

# IRRIGATION SYSTEM DESIGN & ESKOM TARIFFS

SAIAE CPD Event

29 September 2010

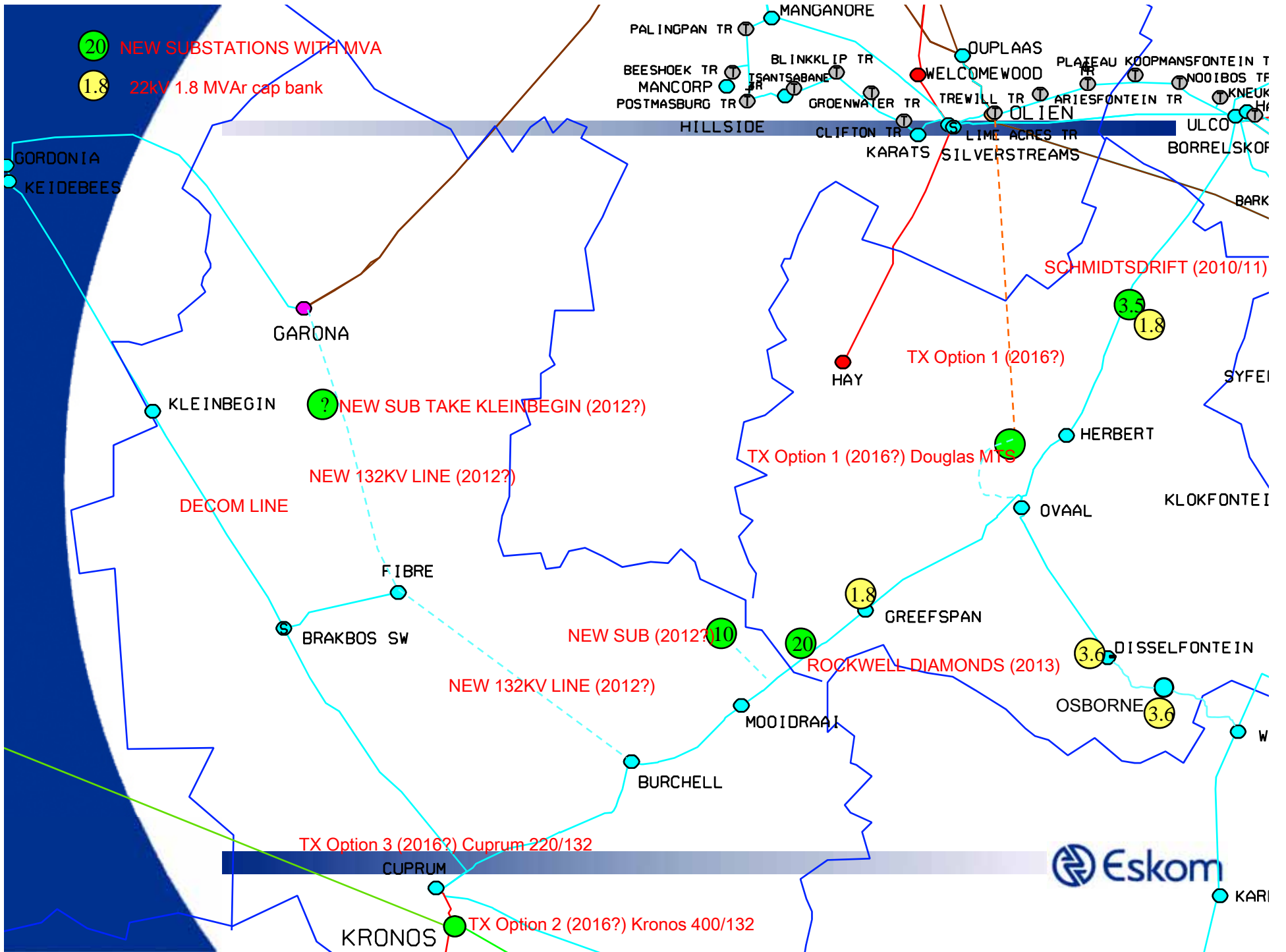


**Presented by:**

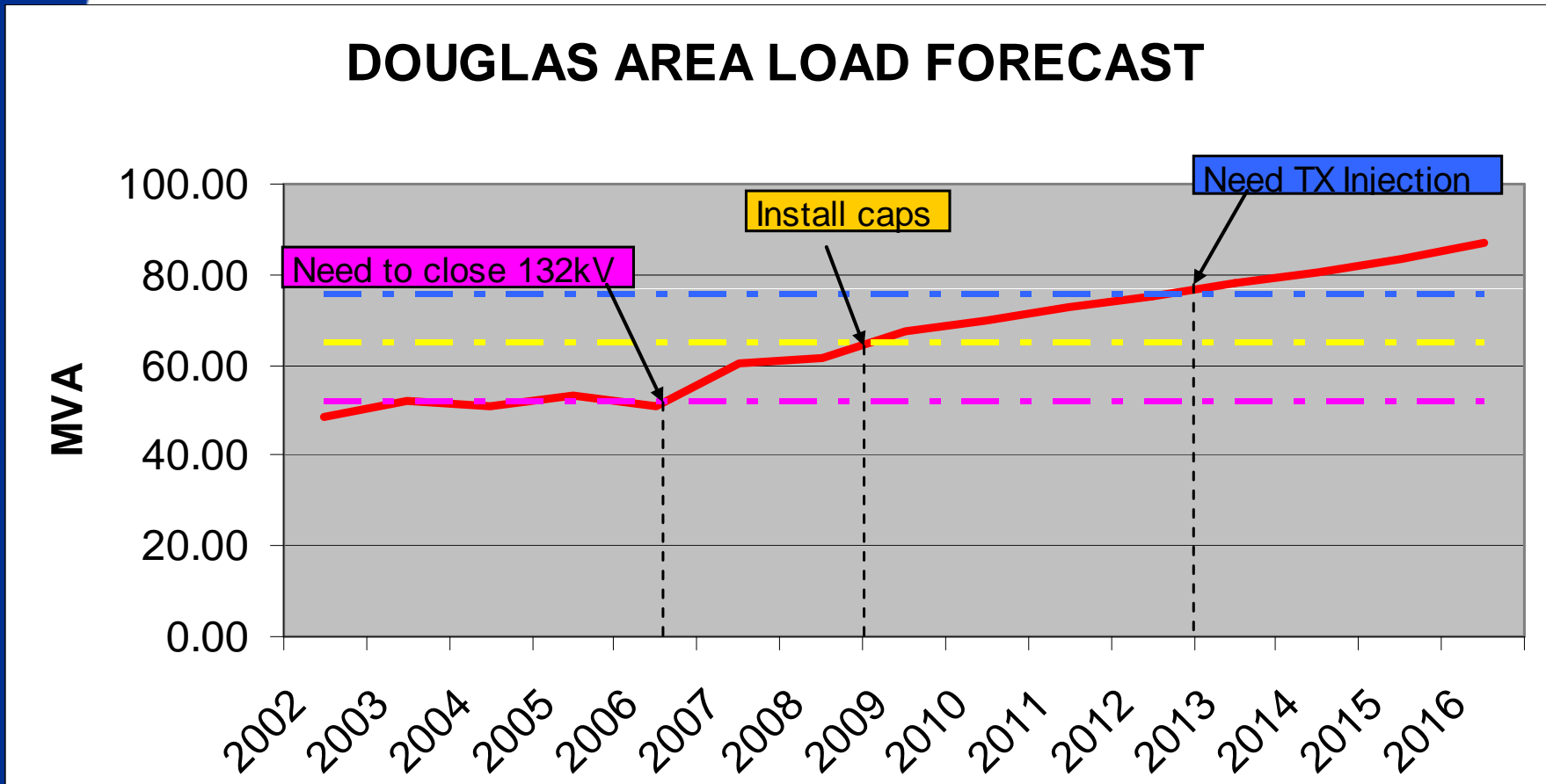
Neels Bezuidenhout  
(Pr.Eng) Agric.

# Problem definition: Network planning

- **Control bus at Boundary and Garona MTS**
  - Boundary – Greefspan 244km 132kV Wolf line.
  - Garona – Greefspan 421km 132kV Wolf line.
  - Growing load far from control bus
- **Voltage problem on network**
  - Ovaal 2007 – 116kV, 2008 – 115kV. 2009 – 122kV
  - Herbert 2007 – 117kV, 2008 – 116kV, 2009 - 122kV
  - Voltage limit on 132kV networks = 0.95 pu = 125kV
- **Fault Levels.**
  - 3 Phase 132kV Fault Levels at Greefspan = 1.9kA
- **No Additional load possible (voltage limit).**
  - 20MVA additional load at Greefspan Voltage drop to 0.89pu = 117kV



