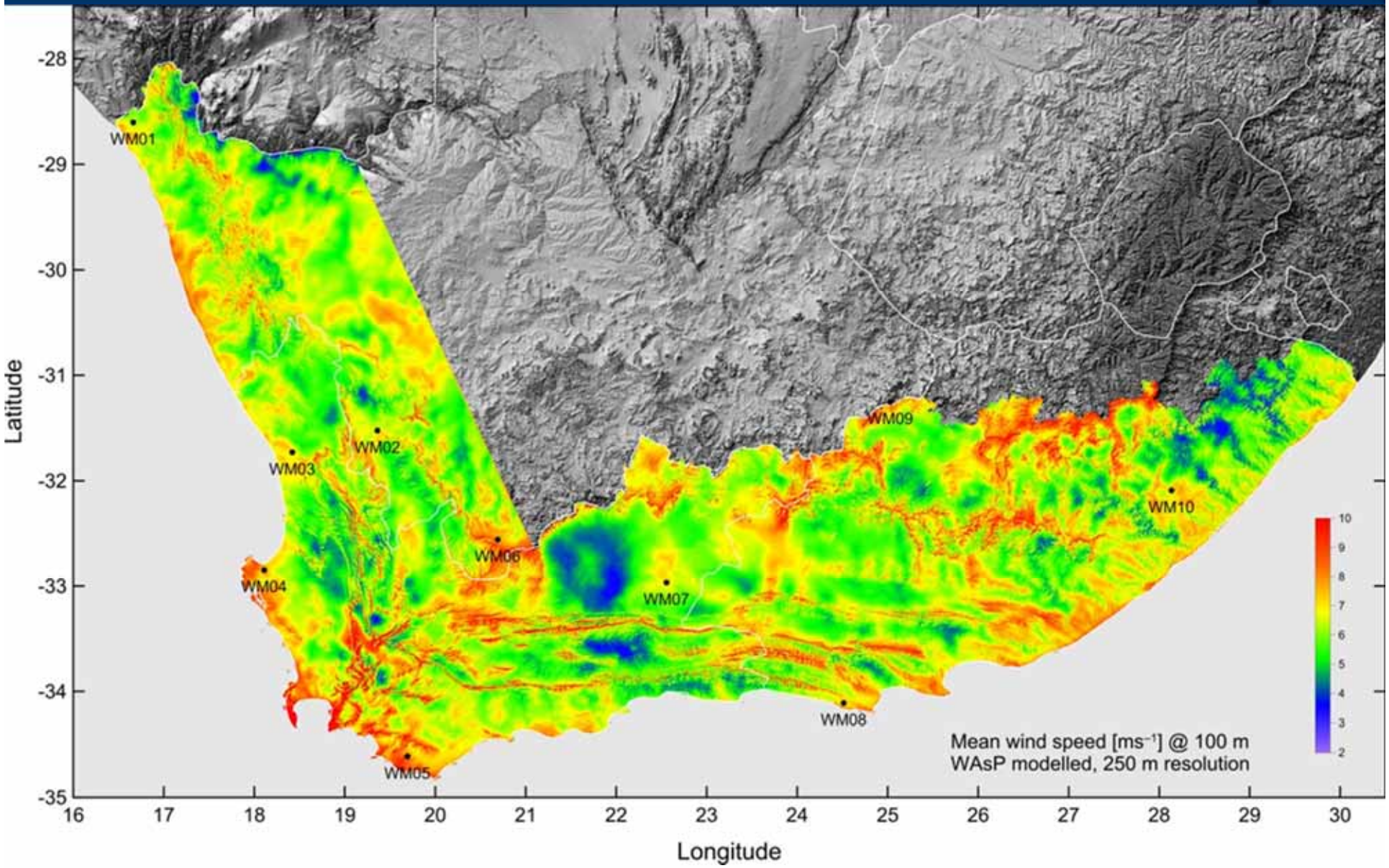
Introduction

- Buildings have a significant impact on energy use and the environment
- Energy in the building sector continues to increase – primarily because new buildings are being constructed faster than old ones are retired
- Energy consumption will continue to increase until buildings can be designed to:
  - use energy efficiently and
  - produce enough energy to offset the energy demand of these buildings
- Consequently, need to create the technology and knowledge base to reduce impact of buildings on the environment
- **Case study: towards standardising rural clinics to be independent of municipal services, such as electricity**

