Biogas Utilisation from Landfill Sites and Anaerobic Digestion

Presented By David Cornish

Items Covered

- Back ground to ENER-G Systems
- Landfill gas basics
- Technology and equipment
- Project implementation structure
- Experience on similar projects
- REIPPPP Small scale

ENER-G Systems

- ENER-G Group global experience
  - Staff compliment of over 600
  - Over 580 CHP units installed
  - Over 120 MW of landfill gas projects
  - 46% market share in UK

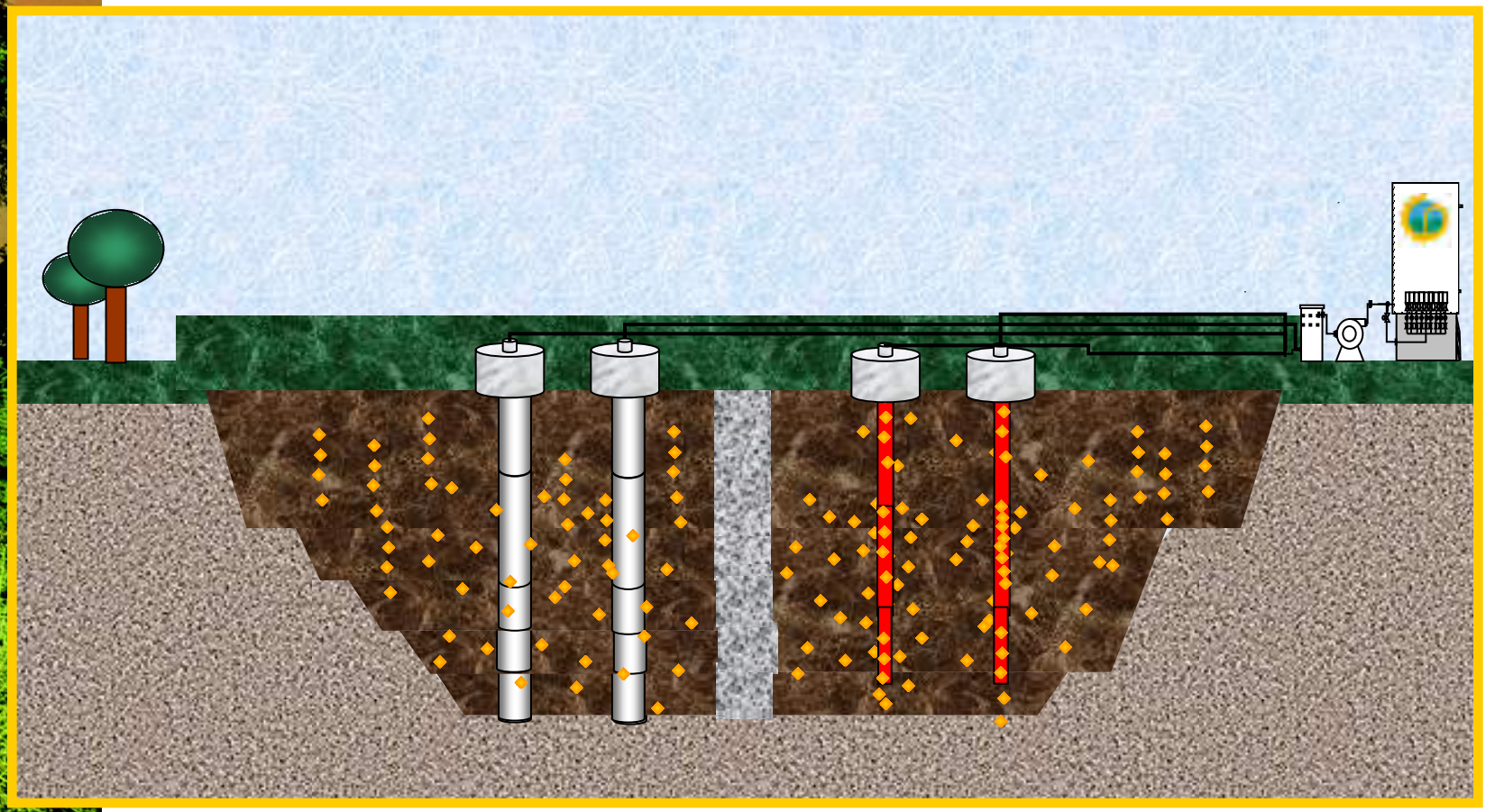
- Locally ENER-G Systems experience
  - 9 Landfill gas to electricity projects
  - One has been running for 3 years selling power to BHP Billiton
  - Chloorkop biogas project Built
  - Robinson Deep and Marie Louise Biogas project Built
  - Submitted 1 bid in round 3 of the large scale REIPPPP
  - Submitted 1 bid in Stage 1 of the small scale REIPPPP

Biogas Production

Rule of thumb calculations

- 1 tonne of highly organic waste (expected in South Africa) will produce at least 6m^3 of gas
- 100,000T of domestic waste in a landfill p.a. is 1MW
- 1MW generator requires 600 m^3/hour of Biogas at 50% CH_4