## Load Data and load forecast for the Douglas area

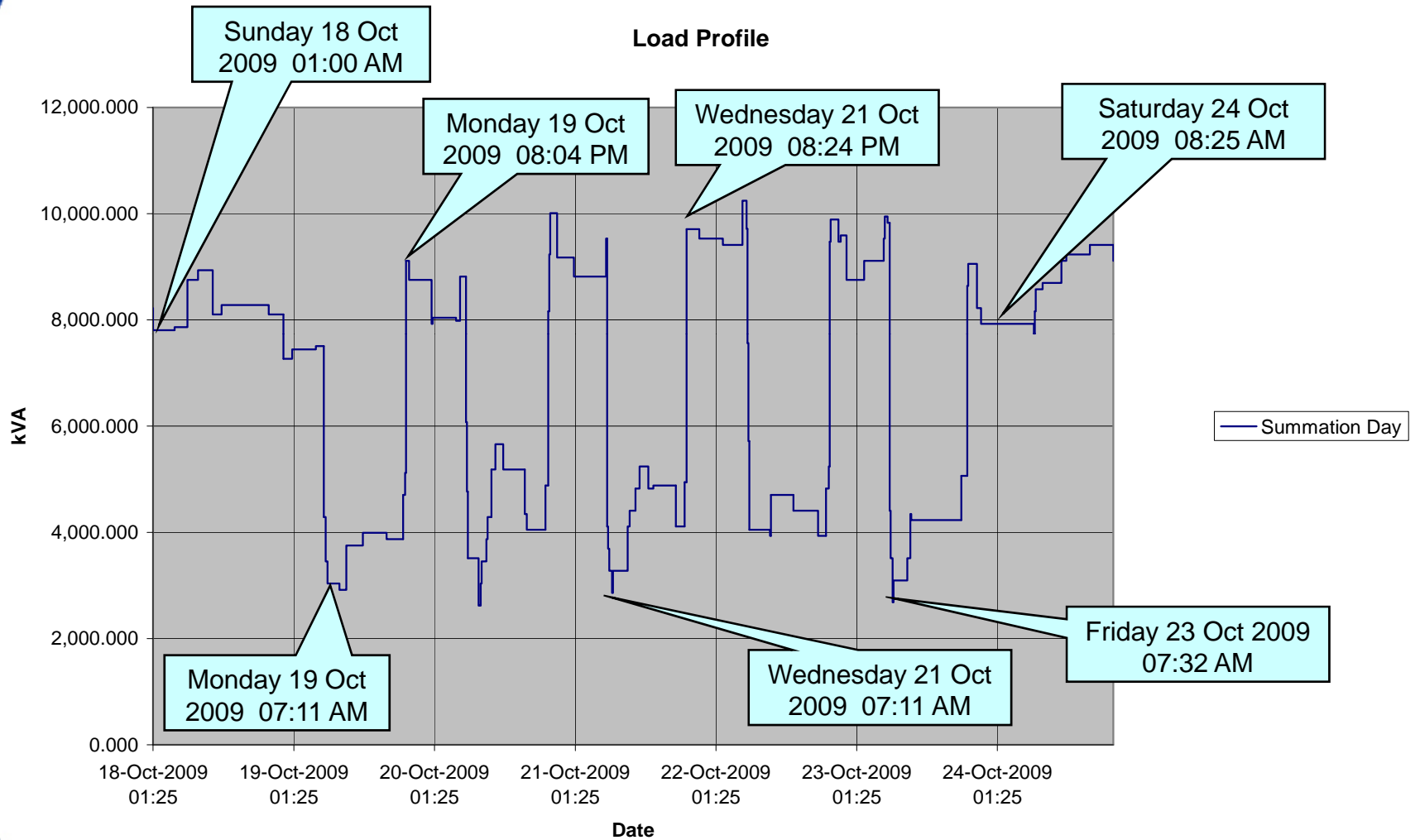


## Completed and Planned Projects by Network Planning

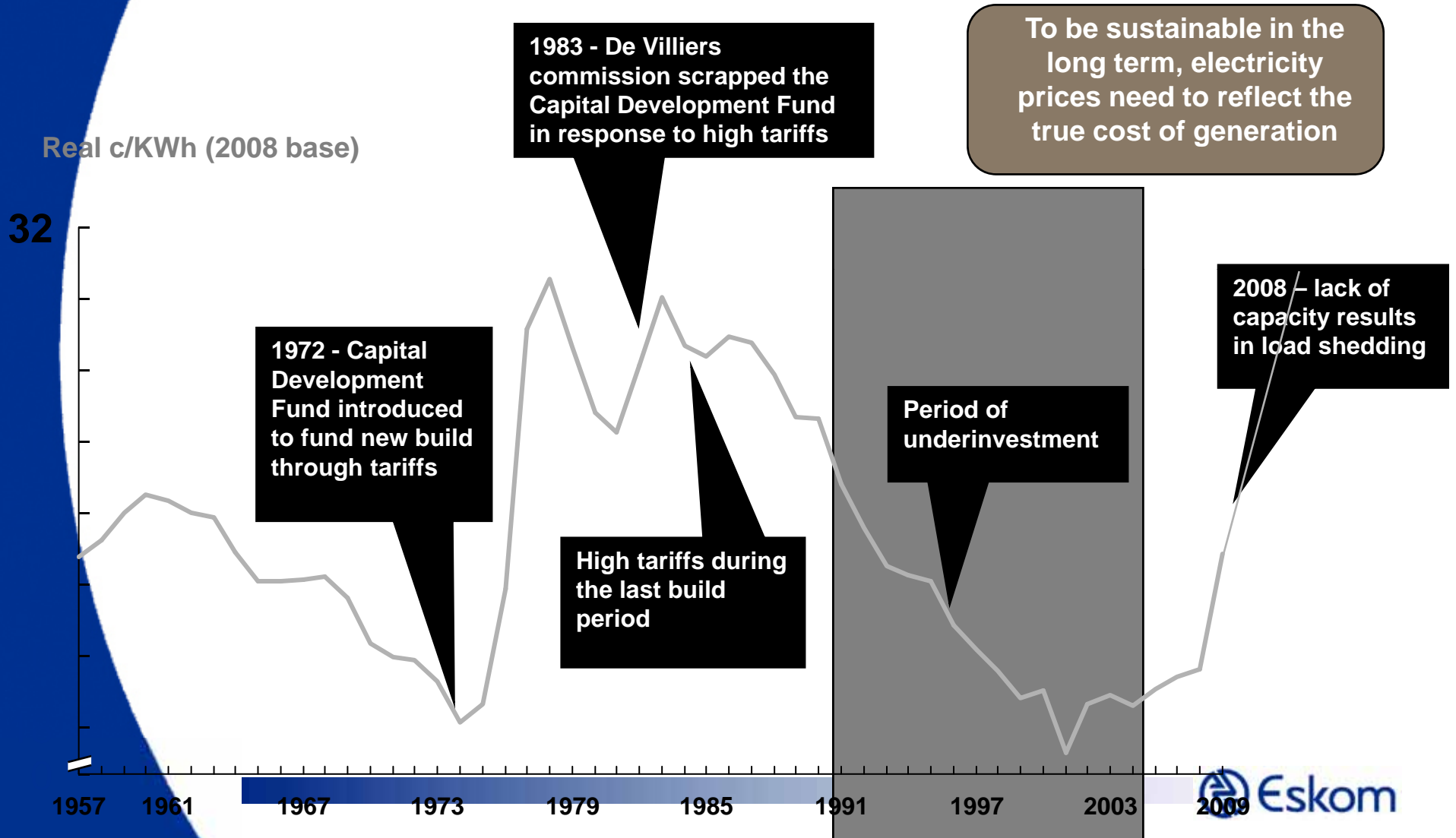
- Wighton Osborne Disselfontein Project (Completed)
  - Completed end 2008.
  - Total project cost R 49.9m.
- Schmidtsdrift (PTEC Approved)
  - Scheduled 2009/10
  - Estimated cost = R 15.5 m
  - New 2x10MVA sub
- Herbert (Presented 2010/02/11 PTEC)
  - Scheduled 2011/12.
  - Estimated cost = R 17 m
  - 2x20MVA trfr's
- Cap Banks new projects (Presented 2010/02/11 PTEC)
  - Scheduled 2011/12. - Estimated cost = R 4 m
  - Supply to 76 MVA (additional 14MVA)
- TX injection
  - Kronos 400/132kV trfr – additional 30MVA – about R 100 m
  - Olien – Douglas line - additional 150MVA – Phase 1 =R450 m, Phase 2 =R150m Total = R700 m



# Osborne week profile.



# As a country, we need to make up for a long period of underinvestment

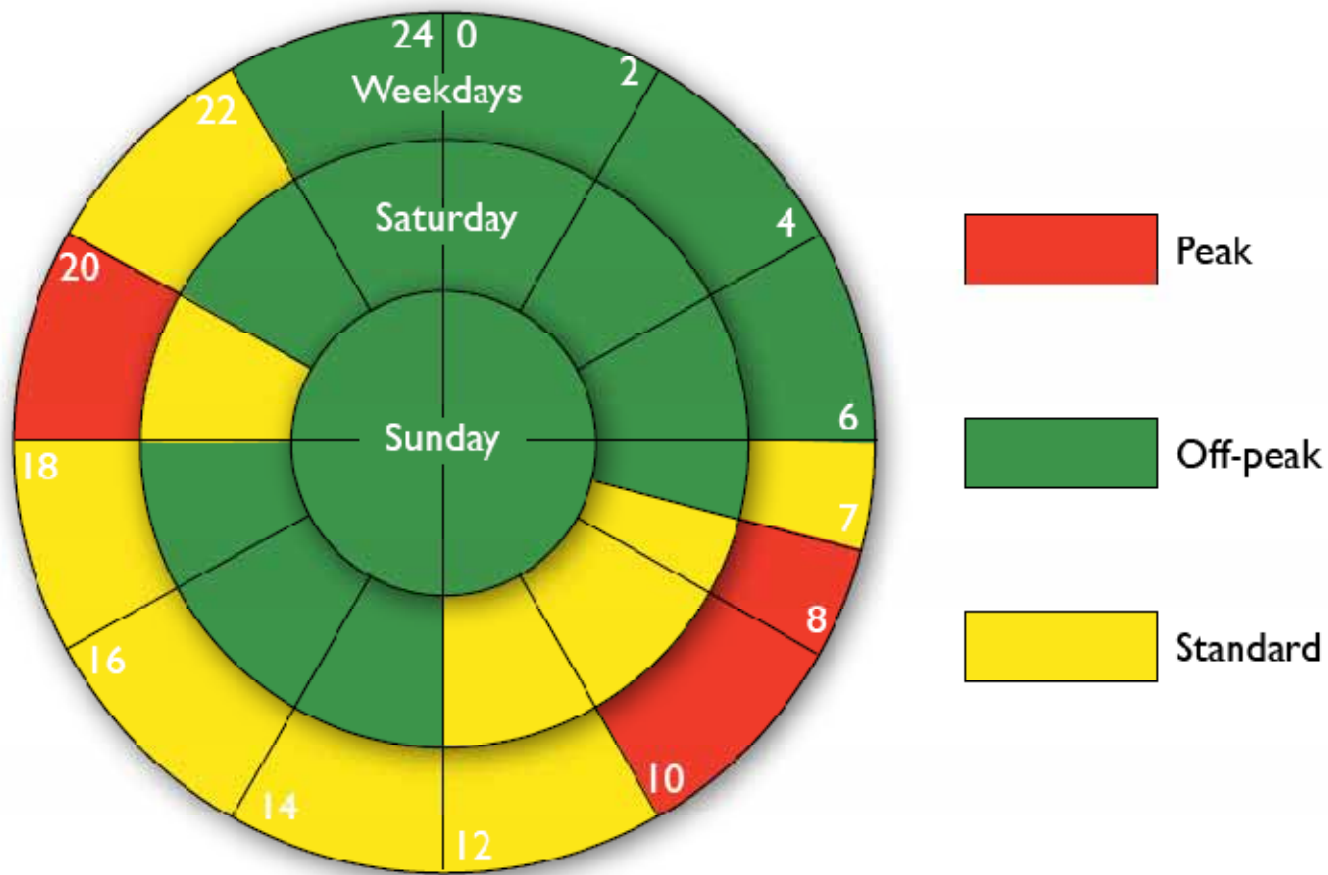


# What is energy efficiency?

---

- ↻ Using energy in a **sustainable manner**
- ↻ Avoiding **unnecessary waste** of energy in our day-to-day activities e.g. bathing and cooking
- ↻ Understanding that an **uninterrupted supply** of energy depends on all South Africans **reducing** their consumption of energy **by 10%**
- ↻ Seeing energy in a new way – as a **valuable resource** that needs to be **conserved**
- ↻ Using **less energy over peak time** where the demand on energy is at its highest


# RURAFLEX



# Why save energy?

↻ The **production of energy** involves the **burning** of a natural resource such as **coal** especially in SA



- The **more energy** we use = **more coal** needs to be mined and burnt = **more power stations** need to be built =  **taxpayers money**
- Burning coal also **emits carbon dioxide** - one of the biggest contributors to global warming and climate change
- Energy is no **longer a cheap and ever-present** commodity
- With the **rising cost of living**, **saving energy** is one way to reduce living expenses



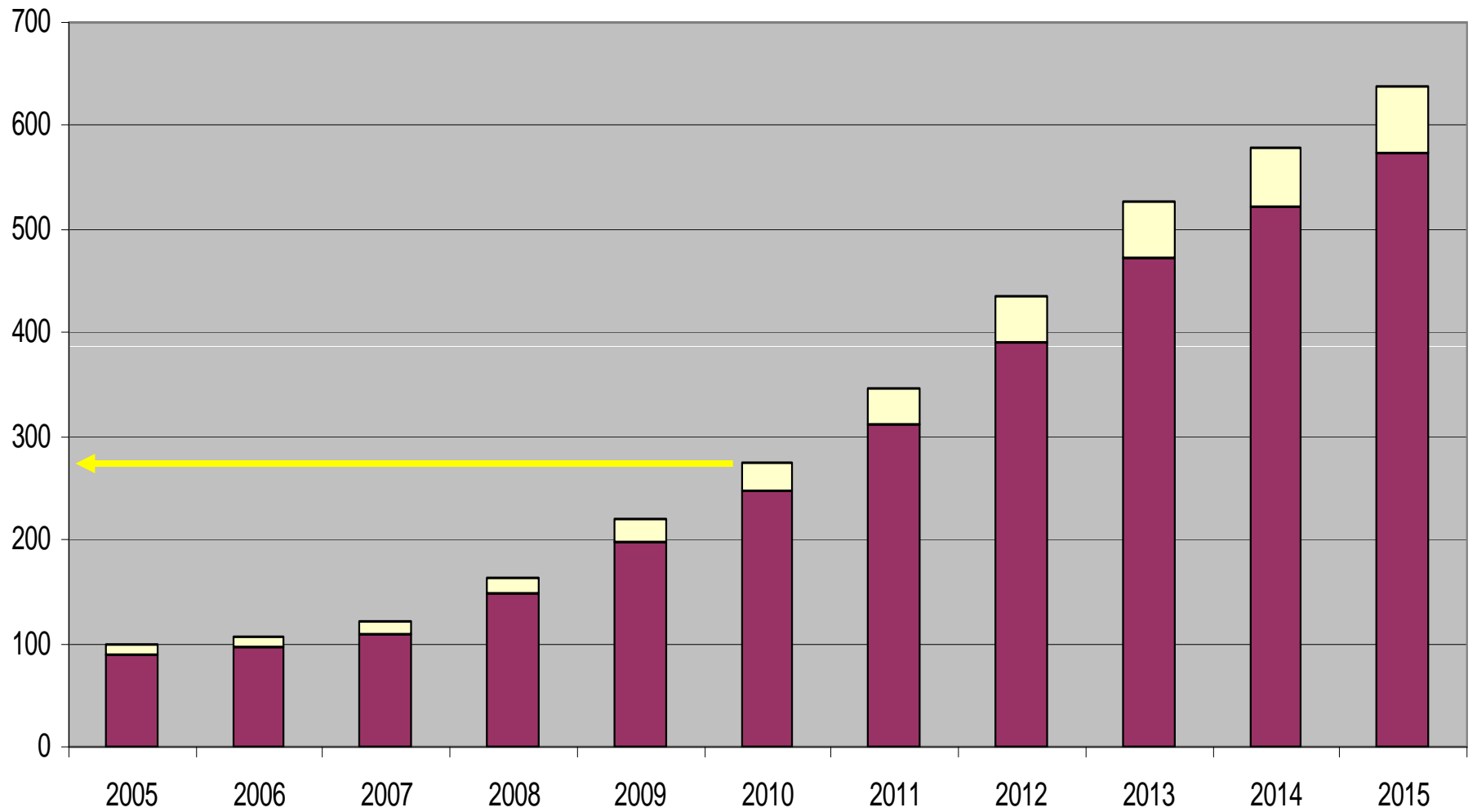
**2009 / 2010 TARIFFS****2010 / 2011 TARIFFS****(Tariff increase = 18,7%)**

	Service Charge	Network Charge	Energy Charge	Service Charge	Network Charge	Energy Charge	Environmental Charge
	R / Day	R / Day	c / kWh	R / Day	R / Day	c / kWh	c / kWh
	VAT excl VAT inc	VAT excl VAT inc	VAT excl VAT inc	VAT excl VAT inc	VAT excl VAT inc	VAT excl VAT inc	VAT excl VAT inc
LANDRATE 1 (16, 25 Kva)	<b>R8.29</b>	<b>R10.12</b>	<b>46.27</b>	<b>R9.84</b>	<b>R12.01</b>	<b>54.92</b>	<b>2.00</b>
	<b>R9.45</b>	<b>R11.54</b>	<b>52.75</b>	<b>R11.22</b>	<b>R13.69</b>	<b>62.61</b>	<b>2.28</b>
LANDRATE 2 (32, 50, 64 Kva)	<b>R8.29</b>	<b>R15.56</b>	<b>46.27</b>	<b>R9.84</b>	<b>R18.47</b>	<b>54.92</b>	<b>2.00</b>
	<b>R9.45</b>	<b>R17.74</b>	<b>52.75</b>	<b>R11.22</b>	<b>R21.06</b>	<b>62.61</b>	<b>2.28</b>
LANDRATE 3 (100 Kva)	<b>R8.29</b>	<b>R24.88</b>	<b>46.27</b>	<b>R9.84</b>	<b>R29.53</b>	<b>54.92</b>	<b>2.00</b>
	<b>R9.45</b>	<b>R28.36</b>	<b>52.75</b>	<b>R11.22</b>	<b>R33.56</b>	<b>62.61</b>	<b>2.28</b>
LANDRATE 4 (16 Kva Low Usage)		<b>R8.06</b>	<b>90.86</b>		<b>R9.57</b>	<b>107.85</b>	<b>2.00</b>
		<b>R9.19</b>	<b>103.58</b>		<b>R10.91</b>	<b>122.95</b>	<b>2.28</b>
LANDRATE DX	<b>R17.94</b>	<b>ENVIRONMENTAL LEVY INCL.</b>		<b>R21.28</b>	<b>ENVIRONMENTAL LEVY INCLUDED</b>		
	<b>R20.45</b>			<b>R24.26</b>			
LANDLIGHT (< 20A) – Pre Payment			<b>141.92</b>			<b>166.12</b>	<b>2.00</b>
			<b>161.79</b>			<b>189.38</b>	<b>2.28</b>