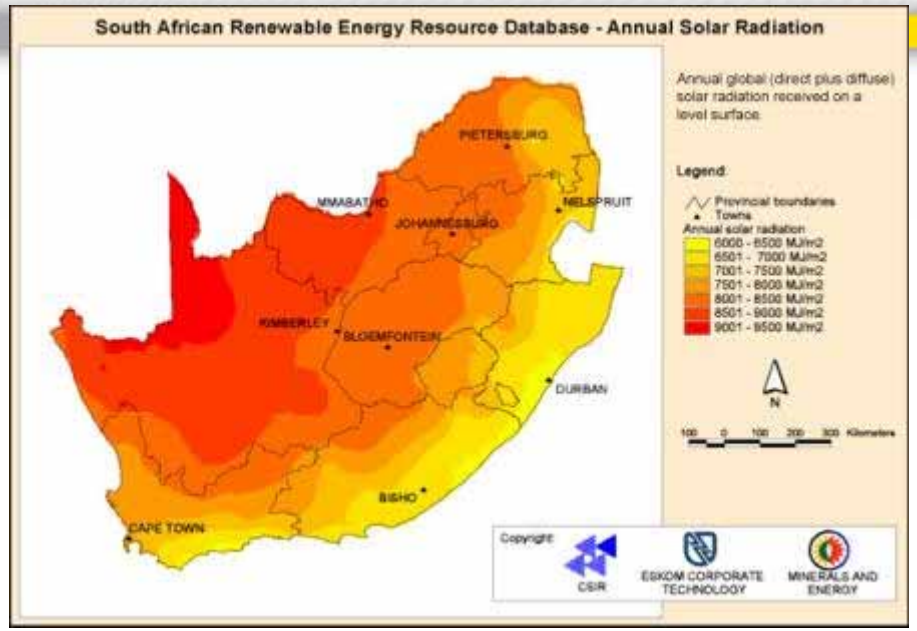
Electricity Supply Option Hierarchy
(courtesy of National Renewable Energy Laboratory, USA)