Landfill Gas



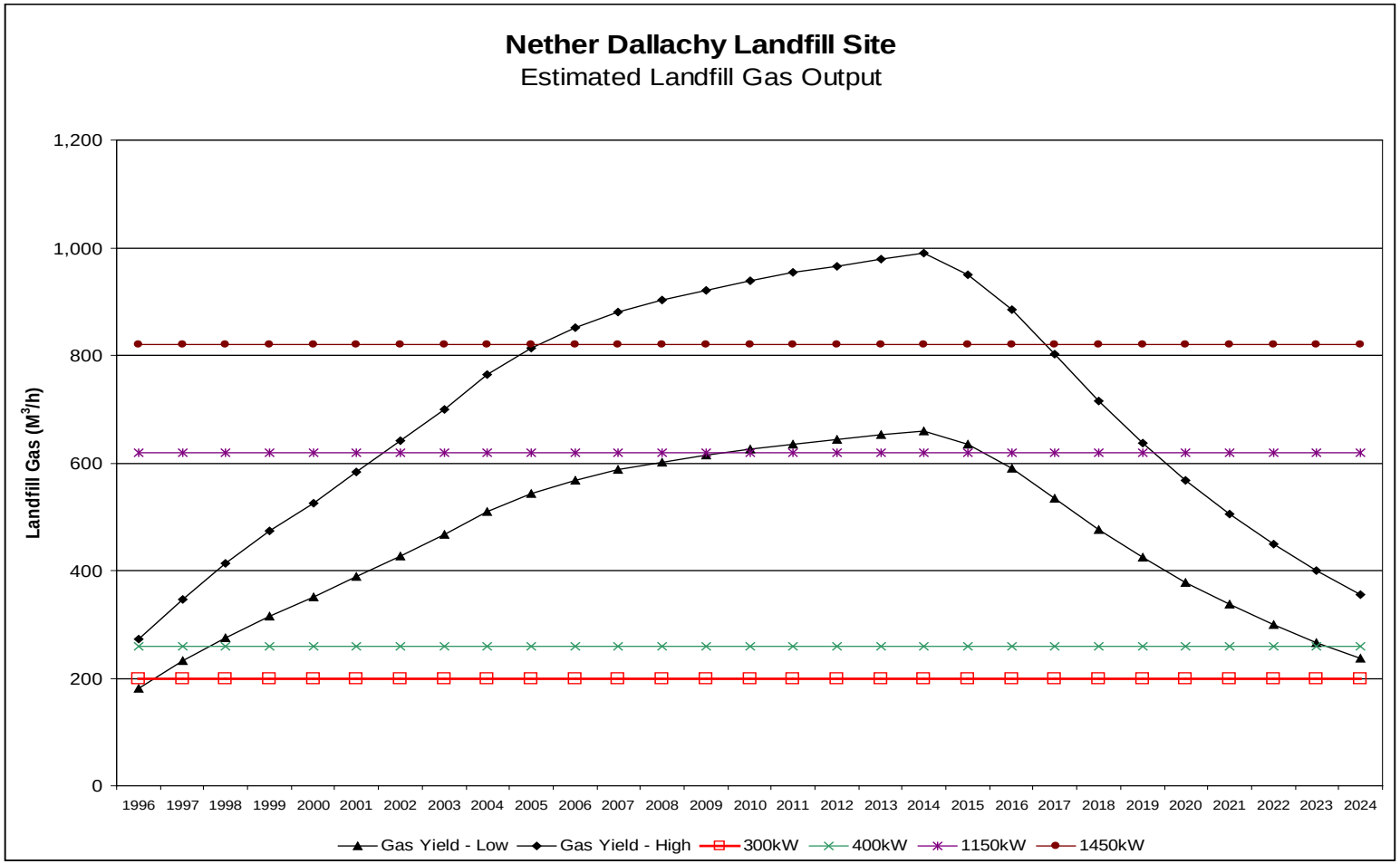
Biogas Generation (assessment of gas generated)

- The calculation of the amount of gas produced in a landfill site is NOT an exact science and can be influenced by many factors:
  - The input of waste per annum and the percentage or organics in the mix
  - The surface area and depth of waste.
  - How the site is lined and capped.
  - The amount of moisture and leachate handling systems.
  - The method of site filling and operation.