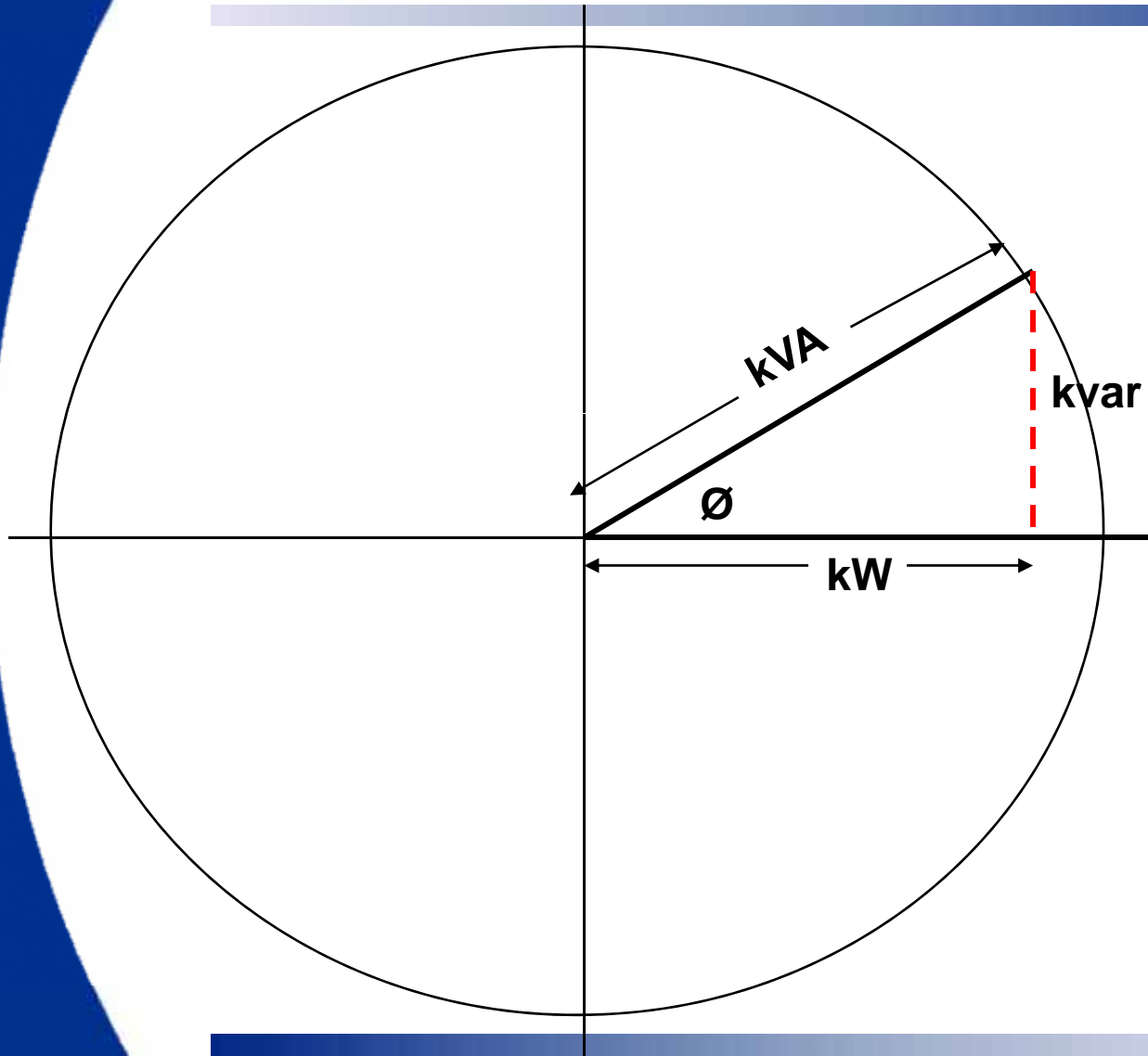
# Ruraflex – Active Energy

Transmission Zone	Voltage	Active Energy Charge (c/kWh) – Excl VAT						Network Access Charge (R/kVA/m)
		High Demand Season			Low Demand Season			
		Peak	Standard	Off-Peak	Peak	Standard	Off-Peak	
< 300 km	< 500V	225.14	57.68	30.33	61.97	37.53	25.91	7.89
	>500V < 22kV	214.73	55.08	28.99	59.17	35.86	24.78	7.23
300 – 600 km	< 500V	226.59	58.03	30.51	62.38	37.76	26.08	7.92
	>500V < 22kV	216.14	55.42	29.16	59.55	36.08	24.94	7.28
600 – 900 km	< 500V	228.03	58.41	30.71	62.76	37.98	26.24	7.96
	>500V < 22kV	217.55	55.77	29.35	59.92	36.31	25.11	7.31
> 900 km	< 500V	229.48	58.77	30.89	63.15	38.22	26.39	7.99
	>500V < 22kV	218.95	56.13	29.52	60.30	36.55	25.24	7.32

## Electricity Price trends



# Power Factor (Cos $\emptyset$ ) – Inductive load

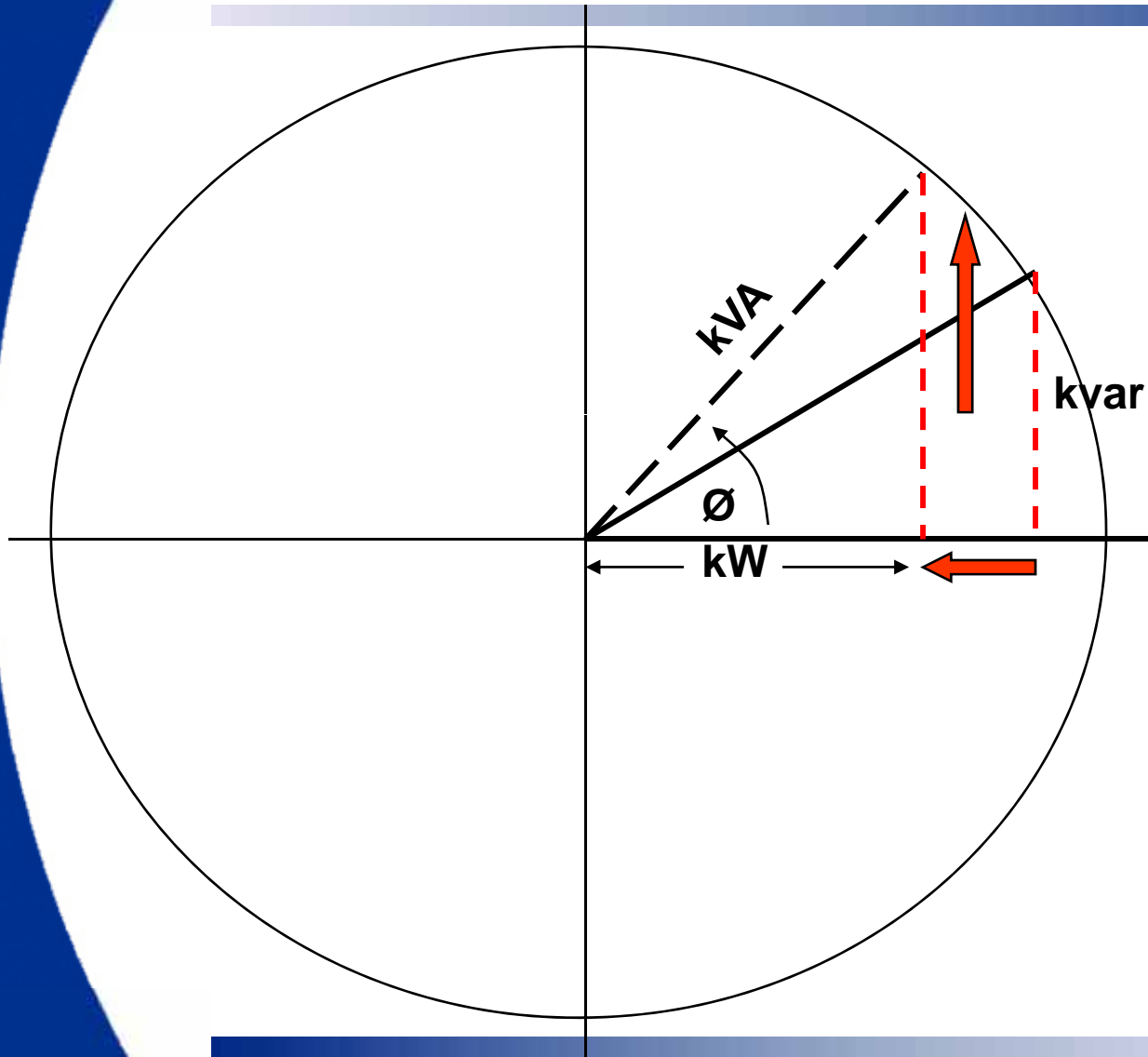


**Eskom Supplies in  
kVA**

**Equipment uses kW**

**Losses for Eskom -  
kvar**

# Power Factor ( $\cos \theta$ ) – Inductive load



Increased  $\theta$

$\cos \theta$  decrease  
(Bad power factor)