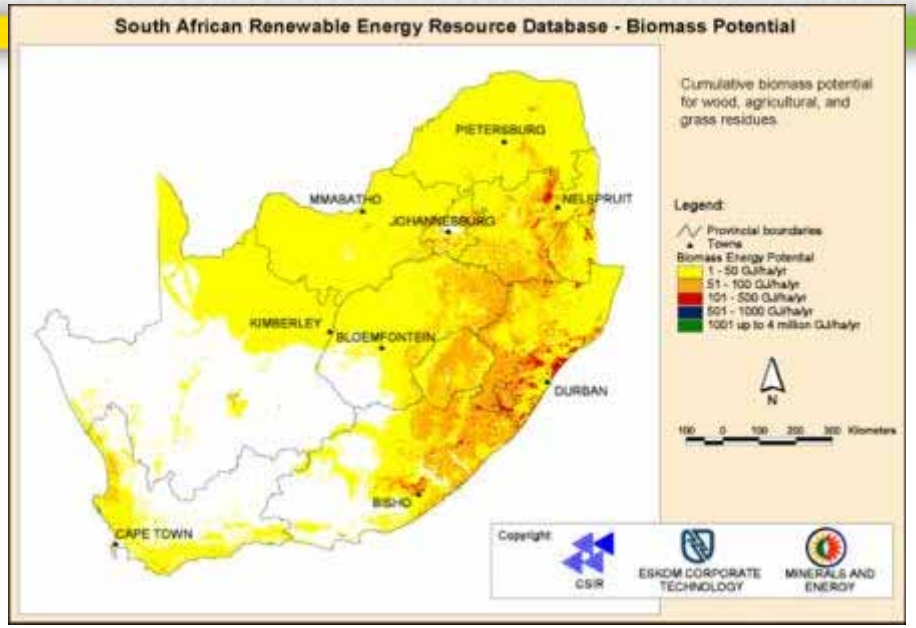
Option No.	Supply-Side Options	Examples
0	Reduce site energy use through energy efficiency and demand-side renewable building technologies.	Daylighting; insulation; passive solar heating; high-efficiency heating, ventilation and air-conditioning equipment; natural ventilation, evaporative cooling; heat pumps;
	On-Site Supply Options	
1	Use RE sources available within the building footprint and connected to its electricity or hot/chilled water system	PV, solar hot water, and wind located on the building
2	Use RE sources available at the building site and connected to its electricity or hot/chilled water distribution system.	PV, solar hot water, low-impact hydro, and wind located on parking lots or adjacent open space, but not physically mounted on the building
	Off-Site Supply Options	
3	Use RE sources available off site to generate energy on site and connected to the building's electricity and/or hot/chilled water system.	Biomass, wood pellets, ethanol, or biodiesel that can be imported from off site, or collected from waste streams from on-site processes that can be used on site to generate electricity and heat
4	Purchase electricity from off-site RE sources, e.g REIPPP.	Utility-based wind, PV, emissions credits, or other "green" purchasing options. All off-site purchases must be certified as RE. A building could also negotiate with its power provider to install dedicated wind turbines or PV panels at a site with good off-site solar and/or wind resources

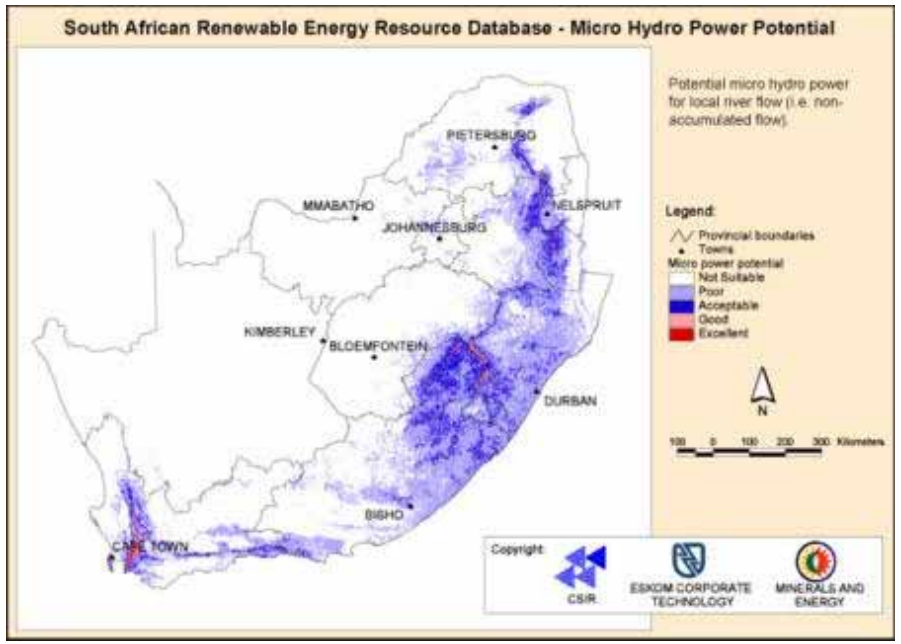
SA’s renewable energy resource (WASA Phase 1)



South Africa's Renewable Energy Resource cont'd







Waste is another resource that can be exploited.