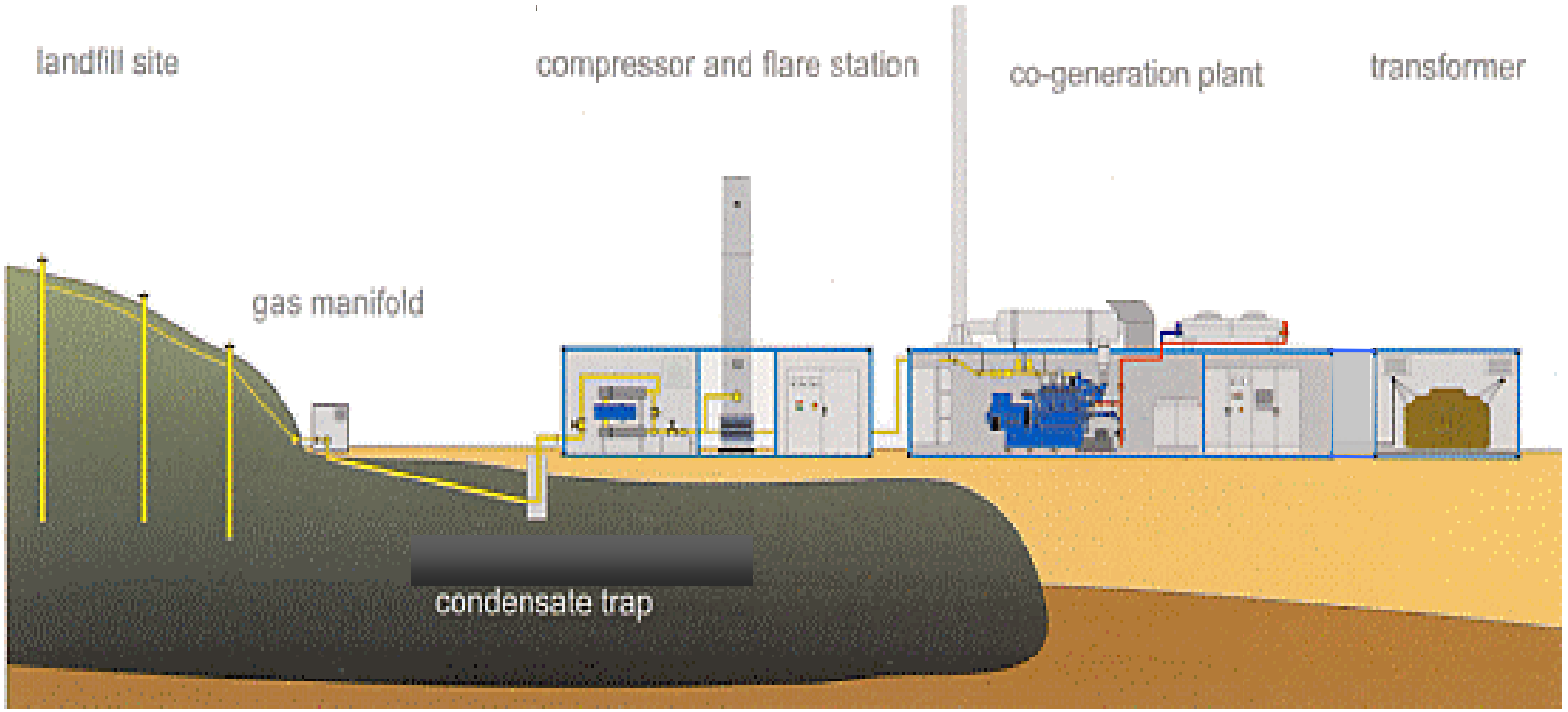
Nether Dallachy

Waste Category		A	B	C	D					
Waste Type		Inert	Industrial	Comm/Ind	Domestic					
% Putrescible (assumed)		0%	25%	50%	60%		tonne/m^3:	1		
Decomp. Rate Factd	0 - 10	0	4.0	5.5	8.0					
Proportion 1		15%	15%	20%	50%	100%				
Proportion 2 (option)		0%	0%	0%	0%	0%				
Units - tonnes or m^3		tonnes	tonnes	tonnes	tonnes	tonnes Total	% Putrescible	Weight Weight	Volume Cumulative	Weight Cumulative
Proportion Equation 1		0	0	0	1	1				
Proportion Equation 2		0	0	0	0	1				
Sum of Actuals						0				
1993		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	64,000	64,000
1994		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	128,000	128,000
1995		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	192,000	192,000
1996		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	256,000	256,000
1997		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	320,000	320,000
1998		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	384,000	384,000
1999		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	448,000	448,000
2000		9,600	9,600	12,800	32,000	64,000	43.75%	64,000	512,000	512,000
2001		12,000	12,000	16,000	40,000	80,000	43.75%	80,000	592,000	592,000
2002		12,000	12,000	16,000	40,000	80,000	43.75%	80,000	672,000	672,000
2003		12,000	12,000	16,000	40,000	80,000	43.75%	80,000	752,000	752,000
2004		14,469	14,469	19,293	48,232	96,463	43.75%	96,463	848,463	848,463
2005		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	920,463	920,463
2006		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	992,463	992,463
2007		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,064,463	1,064,463
2008		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,136,463	1,136,463
2009		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,208,463	1,208,463
2010		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,280,463	1,280,463
2011		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,352,463	1,352,463
2012		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,424,463	1,424,463
2013		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,496,463	1,496,463
2014		10,800	10,800	14,400	36,000	72,000	43.75%	72,000	1,568,463	1,568,463
2015		0	0	0	1	1	43.75%	1	1,568,464	1,568,464
2016		0	0	0	1	1	43.75%	1	1,568,465	1,568,465
2017		0	0	0	1	1	43.75%	1	1,568,466	1,568,466