kVA stays the same

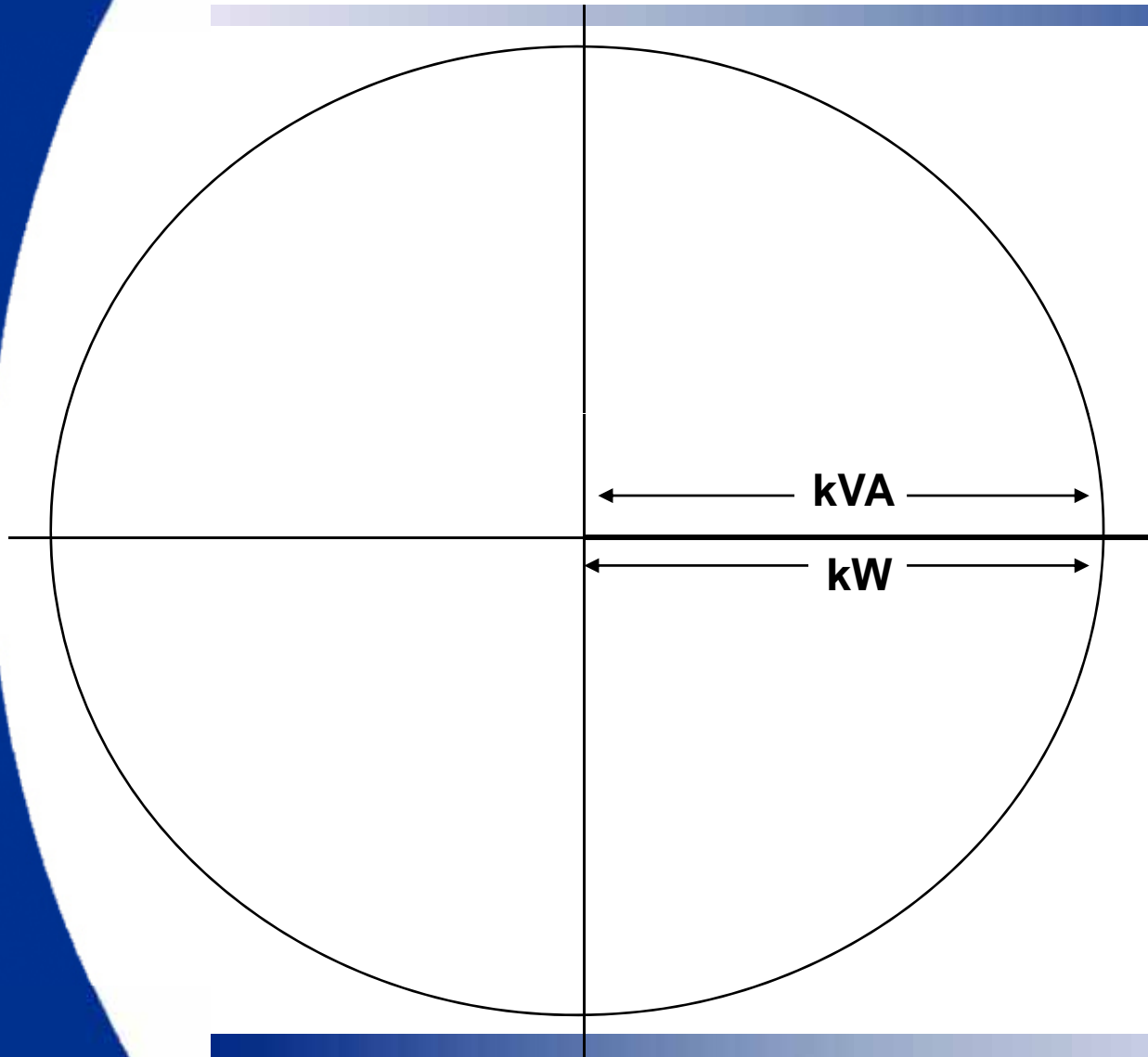
Less kW available to  
use by equipment

Larger than needed  
transformers  
installed

Losses for Eskom  
(kvar) increase

Higher demand on  
national grid

## Power Factor ( $\cos \phi$ ) – Resistive load



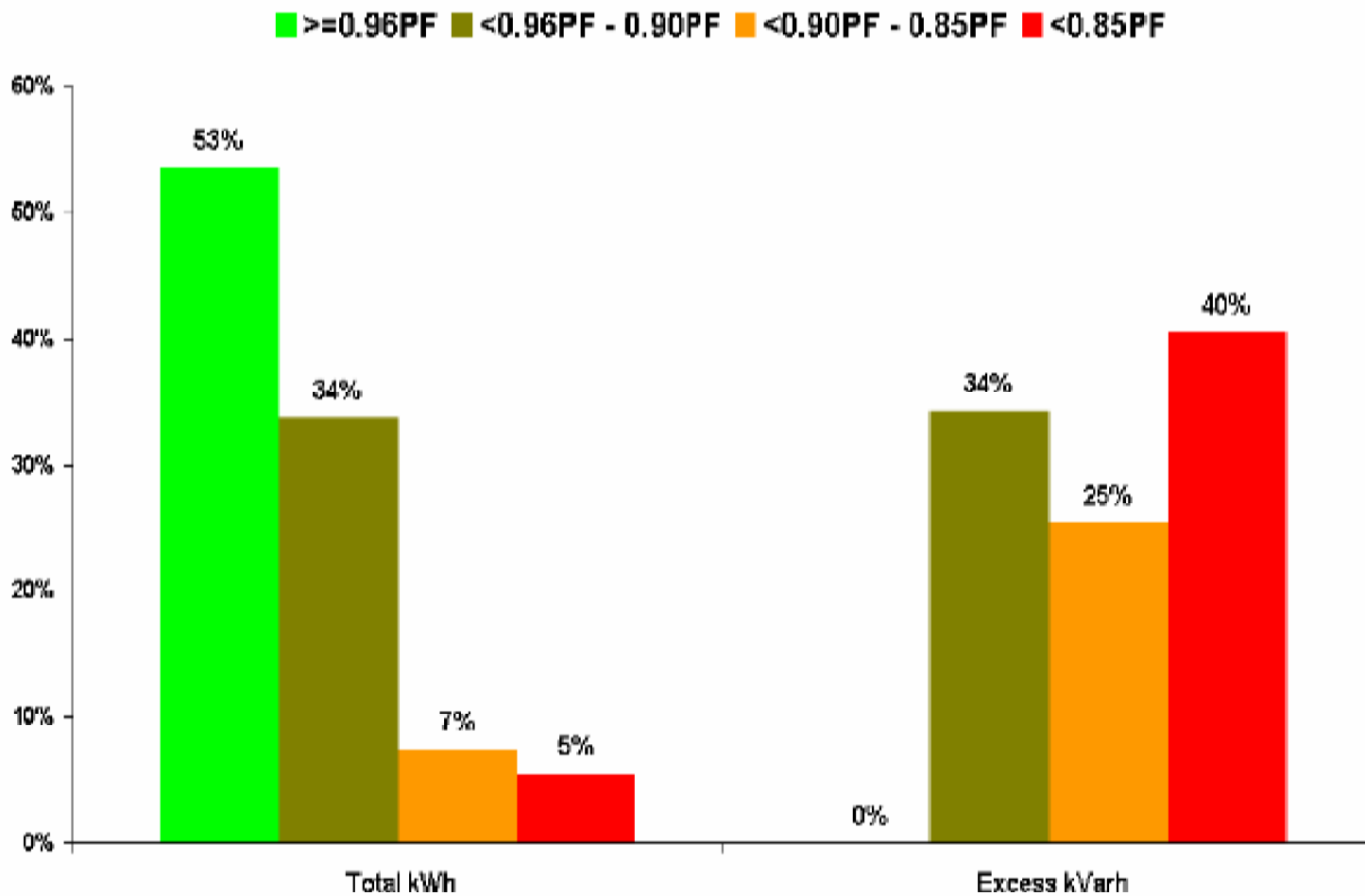
- Elements
- Heaters
- Lights

$$\phi = 0$$

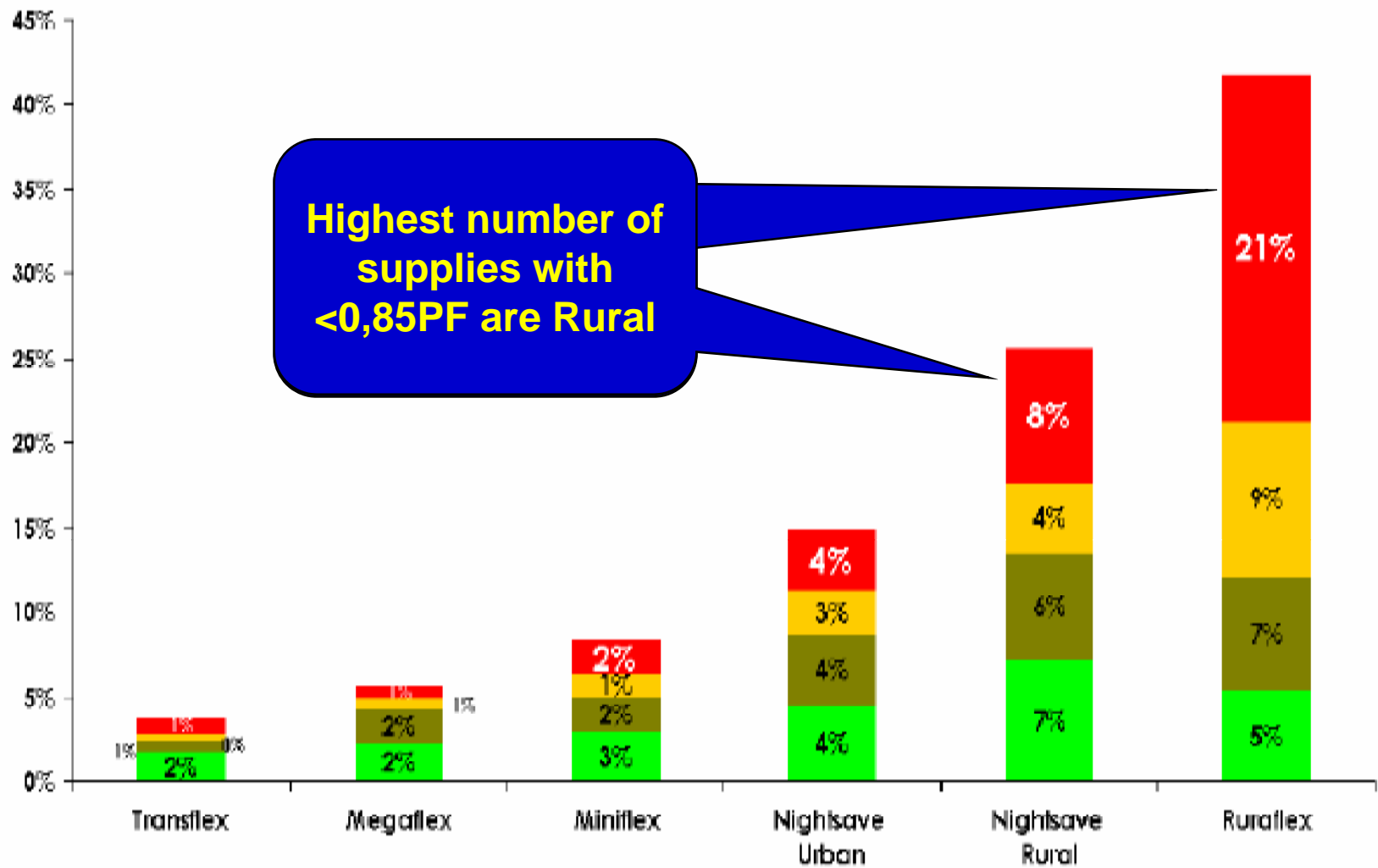
$$\cos \phi = 1$$

$$\text{kVA} = \text{kW}$$

**No Losses**



■  $\geq 0.96PF$  ■  $<0.96PF - 0.90PF$  ■  $<0.90PF - 0.85PF$  ■  $<0.85PF$



Highest number of supplies with  $<0.85PF$  are Rural

**Table 3:** Indicative rates per average power factor and capacity size

2008/9 rand value	$\geq 0.96$ PF	$< 0.96$ PF to $\geq 0.9$ PF	$< 0.9$ PF to $\geq 0.85$ PF	$< 0.85$ PF
$\leq 100$ kVA	0.86	5.19	8.65	12.11
$> 100$ kVA and $\leq 500$ kVA	0.67	3.99	6.65	9.31
$> 500$ kVA and $\leq 1$ MVA	0.51	3.07	5.12	7.17
$> 1$ MVA	0.39	2.36	3.94	5.51

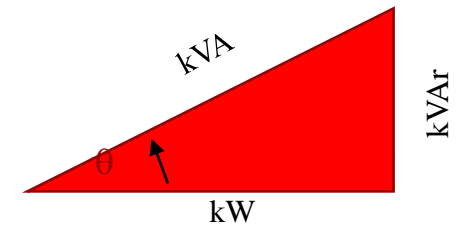
# Power Quality

- 90% of all electrical problems in a plant are voltage related
- 70 % of these are internally generated
- IBM found that on average large facilities suffers 2500 incidents daily

Voltage

- Integration of different systems are a necessity but very difficult
- New technology are available that are more efficient and reliable

Power Factor

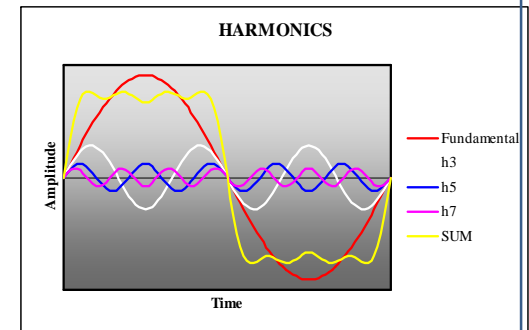


Current

- Although electrical equipment can handle disturbances it severely reduces the longevity of the equipment
- Non optimal operations leads to energy wastage
- Energy can only be converted never created or destroyed
- If conversion is in-efficient, wastage occurred – heat - energy

Harmonics

Distortions in electrical systems is a given side effect of using electrical equipment it exists in all network all over the world



*Do something about it or live with it*

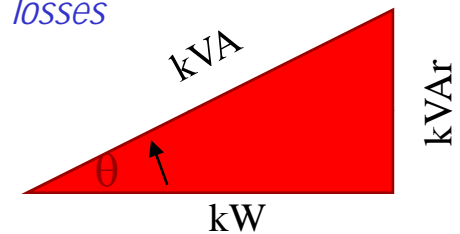
# Power Quality Problems Causes & Effects Recap

- Imbalance - *Temperature rise in motors – insulation breakdown – cumulative can't be reversed*
  - Over voltage - *Increase starting torque & inrush current*
  - Under voltage - *Increase of current in system*
  - Surge & transients - *Equipment damage*
  - Brownout - *losses in production*
  - Intermittent supply failure - *losses in production*
  - Phase loss - *equipment damage & losses in production*
- Energy losses – kWh*  
*Increase plant susceptibility to surge & transients*  
*Reduction in equipment longevity*

**Voltage**

- Large inductive loads
  - Non linear loads
- Increase in I<sup>2</sup>R losses – kW*  
*Wasted capacity - kVA*  
*Energy wastage - kWh*  
*Increased transformer losses*

**Power Factor**



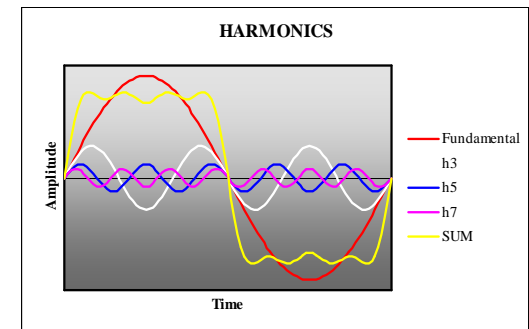
Phase imbalance

**Current**

- Negative voltage sequence*
- Circulating currents*
- Increase in temperature*
- Equipment damage & reduction in longevity*
- Energy wastage – high operating temperature - kWh*
- Losses I<sup>2</sup>R*

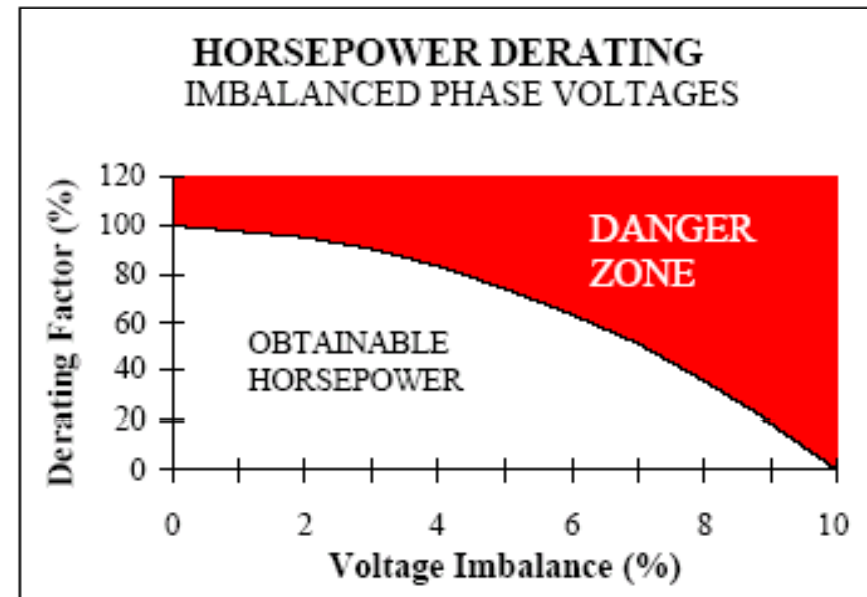
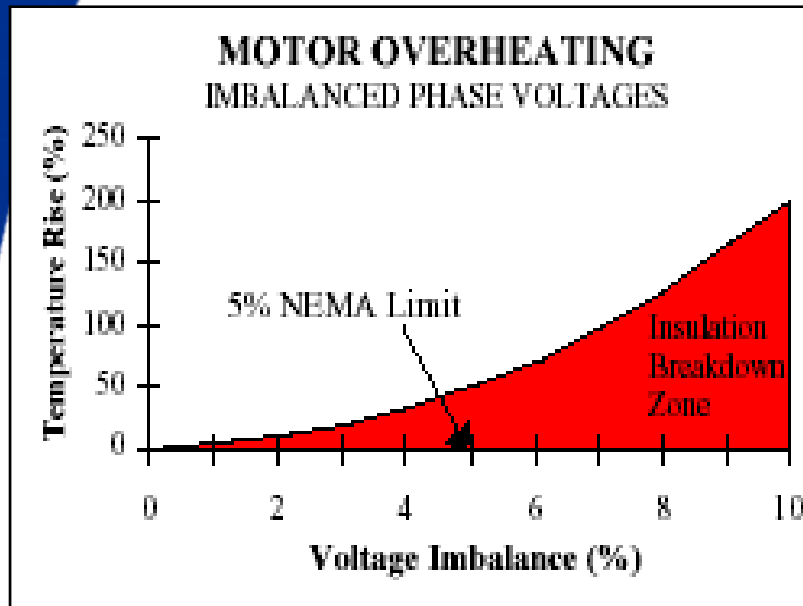
**Harmonics**

- $h=np\pm 1$
  - Non linear loads
  - Rectifiers
- De-rating of trf*  
*Wasted energy*  
*Damage capacitors False or nuisance tripping of equipment – VSD, computers & other sensitive equipment*  
 Transformers, capacitors, cables, switchgear, generators and motors are all effected by Hr