Examples: waste water (sewage), municipal solid waste, agricultural waste

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Case study: Renewable Energy for Electrification of Rural Buildings in the Eastern Cape Province

- 3 year multinational EU (Garrad Hassan of UK, Netherlands Energy Research Foundation) - CSIR investigative project
- Objective: identify rural electrification opportunities using renewable energies linked to existing & new economic activities
- Output: identified implementable projects – emphasis on objective technological evaluations of energy efficiency & renewable energy in buildings
- Identified energy efficiency & renewable energy projects at Hluleka Nature Reserve & Lucingweni village on Wild Coast of Eastern Cape Province
- Both examples of NREL Option 2: Renewable energy based electricity generated within the boundary of the building site

Hluleka Nature Reserve and Lucingweni Village

Hluleka Nature Reserve

Lucingweni village

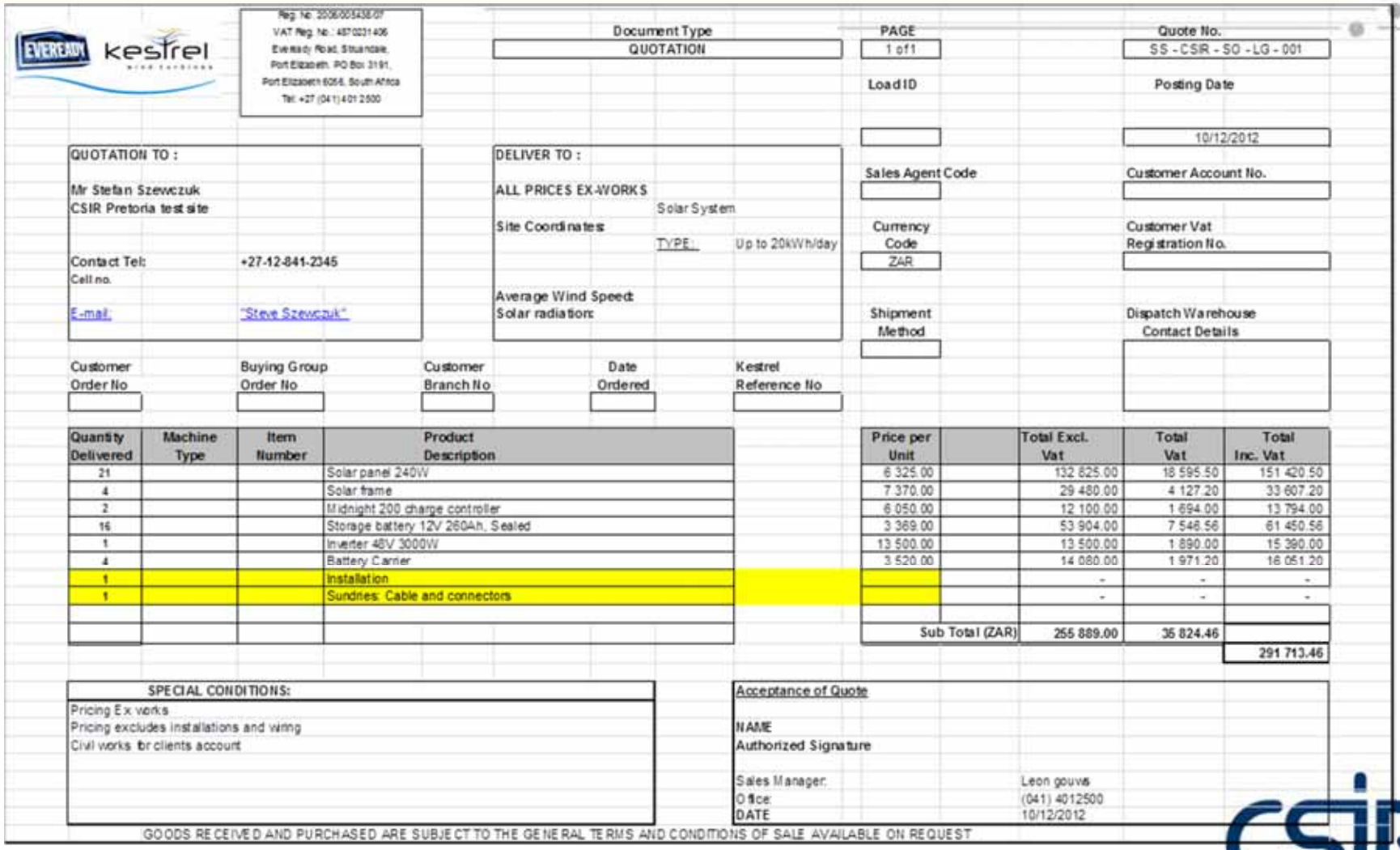
Rural Clinics

- No standardised South African rural clinic
- Provinces have developed their own design guidelines for their respective health facilities
- CSIR investigated patient flow patterns into and out of a typical basic clinic
- A general patient flow pattern was established
- Information used to design a generic rural clinic - standardised clinic
- Designed to be independent of municipal services, ie water, sanitation and energy

Energy requirements for standardised rural clinic

ELECTRICITY CONSUMPTION CALCULATION				
QTY	ITEM / APPLIANCE DESCRIPTION	Power draw of item - Watts	Average hours run-time (each) per week	Watt-hours per week
4	Lights (external) 10hrs/day	40	70	11200
22	Lights (internal)	20	40	17600