Gas Production Curve



Using Landfill Gas



Installation of pipe work manifold arrangement

Robinson Deep

1.15MW – Generator

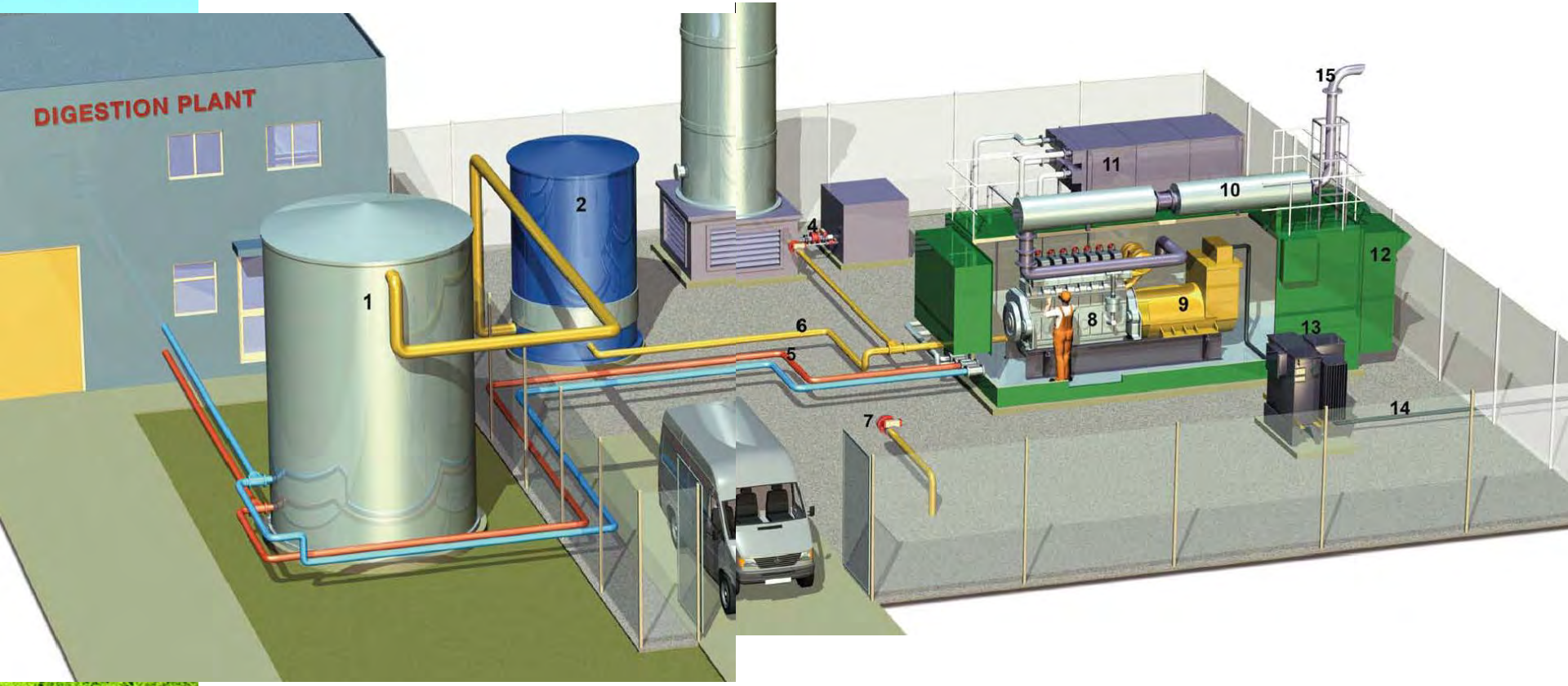
Generators

1030kW & 300kW Generators

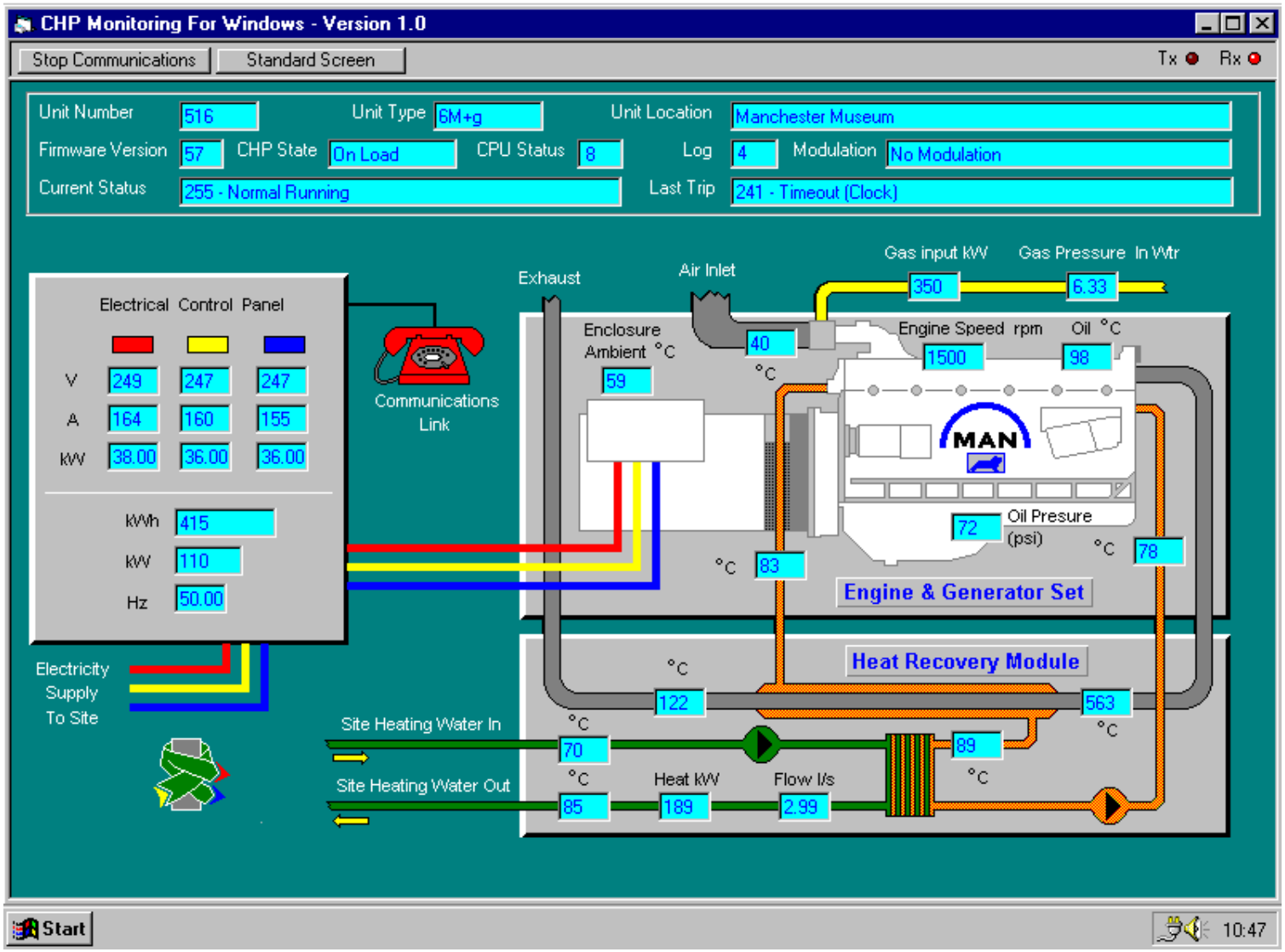
Alton Landfill

400KW landfill gas project