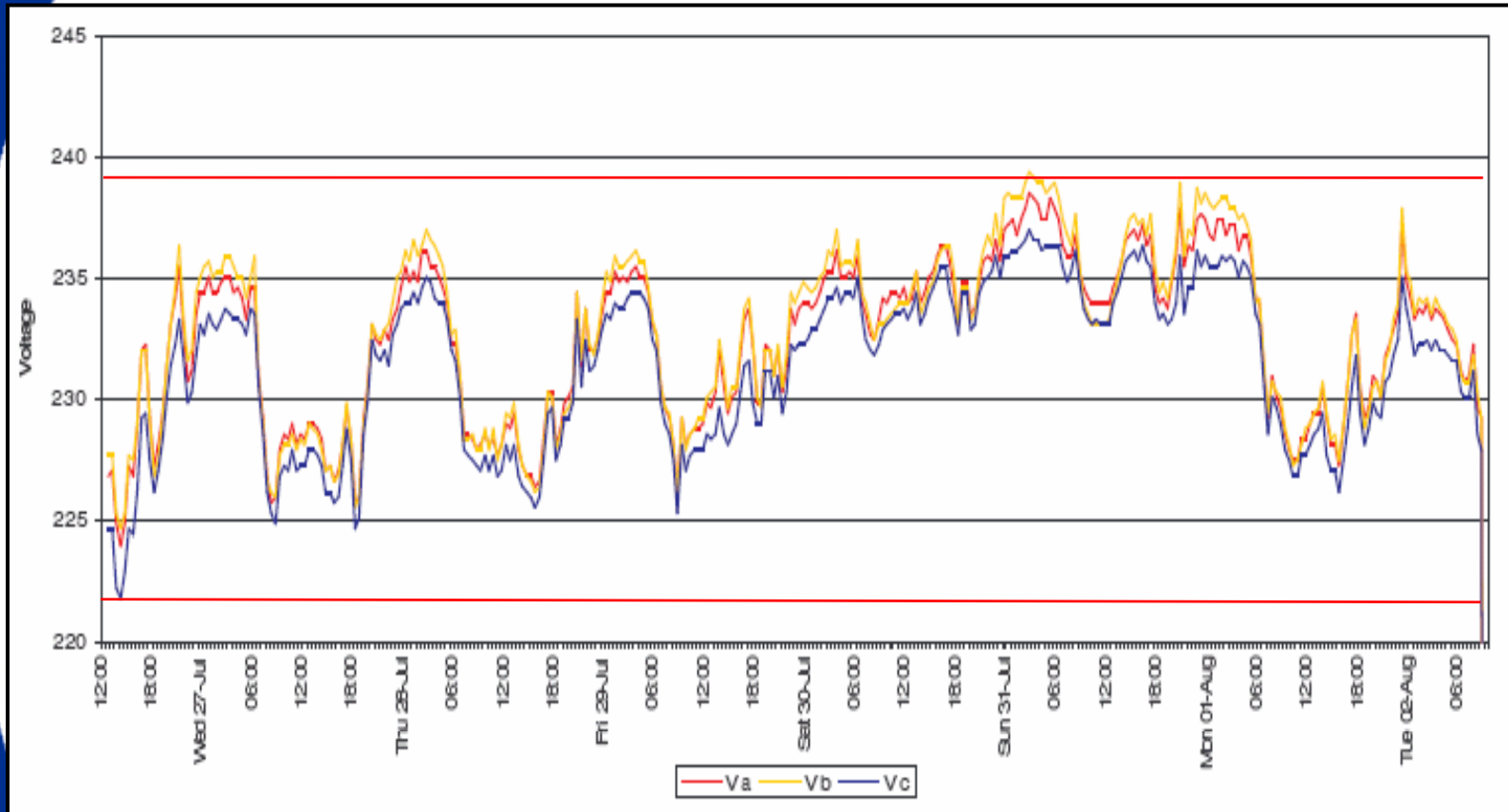
$[(ITHD (\%) \times I) \times (VTHD (\%) \times V)] = \text{power wastage}$

# Effect of Voltage on motors



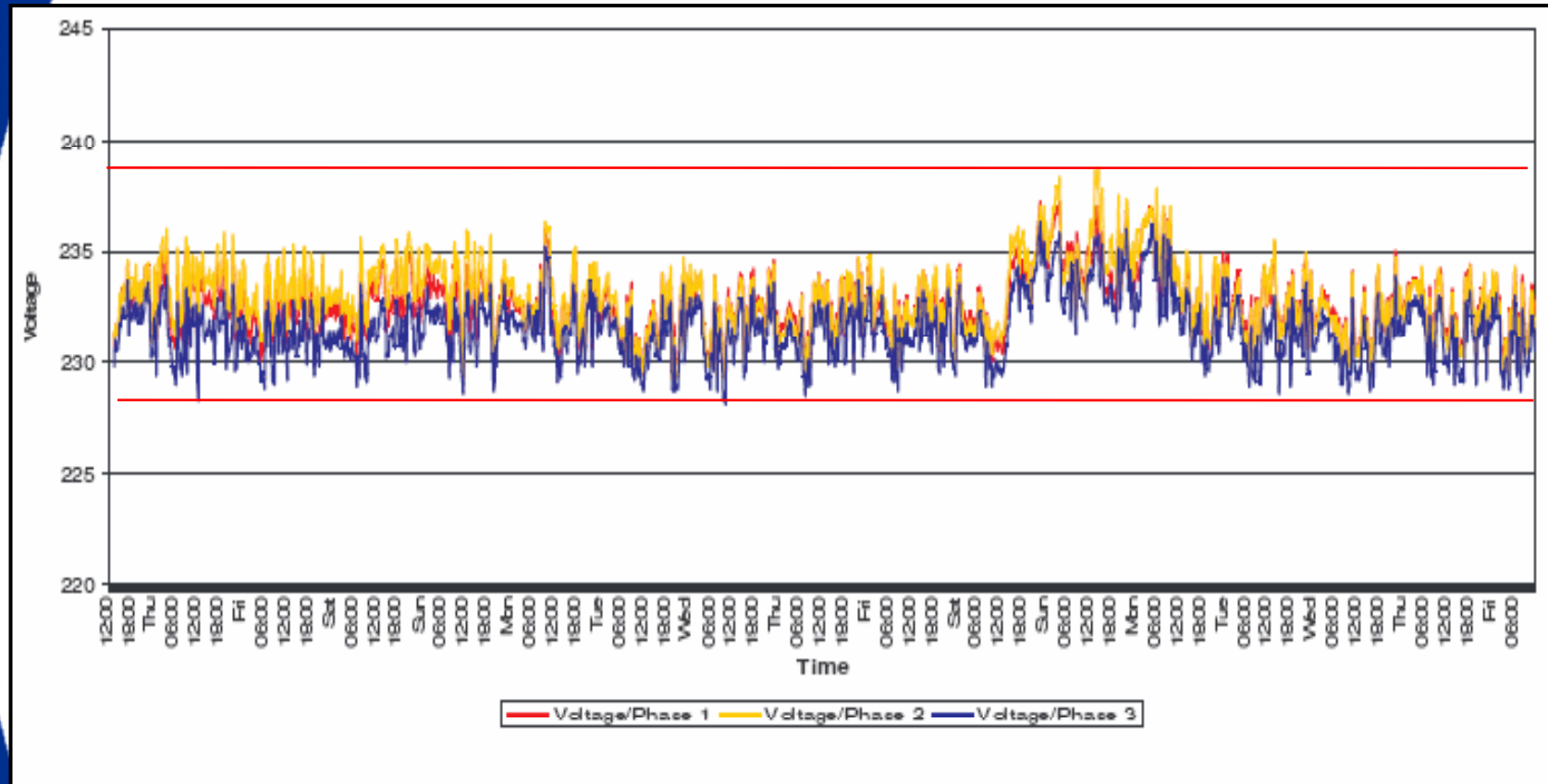
Effect of voltage increase on temperature:  $\Delta T = 2 \cdot \Delta V^2$  *increase in heat = insulation & bearing break down*

# Voltage fluctuation



**Picture 1.** Seven day profile representing a 7,22% V fluctuation, this is still within the allowable utility voltage fluctuation of 10%, PFC was connected

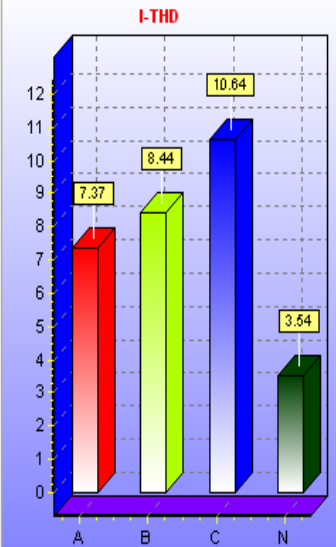
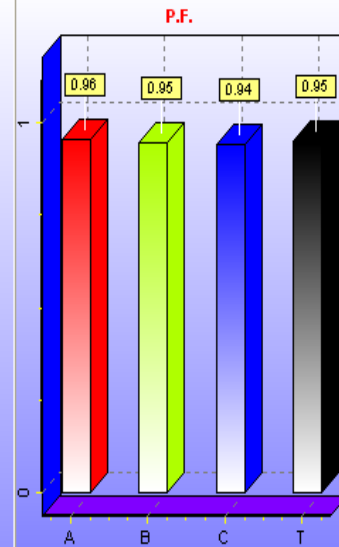
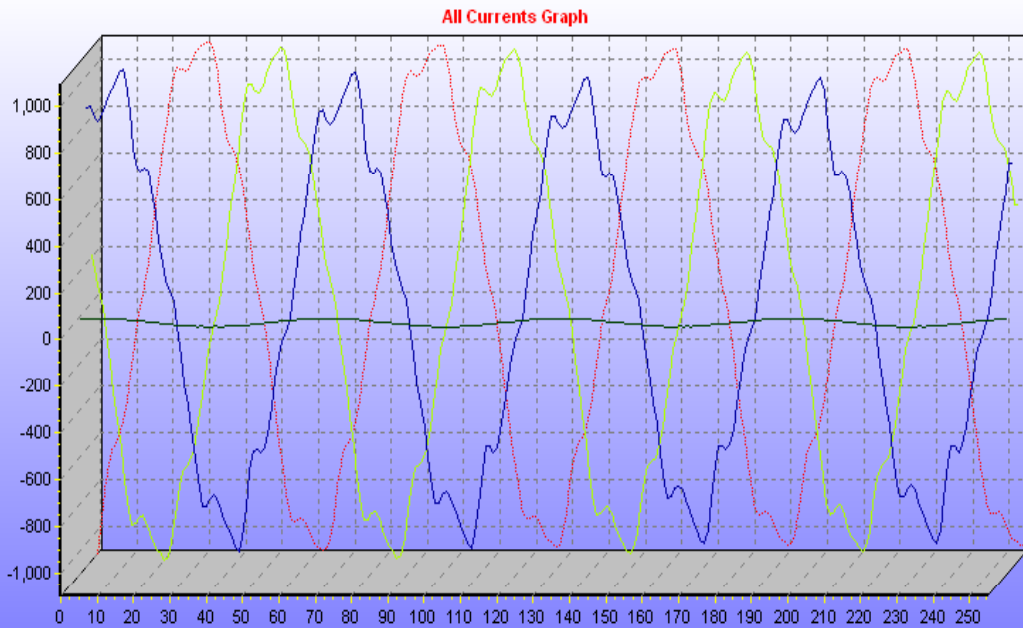
# Voltage fluctuation with Powerfix on



**Picture 2.** Profile representing V fluctuation with Electroflow in operation (and PFCC disconnected)

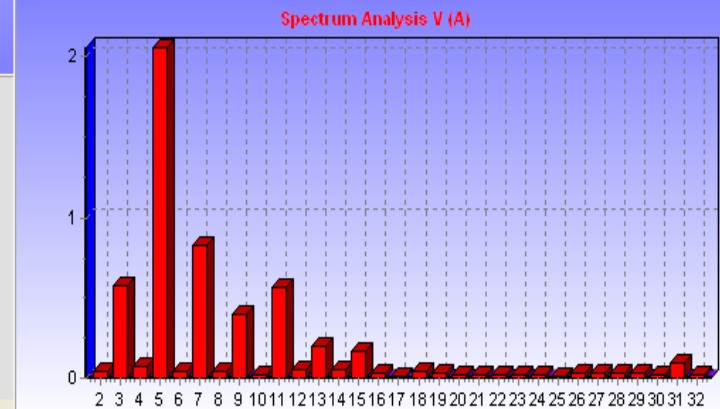
The voltage fluctuation has reduced only to a fluctuation over a 16 day period of 3,87% compare to the previous 7,22% over a 7 day period. This depicts an improvement of 87%

# Sinus Curve of currents with PF Correction

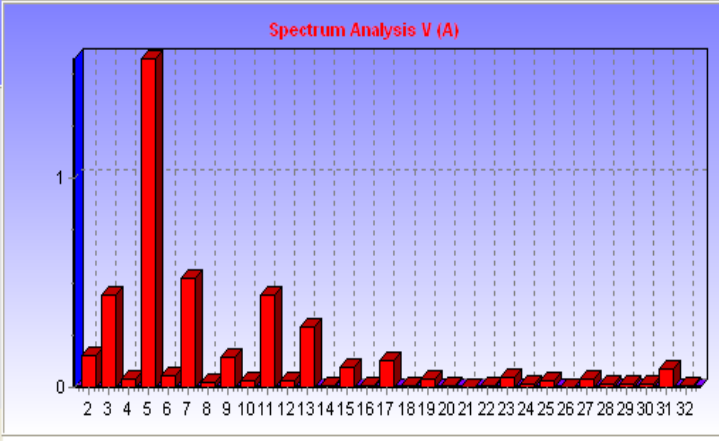
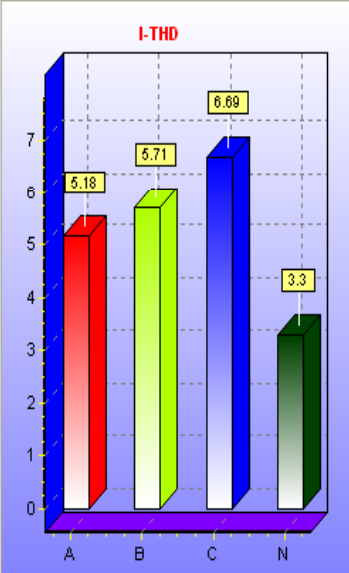
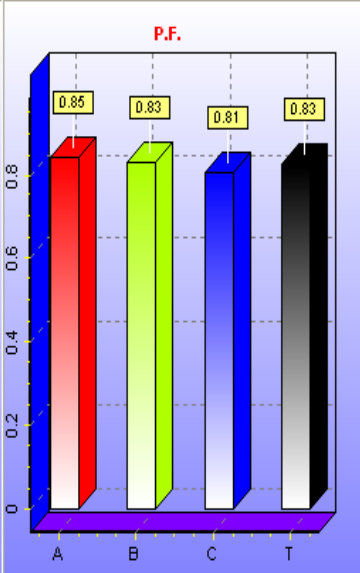
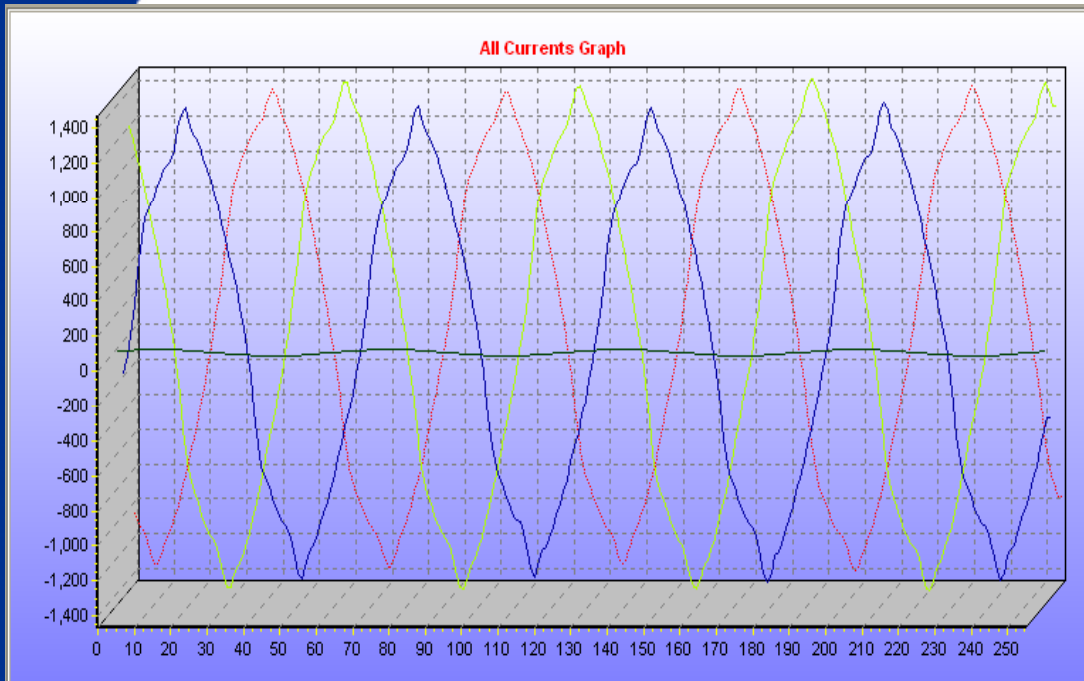