1	TV 67cm	80	40	3200
1	Radio / Hi-Fi	30	30	900
1	Alarm System (48 hrs over weekend, 10hrs/day weekday)	30	98	2940
1	Fridge medium, modern energy efficient. 1700-2500 watt-hrs/day but depends lot on ambient temp, thermostat setting, door openings, content turnover. Select 2200 watt-hrs/day	2200	10	22000
1	Microwave medium (1hr/day)	1200	5	6000
1	Toaster 2hrs/day	800	10	8000
2	Computer (desktop) 14inch screen	175	40	14000
1	Printer (Dot matrix) 1hour/day	150	5	750
1	Kettle 2hrs/day - high power, use must be limited	1500	10	15000
5	Medical appliances, 5 items each 100w	100	20	10000
1	Vacuum cleaner	800	5	4000
1	other - switchboard small	50	40	2000
2	other - cell phone charger	100	20	4000
1	other - DSTV	40	40	1600
1	other - pump 5hrs/day	400	25	10000
1	other - contingency 0.5hr/day	1200	3.5	4200
1	other - contingency 0.25 hr/day	800	1.75	1400
			TOTAL WATT-HOURS PER WEEK	138790

Standard clinic: CSIR Pretoria demo site - solar



kestrel wind turbines

Reg. No: 2006/005438/07
VAT Reg. No.: 4870231406
Eveready Road, Struandale,
Port Elizabeth, PO Box 3191,
Port Elizabeth 6056, South Africa
Tel: +27 (041) 401 2500

Document Type: QUOTATION
PAGE: 1 of 1
Quote No.: SS - CSIR - SO - LG - 001
Load ID:
Posting Date: 10/12/2012

QUOTATION TO :
Mr Stefan Szewczuk
CSIR Pretoria test site
Contact Tel: +27-12-841-2345
Cell no.
E-mail: "Steve Szewczuk"

DELIVER TO :
ALL PRICES EX-WORKS
Solar System
Site Coordinates:
TYPE: Up to 20kWh/day
Average Wind Speed:
Solar radiation:

Sales Agent Code:
Customer Account No.:
Currency Code: ZAR
Customer Vat Registration No.:
Shipment Method:
Dispatch Warehouse Contact Details:

Customer Order No	Buying Group Order No	Customer Branch No	Date Ordered	Kestrel Reference No