Design Philosophy



Automated Operating Systems



System Integration

Operating Sites

22 Operational AD projects

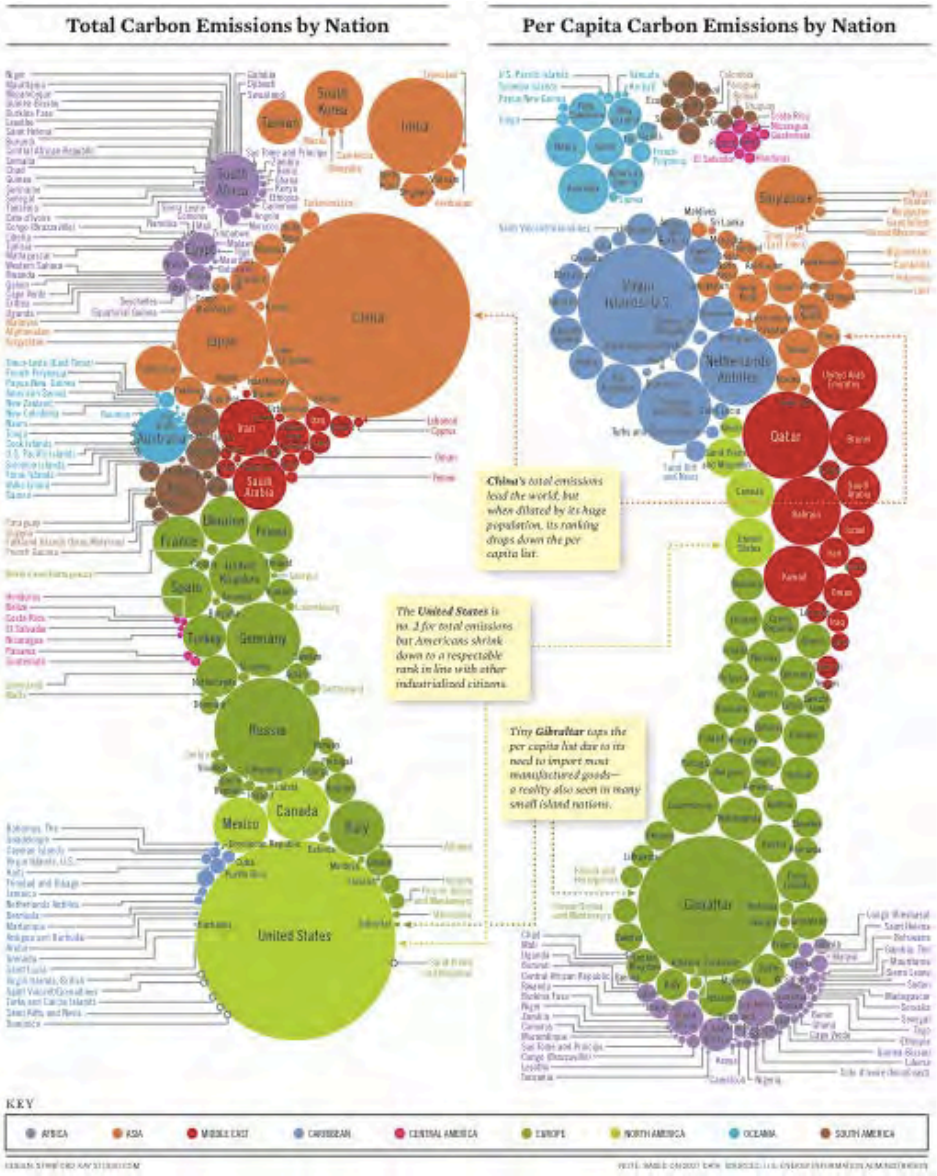
20 MW installed capacity

510 000 operating hours

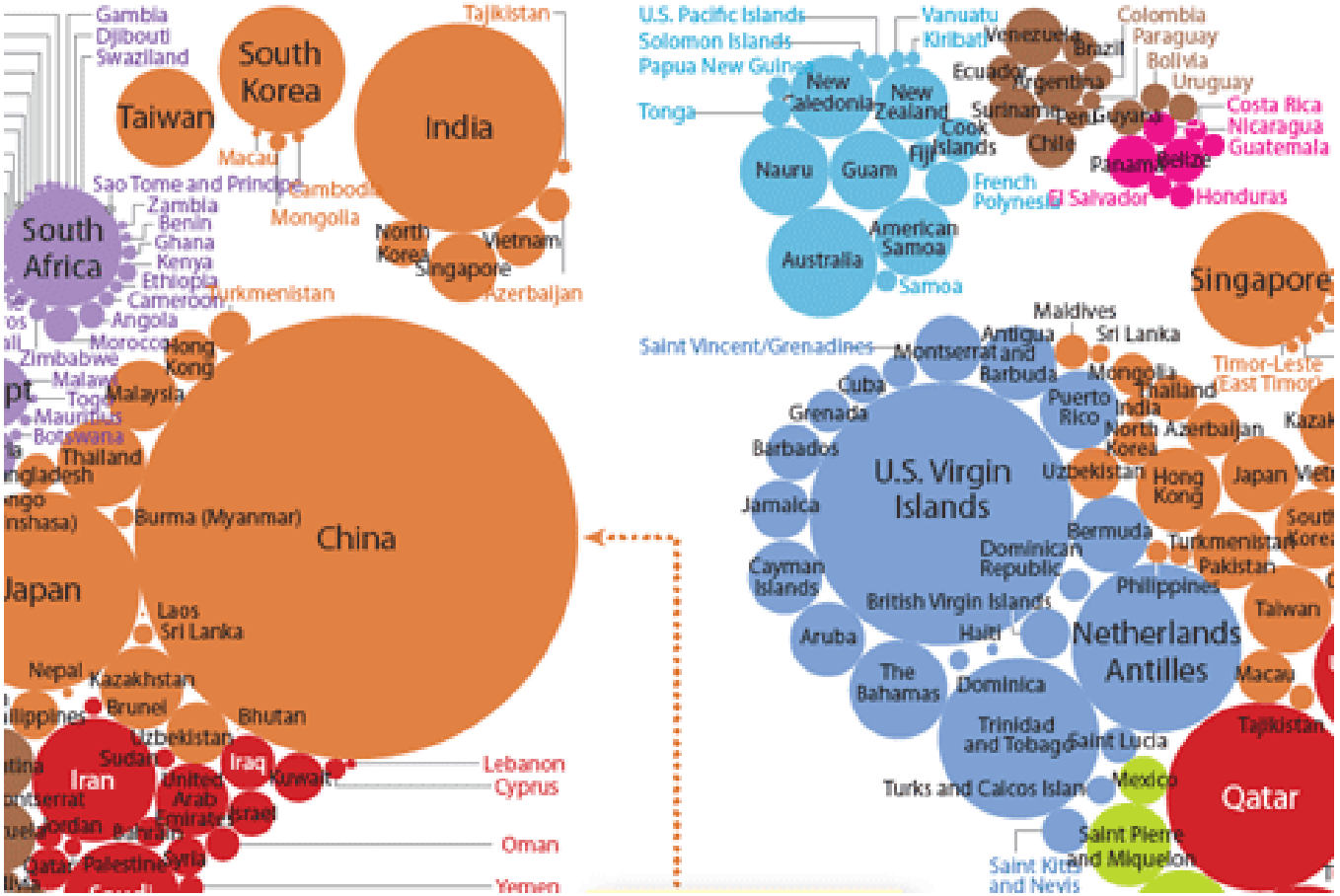
Why Bother utilising Landfill Gas?