Reset	Inst	Max	Min	THD
V (AB):	407.3	407.7	406.3	2.4
V (BC):	405.6	406.0	404.2	2.5
V (CA):	402.5	404.4	397.5	2.7
T.P.F.:	1	1.0	1.0	
D.P.F.:	0.9	0.9	0.9	

	Inst	Max	Min	THD
I (A):	749.8	764.7	727.8	7.4
I (B):	738.3	753.0	727.9	8.4
I (C):	662.5	678.2	643.8	10.6
I (N):	29.8	29.8	29.8	3.5
KW:	479.1	479.1	479.1	
Kwh:	161.10	Sequence: ABC		



# Sinus curve of currents - No PF Correction

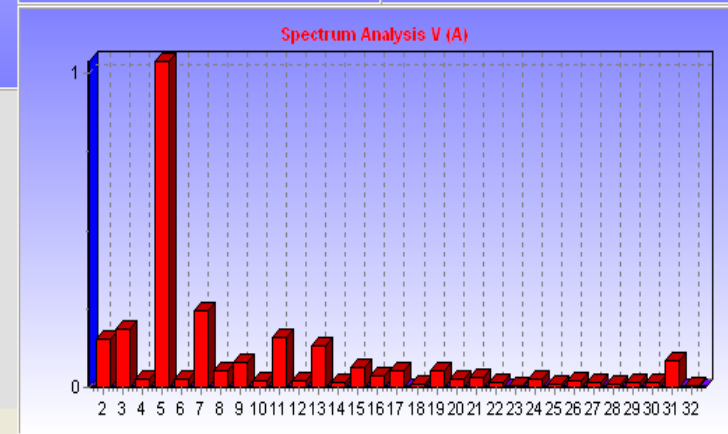
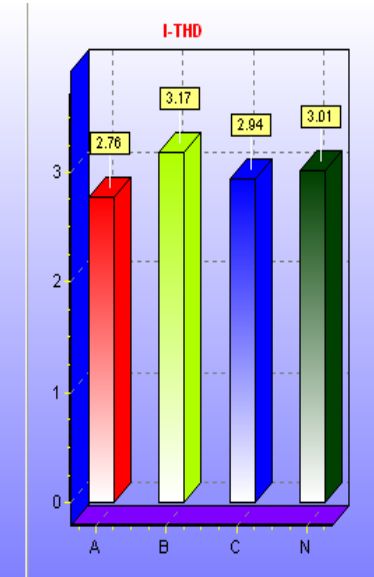
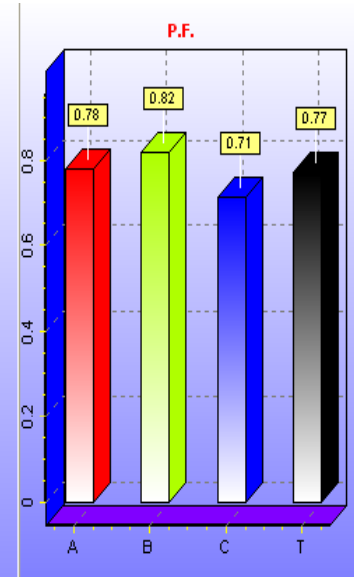
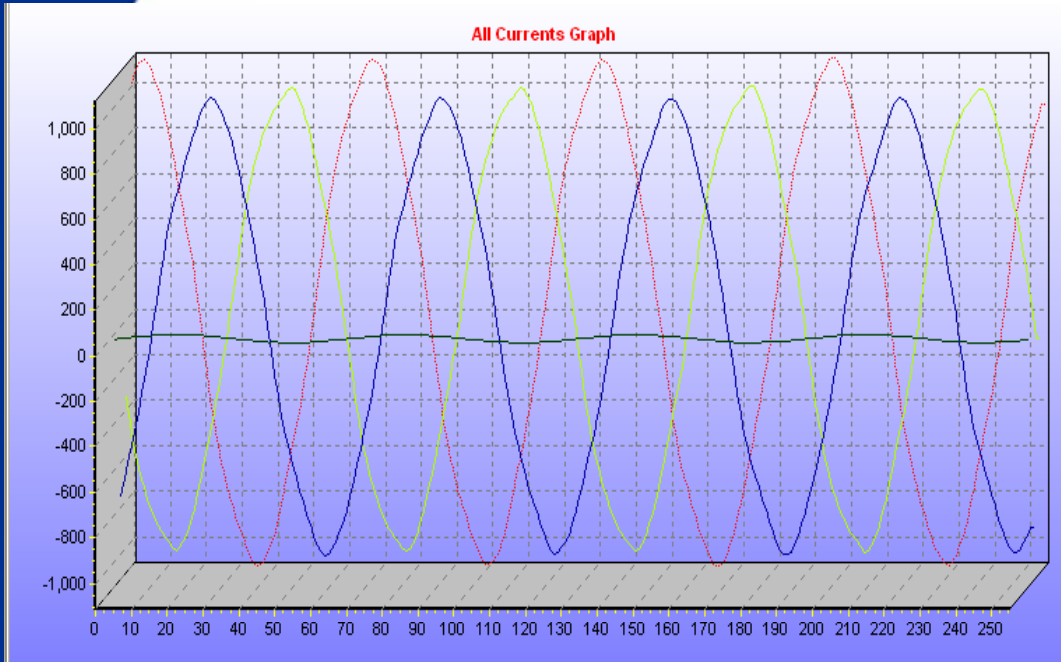


Reset	Inst	Max	Min	THD
V (AB):	400.3	401.8	396.5	1.8
V (BC):	400.4	400.5	400.2	1.9
V (CA):	396.7	397.8	394.1	2.2
I.P.F.:	0.8	0.8	0.8	
D.P.F.:	0.8	0.8	0.8	

	Inst	Max	Min	THD
I (A):	927.3	929.2	921.2	5.2
I (B):	975.4	981.2	966.8	5.7
I (C):	885.6	895.3	880.5	6.7
I (N):	29.7	29.7	29.6	3.3
KW:	534.6	534.6	534.6	
Kwh:	34.30			

Sequence: ABC

# Sinus Curve of currents – No PF Correction




Reset	Inst	Max	Min	THD
V (AB):	388.6	390.1	384.1	1.1
V (BC):	388.5	388.7	388.2	1.3
V (CA):	392.6	393.4	390.4	1.3
L.P.F.:	0.7	0.7	0.7	
D.P.F.:	0.8	0.8	0.8	

	Inst	Max	Min	THD
I (A):	774.6	776.0	765.2	2.8
I (B):	718.4	719.9	716.1	3.2
I (C):	689.2	690.5	679.1	2.9
I (N):	29.7	29.7	29.4	3.0
KW:	379.4	379.4	379.4	
Kwh:	67.60	Sequence:	ACB	

# ELECTRICAL MOTORS

1. **Oversized** motors (e.g. designed for **non-overloading**) runs at a **low power factor** and a **low electrical efficiency**. By installing capacitors, the power factor can be improved.
2. Eskom supplies in **kVA** and equipment is using **kW**
3. **Penalties** for bad power factor will be incorporated in Tariffs in the future
4. If the motor is too large, down size the motor where possible so that the motor can run at **¾ load or higher**.
5. Don't **rewind** motor's. **Efficiency decreases** + - 10 % every time you rewind a motor.

**Alternative**  **Energy Efficient Motors,  
Correct sizing of Motors  
Capacitors or powerfix  
Variable Speed Drives (VSD's)**

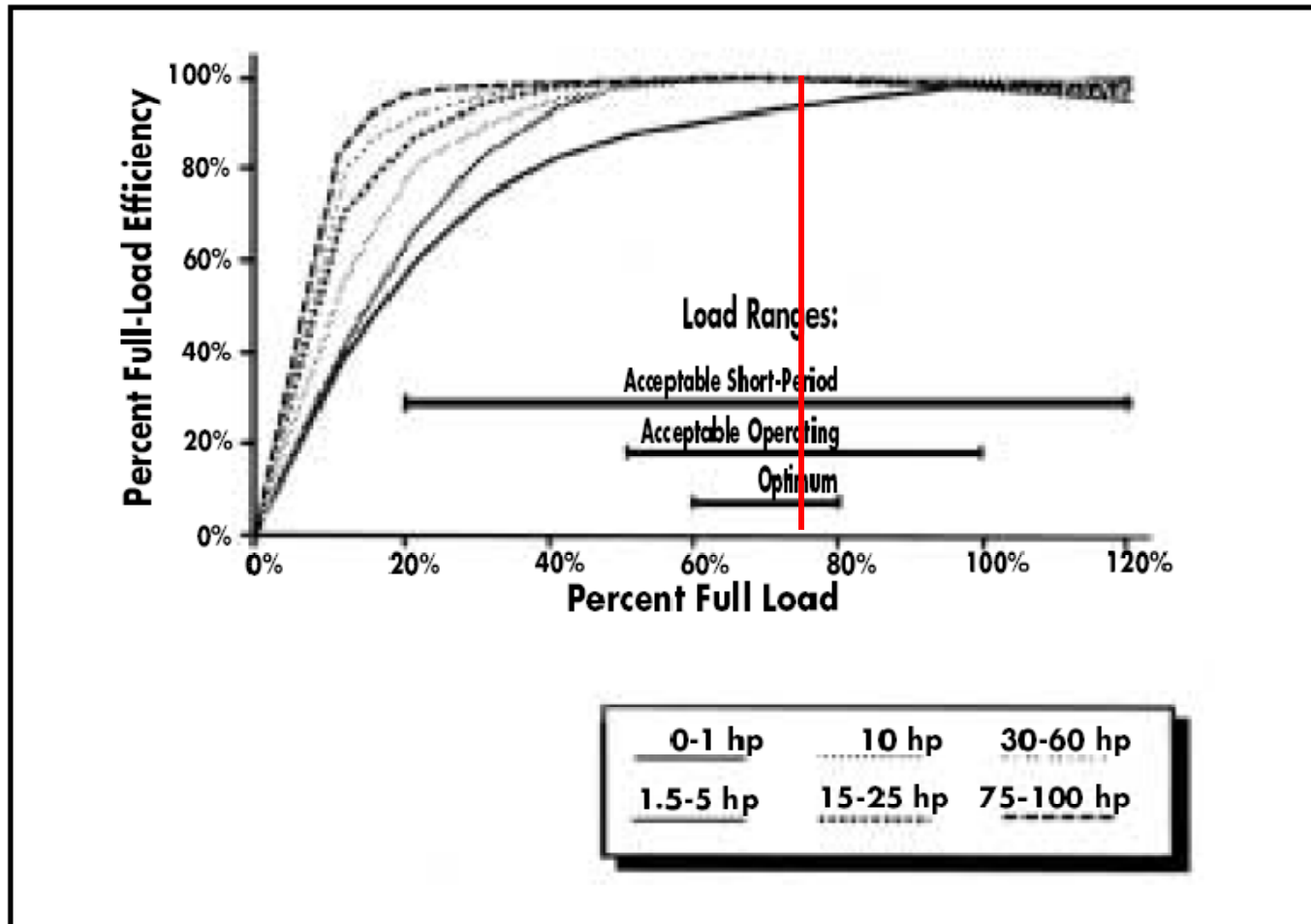
# Motor Sizing (7,5 – 22kW)

kW	r/min	Efficiency			Power Factor		
		FL	3/4	1/2	FL	3/4	1/2
7,5	2 900	83	83	81	0,88	0,87	0,81
7,5	1 450	84,5	84,5	82,5	0,81	0,79	0,68
11,0	2 900	84	82,5	78,5	0,86	0,83	0,75
11,0	1 450	87	87	86	0,86	0,82	0,73
15,0	2 900	88	87,5	85	0,88	0,87	0,82
15,0	1 450	88	88	87,5	0,87	0,84	0,77
18,5	2 900	88,5	88	86	0,89	0,87	0,82
18,5	1 450	88	88	87	0,85	0,82	0,77
22,0	2 900	89,5	89	87,5	0,89	0,85	0,80
22,0	1 450	89,5	89,5	88	0,87	0,86	0,80