Quantity Delivered	Machine Type	Item Number	Product Description	Price per Unit		Total Excl. Vat	Total Vat	Total Inc. Vat
21			Solar panel 240W	6 325.00		132 825.00	18 595.50	151 420.50
4			Solar frame	7 370.00		29 480.00	4 127.20	33 607.20
2			Midnight 200 charge controller	6 050.00		12 100.00	1 694.00	13 794.00
16			Storage battery 12V 260Ah, Sealed	3 369.00		53 904.00	7 546.56	61 450.56
1			Inverter 48V 3000W	13 500.00		13 500.00	1 890.00	15 390.00
4			Battery Carrier	3 520.00		14 080.00	1 971.20	16 051.20
1			Installation			-	-	-
1			Sundries: Cable and connectors			-	-	-
					Sub Total (ZAR)	255 889.00	35 824.46	
								291 713.46

SPECIAL CONDITIONS:
Pricing Ex works
Pricing excludes installations and wiring
Civil works for clients account

Acceptance of Quote
NAME
Authorized Signature
Sales Manager: Leon gouws
Office: (041) 4012500
DATE: 10/12/2012

GOODS RECEIVED AND PURCHASED ARE SUBJECT TO THE GENERAL TERMS AND CONDITIONS OF SALE AVAILABLE ON REQUEST

Based on a technical analysis of the expected electricity requirements of the clinic and the available roof space for solar panels, a demo standardised clinic on CSIR Pretoria campus can be powered solely by PV

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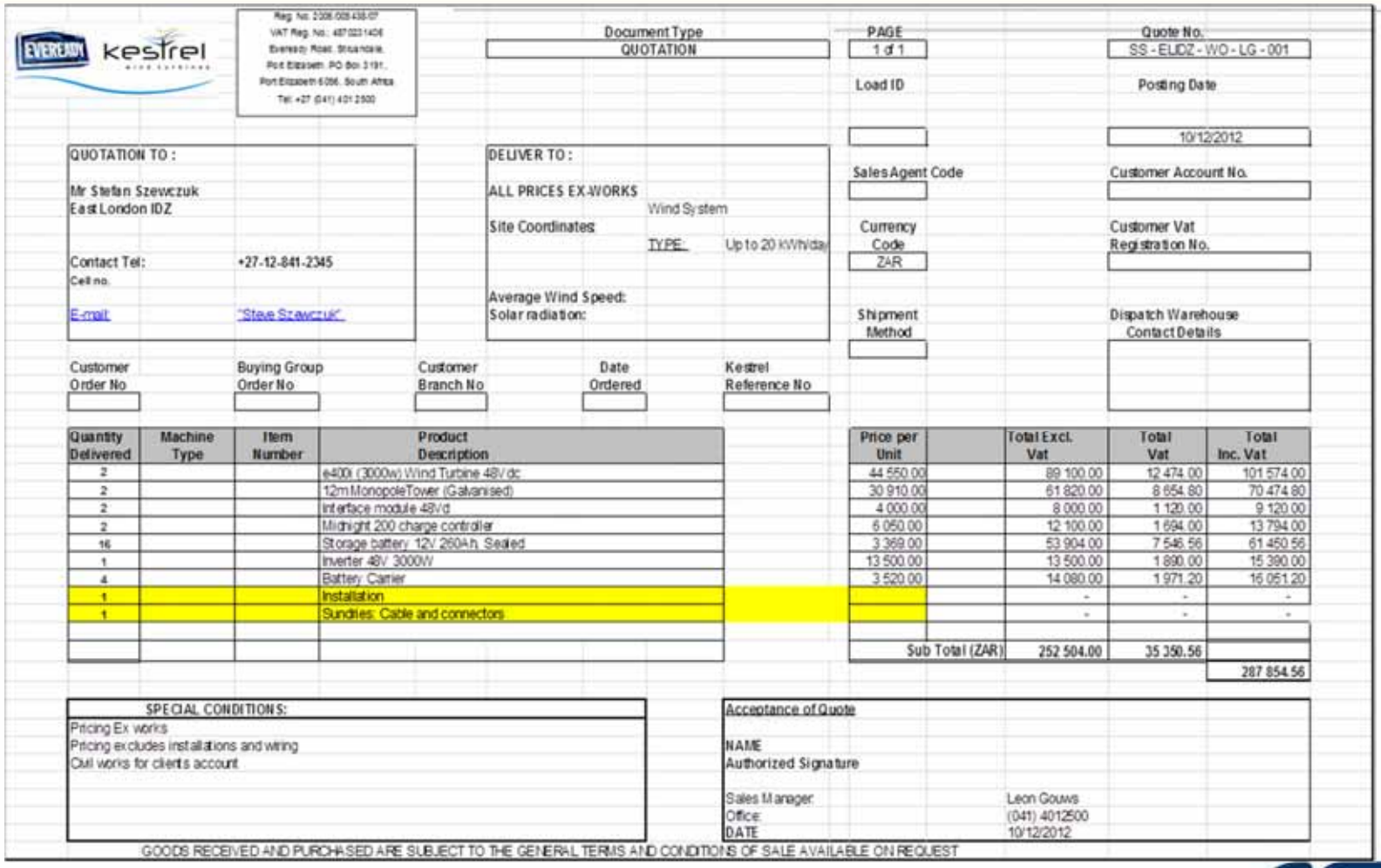
Standard clinic: East London IDZ - wind