- Methane from waste is a huge source of atmospheric methane throughout the word and in the SA it is the significant contributor to our green house gas emissions.
- Methane venting to the atmosphere is 21 times more damaging to the ozone than the CO_2 emissions.
- Methane is a valuable fuel source
- Control of methane helps to reduce odours for those people living in and around a landfill site and maintain safe operating conditions .

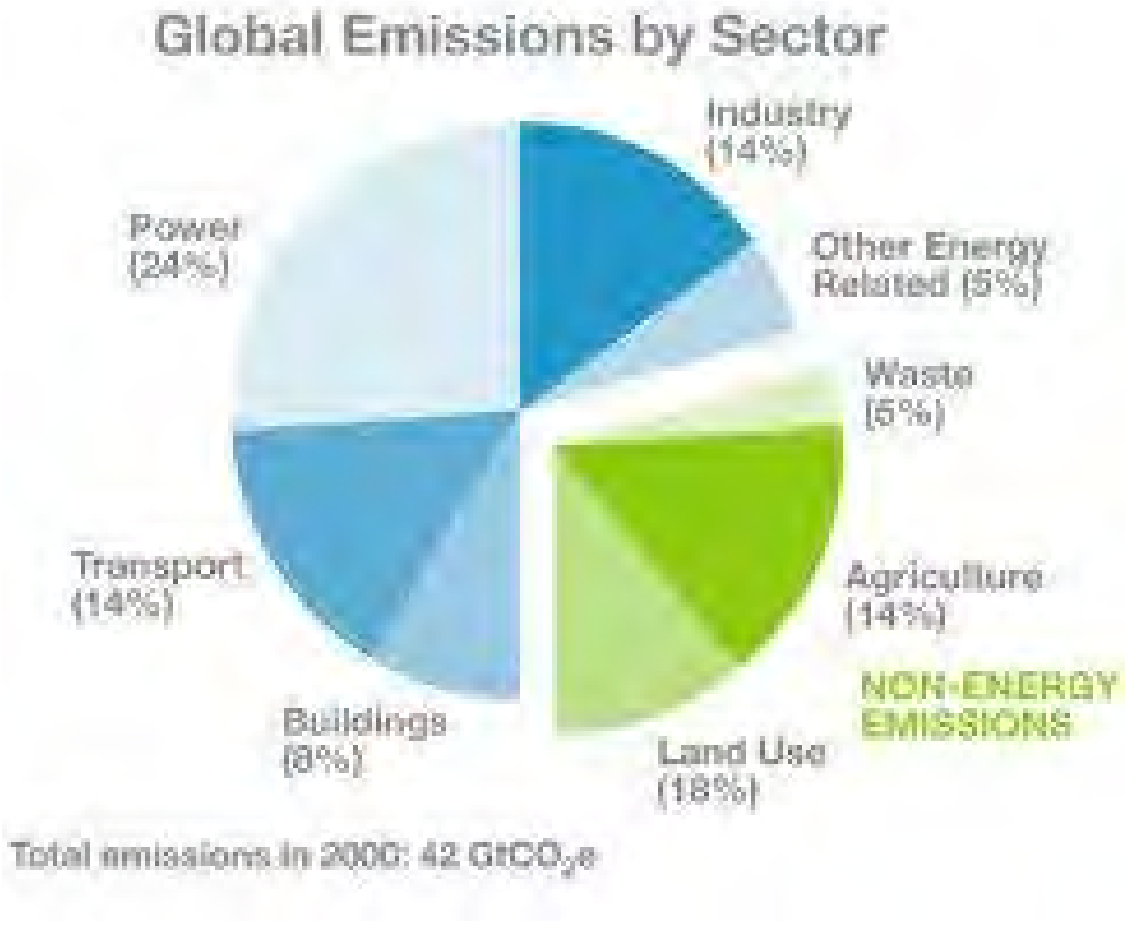
Global Emissions



South Africa

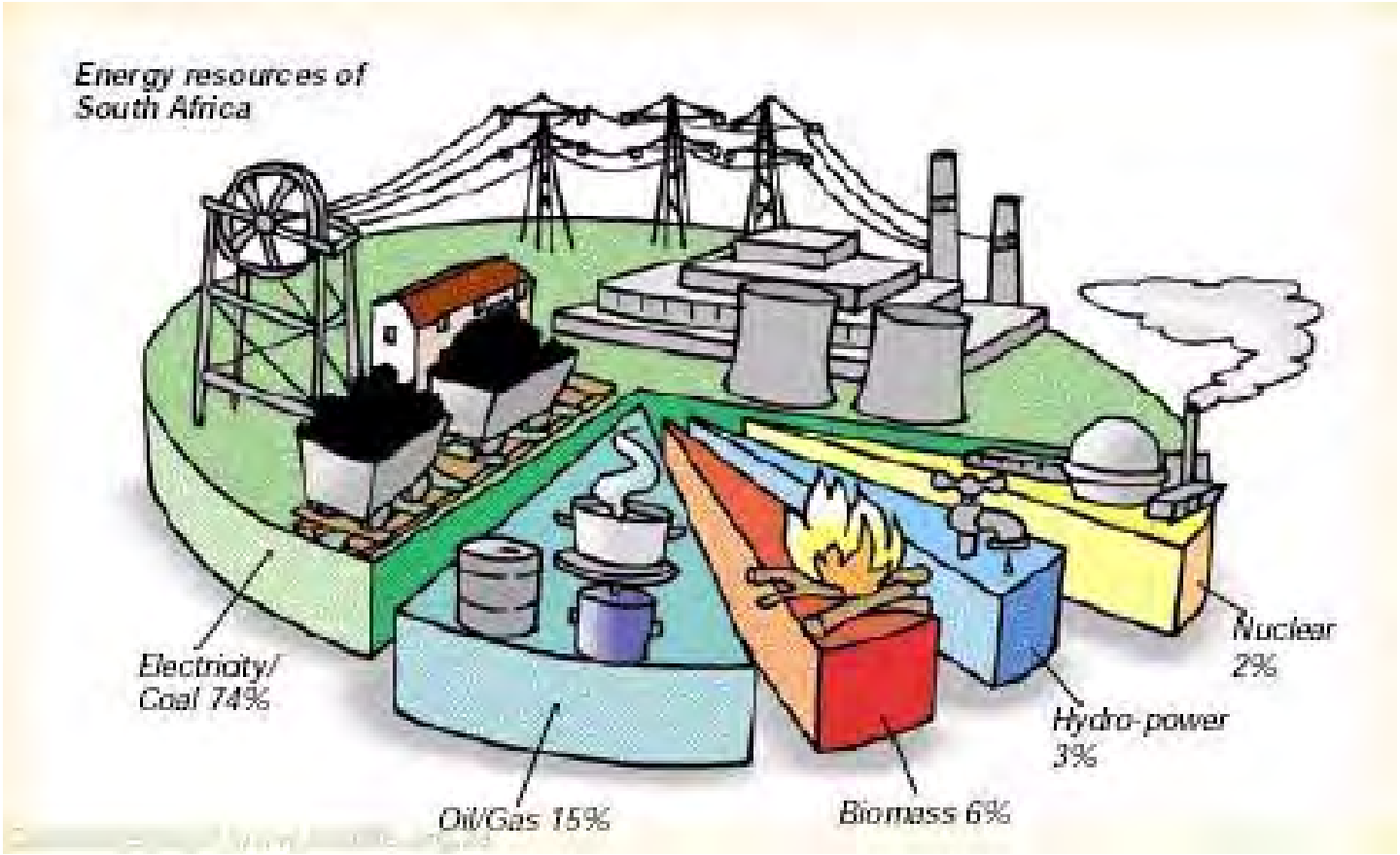


Emissions By Sector

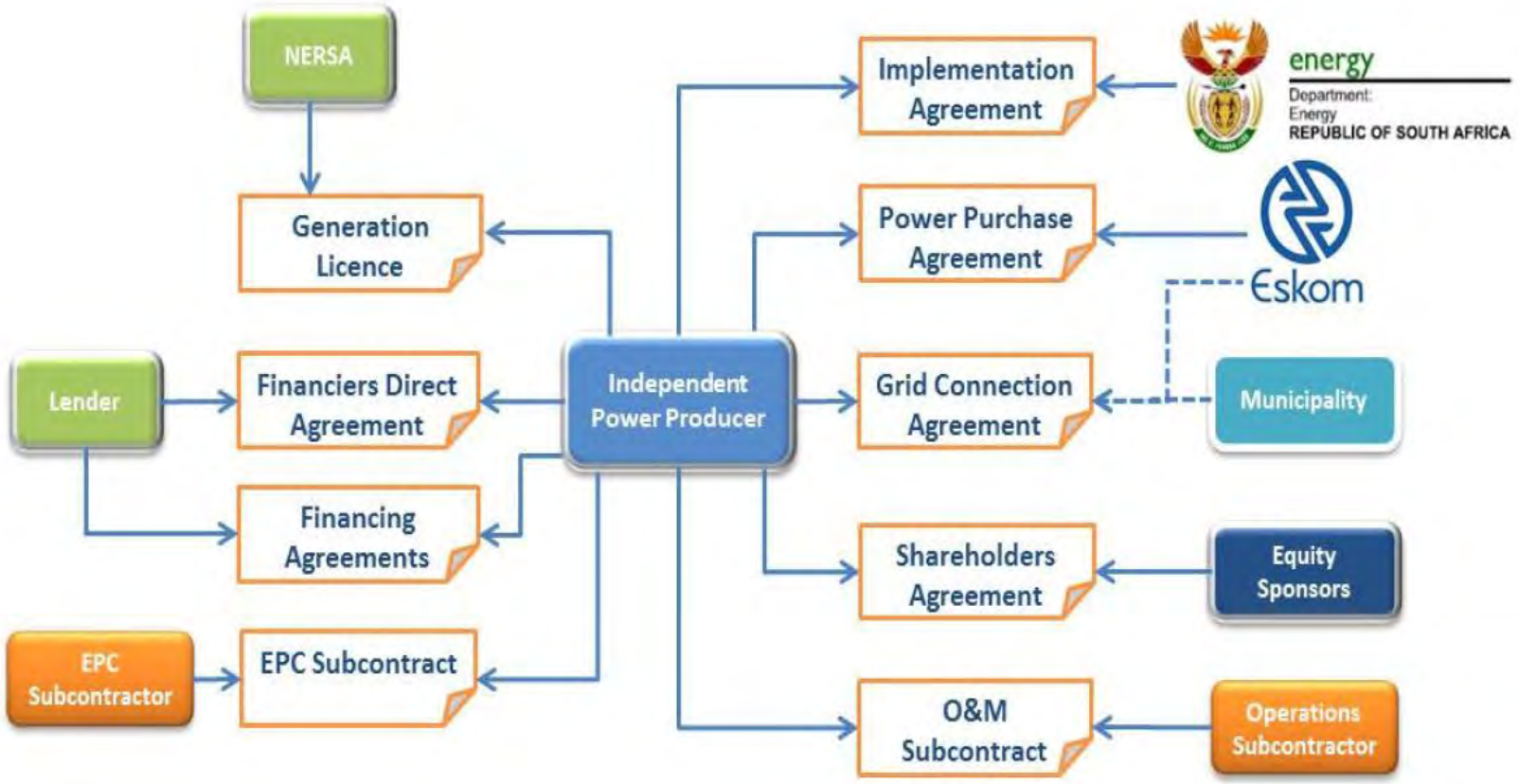


CDM In A Picture

South Africa's Energy Mix



REIPPPP Structure

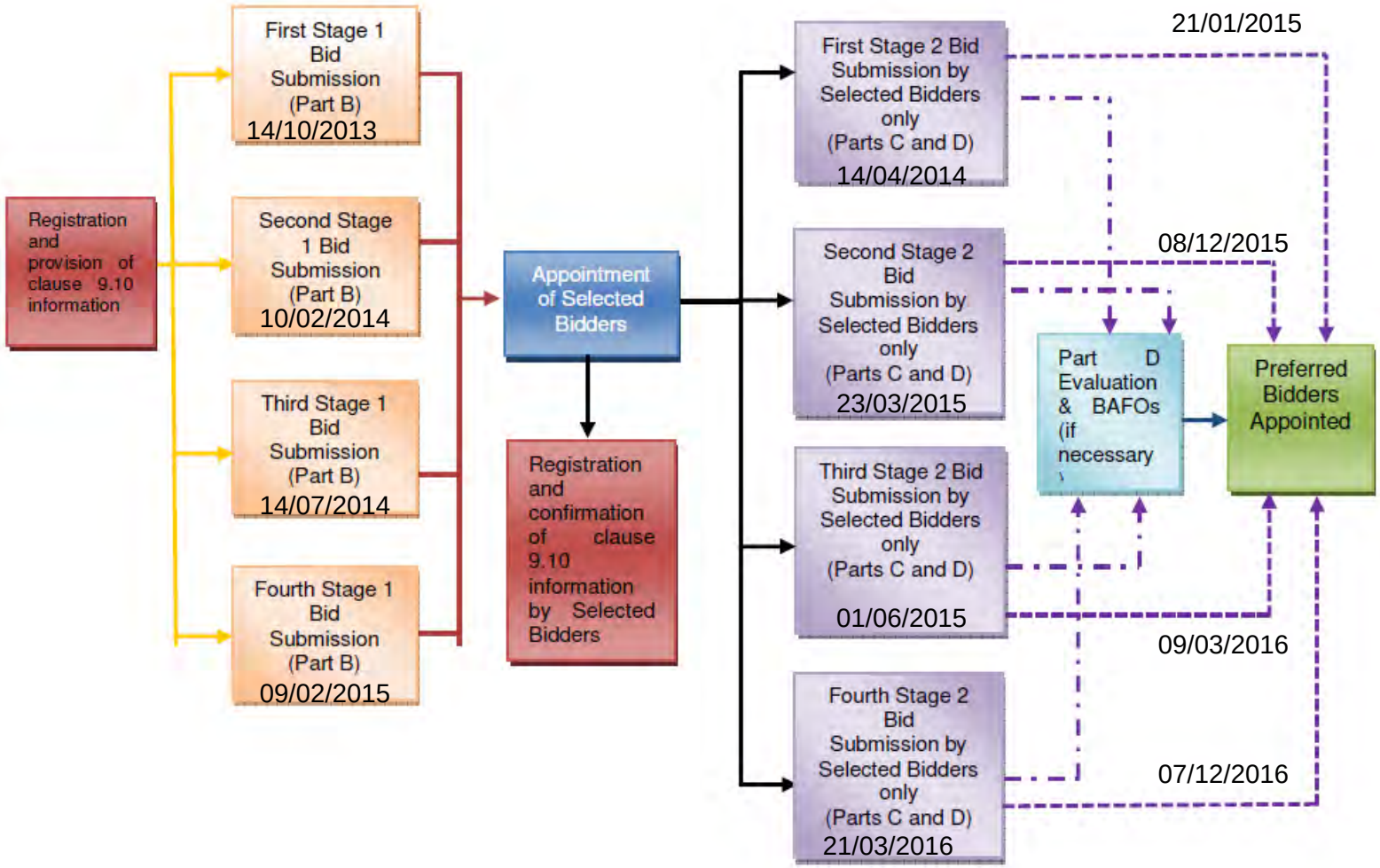


Small Scale REIPPPP

Stage 2 Bid Submission Phase	No. of MW
First Stage 2 Bid Submission Phase	50 (fifty) MW