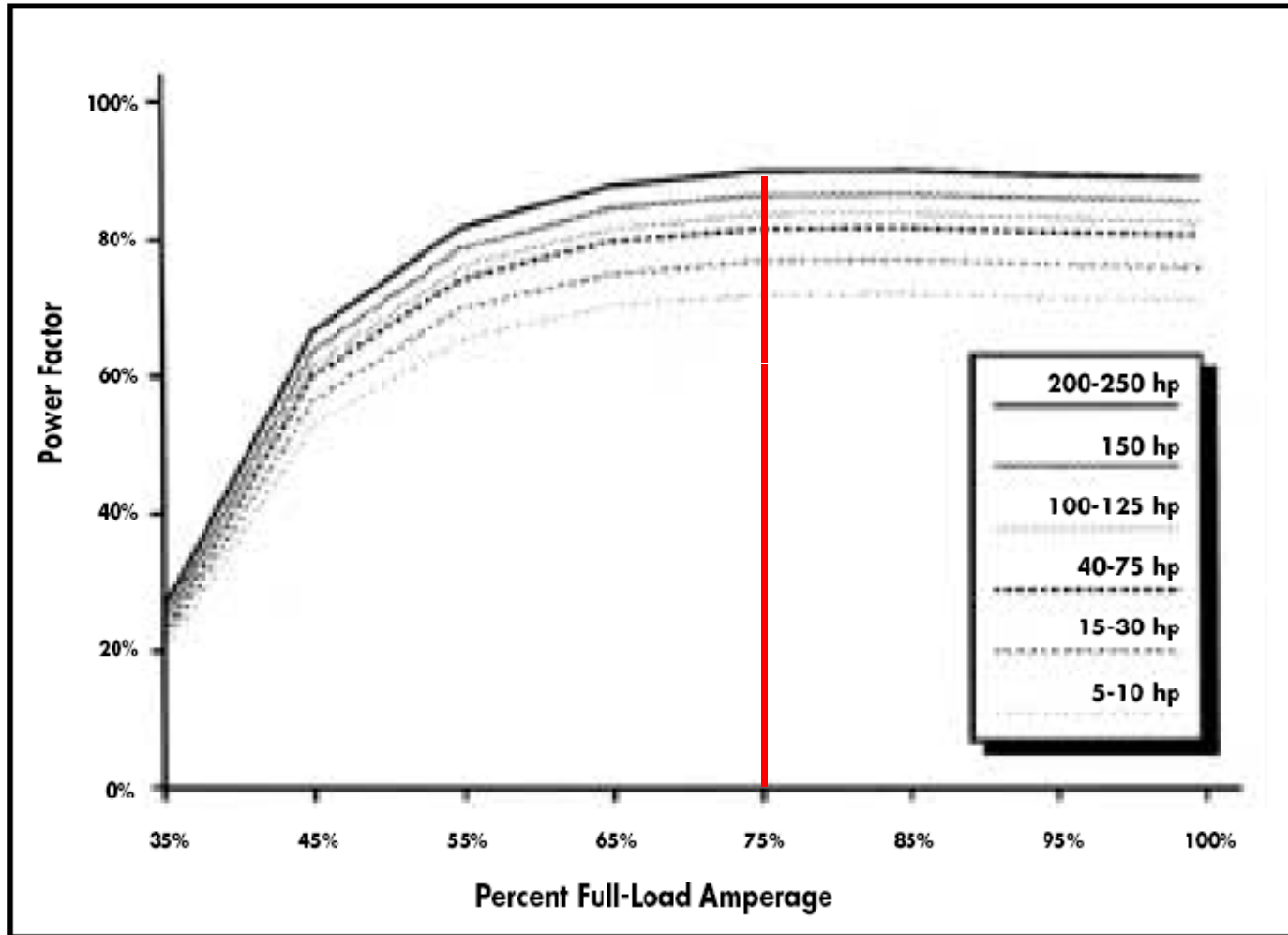
# Motor Sizing (30 – 90kW)

kW	r/min	Efficiency			Power Factor		
		FL	3/4	1/2	FL	3/4	1/2
30	2 900	88	86	83	0,84	0,80	0,75
30	1 450	91	91	89,5	0,84	0,82	0,73
37	2 900	90	89	86	0,83	0,80	0,75
37	1 450	91,5	91	89	0,84	0,80	0,72
45	2 900	89	88	85	0,85	0,81	0,76
45	1 450	91,5	91	90	0,86	0,82	0,75
55	2 900	93	92	90	0,90	0,87	0,83
55	1 450	94	93,5	92,5	0,88	0,85	0,77
75	2 900	93,5	92,5	90	0,91	0,88	0,85
75	1 450	94	93,5	92,5	0,85	0,82	0,72
90	2 900	93,5	92,5	90,5	0,90	0,88	0,84
90	1 450	94	93,5	92	0,82	0,79	0,73

# Electric Motor Efficiency



# Power Factor



# IRRIGATION



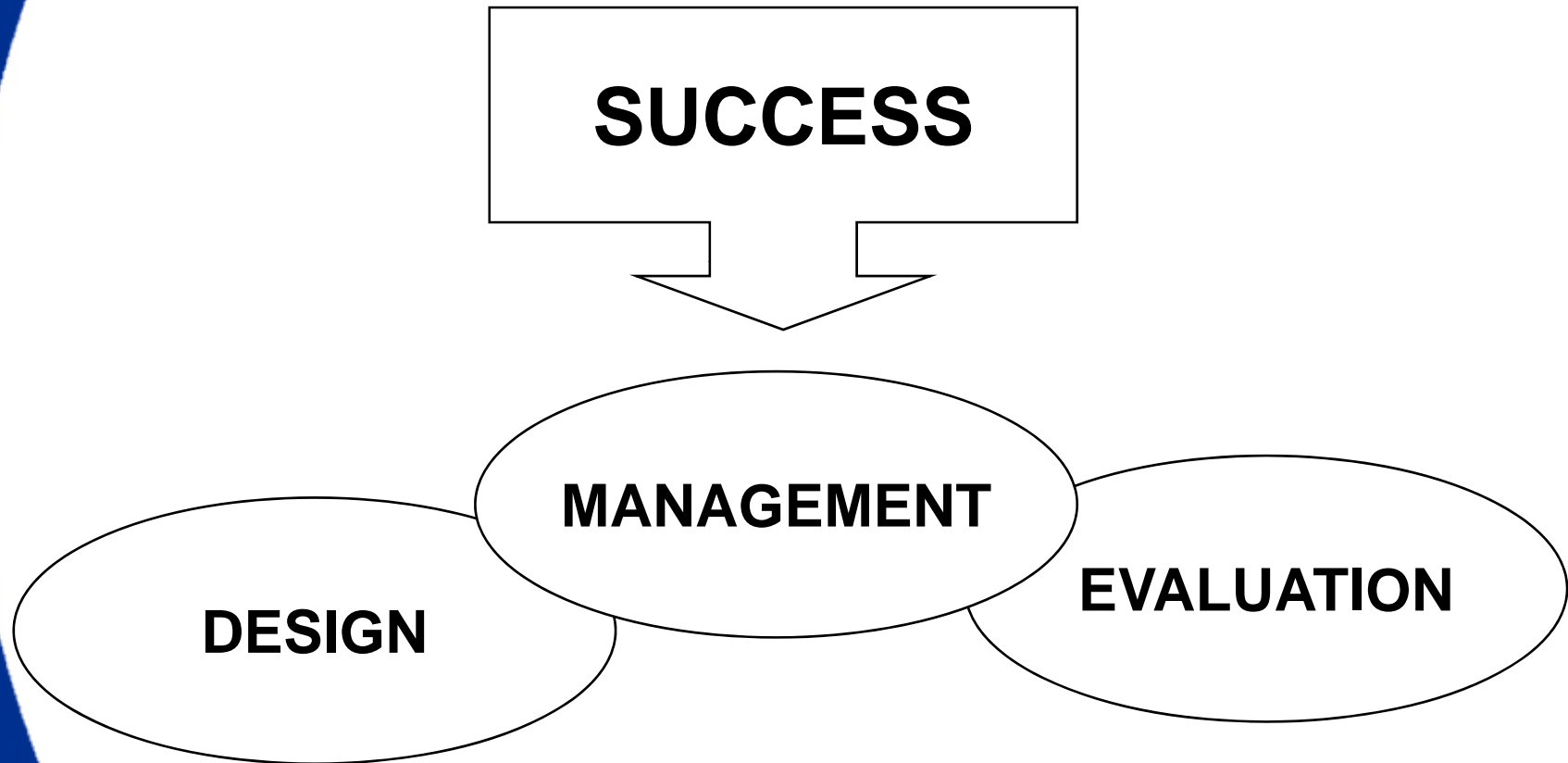
---

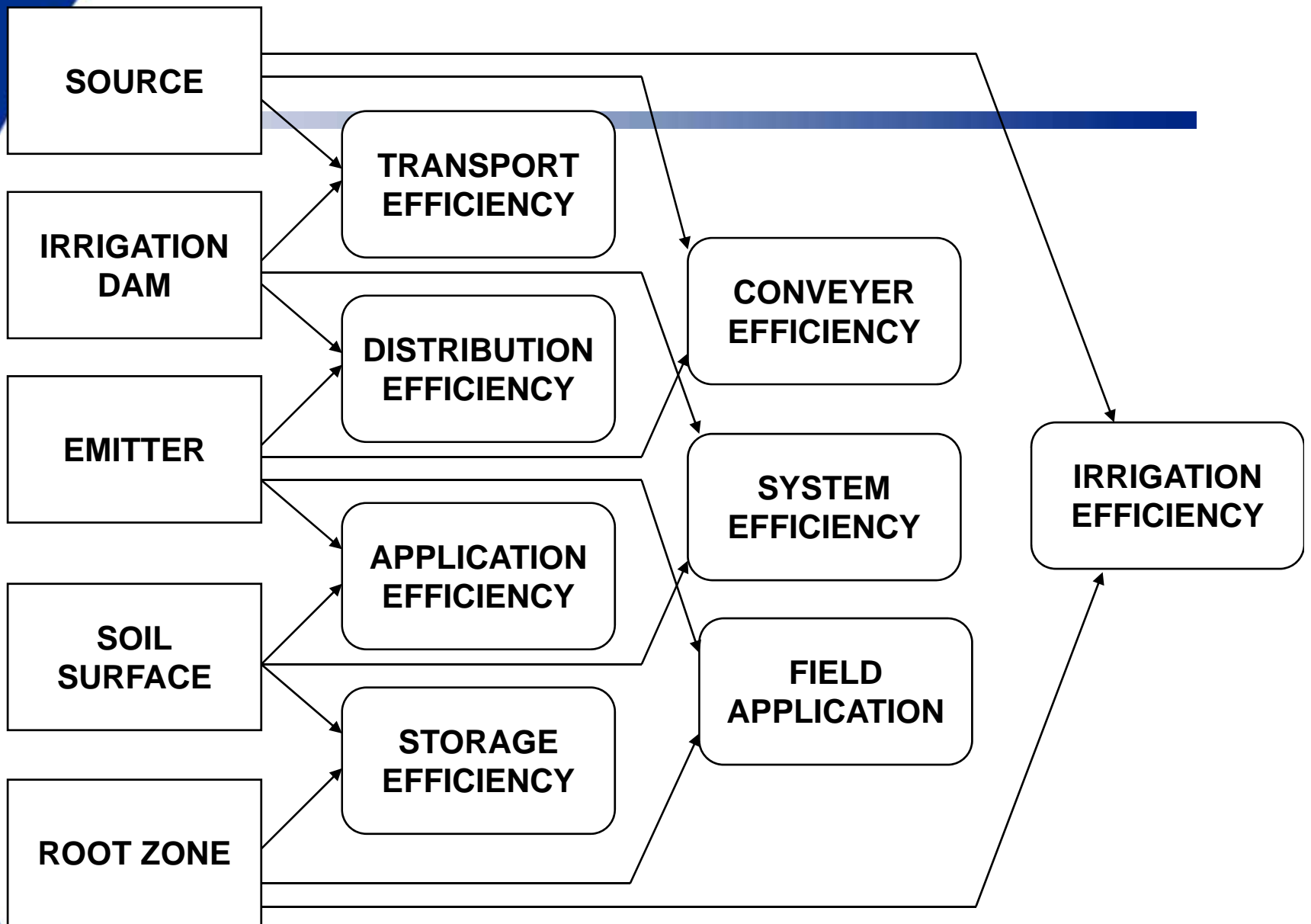
**GOSSIP IS THAT THE  
ELECTRICITY CRISIS IS A DROP  
IN THE BUCKET OF WHAT THE  
FUTURE WATER CRISIS WE ARE  
FACING WILL BE**

**GUESS WHO WILL BE TARGETED  
FIRST TO SAVE WATER WHEN  
IT HITS US?**

# IRRIGATION

---

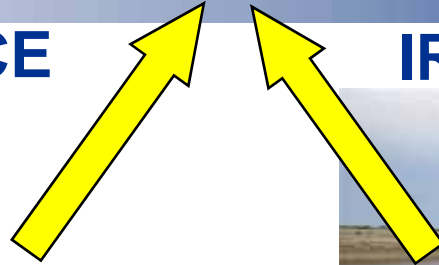




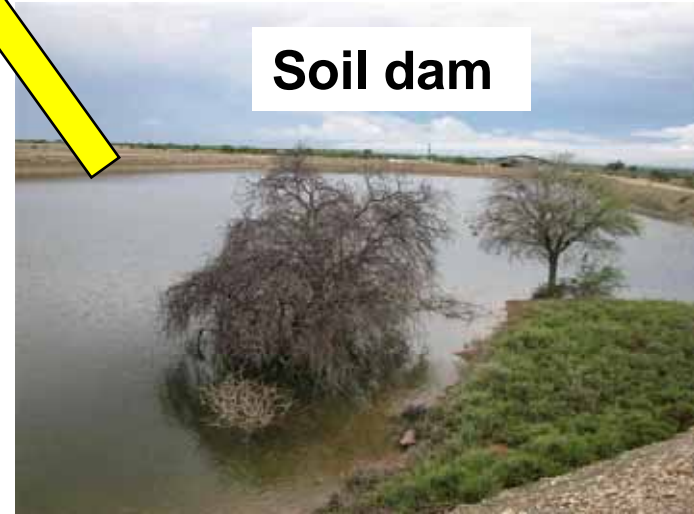
# TRANSPORT EFFICIENCY

SOURCE

IRRIGATION DAM



Maintenance ?