Standard clinic: East London IDZ - wind



kestrel

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PAGE: 1 of 1

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Load ID:

Posting Date: 10/12/2012

QUOTATION TO :

Mr Stefan Szewczuk
East London IDZ

Contact Tel: +27-12-841-2345
Cell no.

E-mail: "Steve Szewczuk"

DELIVER TO :

ALL PRICES EX-WORKS

Wind System

Site Coordinates:

TYPE: Up to 20 kWh/day

Average Wind Speed:
Solar radiation:

Sales Agent Code:

Customer Account No.:

Currency Code: ZAR

Customer Vat Registration No.:

Shipment Method:

Dispatch Warehouse Contact Details:

Customer Order No	Buying Group Order No	Customer Branch No	Date Ordered	Kestrel Reference No

Quantity Delivered	Machine Type	Item Number	Product Description	Price per Unit		Total Excl. Vat	Total Vat	Total Inc. Vat
2			e400i (3000w) Wind Turbine 48V dc	44 550.00		89 100.00	12 474.00	101 574.00
2			12m MonopoleTower (Galvanised)	30 910.00		61 820.00	8 654.80	70 474.80
2			Interface module 48Vd	4 000.00		8 000.00	1 120.00	9 120.00
2			Midnight 200 charge controller	6 050.00		12 100.00	1 694.00	13 794.00
16			Storage battery 12V 260Ah Sealed	3 369.00		53 904.00	7 546.56	61 450.56
1			Inverter 48V 3000W	13 500.00		13 500.00	1 890.00	15 390.00
4			Battery Carrier	3 520.00		14 080.00	1 971.20	16 051.20
1			Installation			-	-	-
1			Sundries: Cable and connectors			-	-	-
					Sub Total (ZAR)	252 504.00	35 350.56	
								287 854.56

SPECIAL CONDITIONS:

Pricing Ex works
Pricing excludes installations and wiring
Civil works for clients account

Acceptance of Quote

NAME
Authorized Signature

Sales Manager: Leon Gouws
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Preliminary investigations indicate that a wind system is slightly cheaper than a PV only system, but is site dependent on the availability of renewable energy resources.

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Preliminary recommendations for off-grid standard clinic

The following options are recommended for the clinic to function off-grid and independent of municipal services:

- Photovoltaic (PV) based system for the generation of electricity for sunny but wind free sites such as CSIR Pretoria campus.
- Wind based system for the generation of electricity for windy sites such as the East London Industrial Development Zone.
- Known renewable energy resources at specific site determines combinations of renewables used
- Solar water heating
- Liquid Petroleum Gas (LPG) for space heating and cooking.

Thank you

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Name (email@csir.co.za)