Second Stage 2 Bid Submission Phase	50 (fifty) MW

Biogas	R/MWh	R900 (nine hundred rand)/MWh
Landfill gas	R/MWh	R940 (nine hundred and forty rand)/MWh

REIPPPP
Bid process



Green Projects
drowning in paperwork

Round Three bid

ENER·G SYSTEMS (PTY) LTD

Ss-REIPPPP shortcomings

- Still to complicated and costly for small scale projects (1-5MW)
- Time frame is too long (>2 years)
- No certainty derived from stage one process
- Administratively top heavy (lots of contracts)
- Ring fenced Entities limits scalability
- Structure of the projects limited

- Biogas and landfill gas projects will find this process problematic with the DOE insisting on real rights Vs commercial rights in terms of the land on which the project is developed.

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Bread Theory

- The number of plant bakeries has dropped to between 60 and 70 compared to 200 in 1991. They are nevertheless very efficient producers of bread.
- The total production of bread based on flour sales in 2003 was 2 800 million loaves (1 500 million white loaves and 1 300 million brown loaves). This is approximately 62 loaves for every South African during the year or nearly 3 slices of bread per day for each person. The market value was approximately R12 billion.
- The plant bakeries produced 1 400 million loaves or 50% of the total production. Their efficiency is illustrated by the fact that there are 8 500 employees in the plant baking sector. Each employee therefore provides the bread requirements for approximately 2 600 South Africans based on the fact that this sector supplied half of the South African bread market or 22,5 million people.
- Estimated 2012 per capita electricity consumption 457w