Soil dam



Cement dam

# DISTRIBUTION EFFICIENCY



# CONVEYER EFFICIENCY



# APPLICATION EFFICIENCY



---

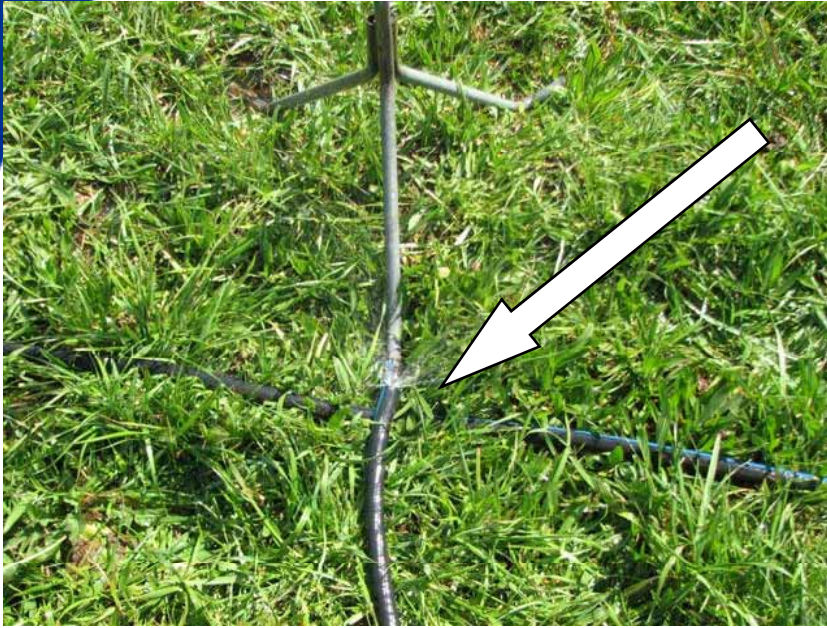
# Leaking pipes:

Will increase the water delivery of a pump resulting in the increase in power demand







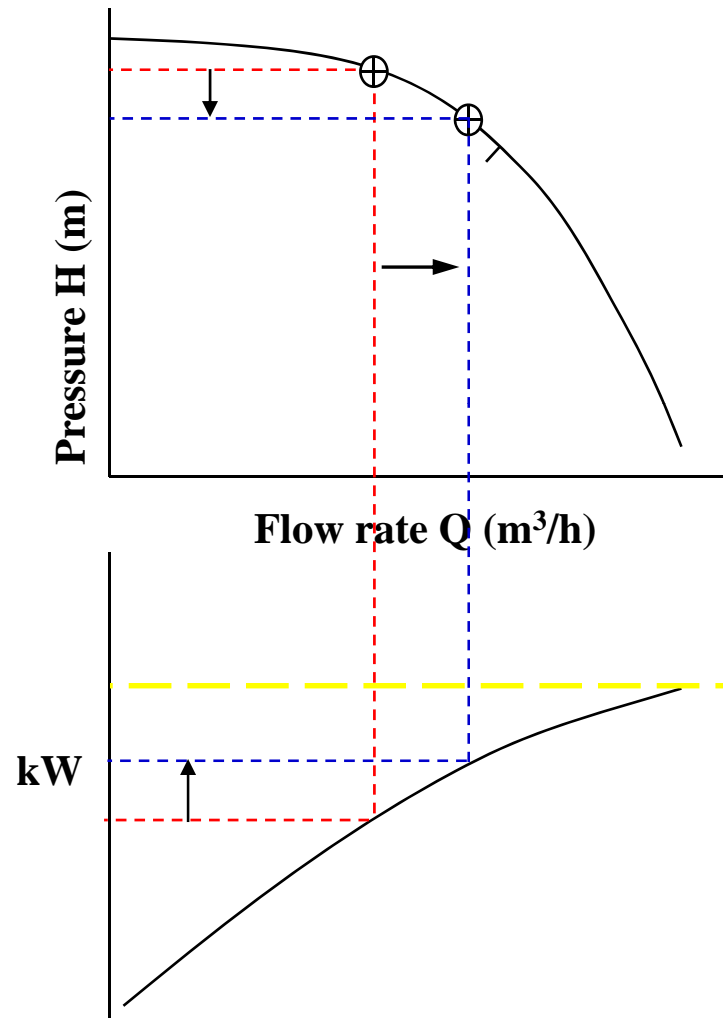


# Nozzle sizes

---

- **N**eeds to be checked regularly for wear and tear since increased nozzle sizes increases water delivery which results in a considerable increase in power demand. (Low pressure system – less energy used)
- 5% increase in diameter => 10% increase in water volume
- Replace at 5%

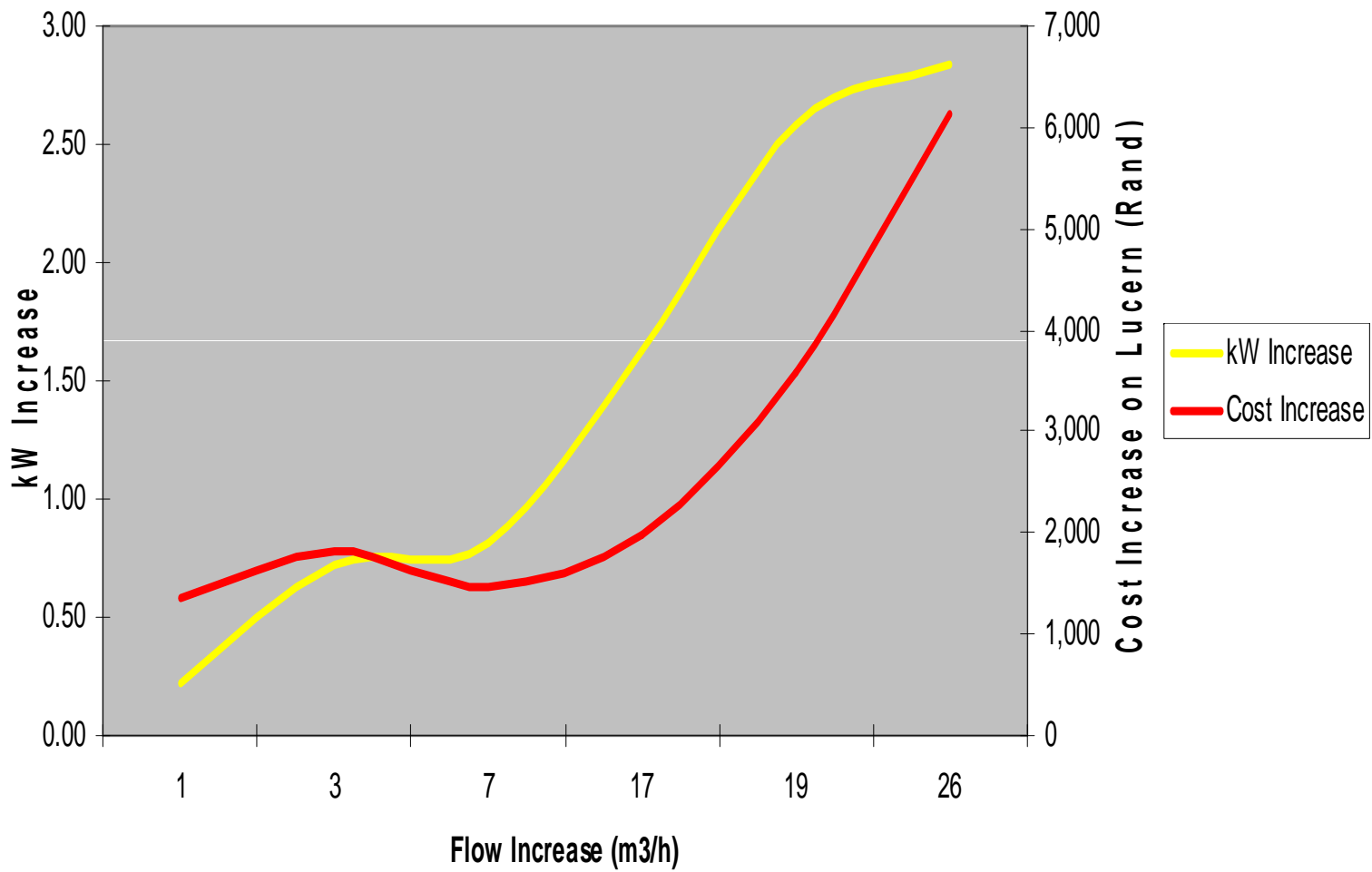
## Wear & Tear on Nozzles + Leaking pipes



- Increasing Flow Rate
- Decreasing Pressure
- Increasing kW
- Pump might cavitate
- Motor trip on overload

**Non-Overloading**

### Influence of 10% Volume Increase due to nozzle wear & tear



# Irrigation in windy conditions

---

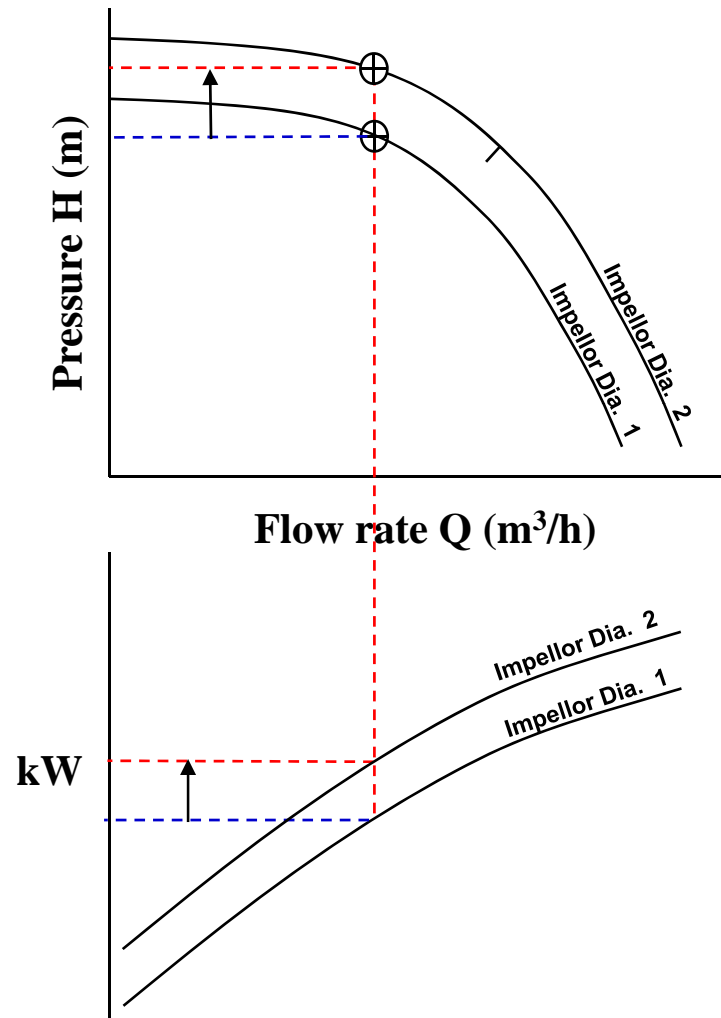


# Pipes

---

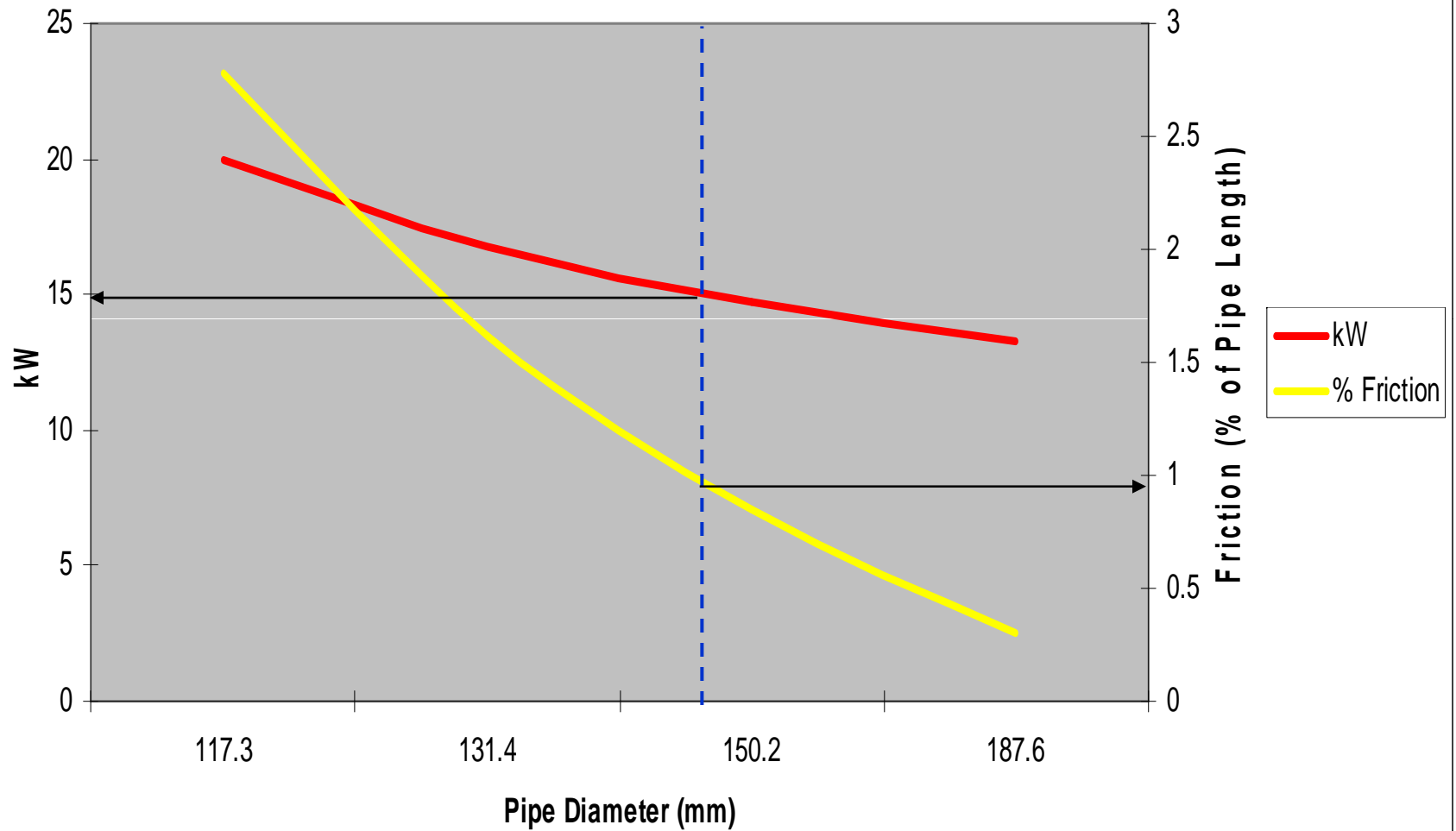
- Ensure irrigation system is **correctly designed** (Correct size pipes, pumps, motors). **Too small pipes – more friction – more energy used**
- **Economical – 1,0 to 1,5% of pipe length**
- **Second hand pipes vs. new pipes**

## Increased Pressure Head (Pipe Friction)

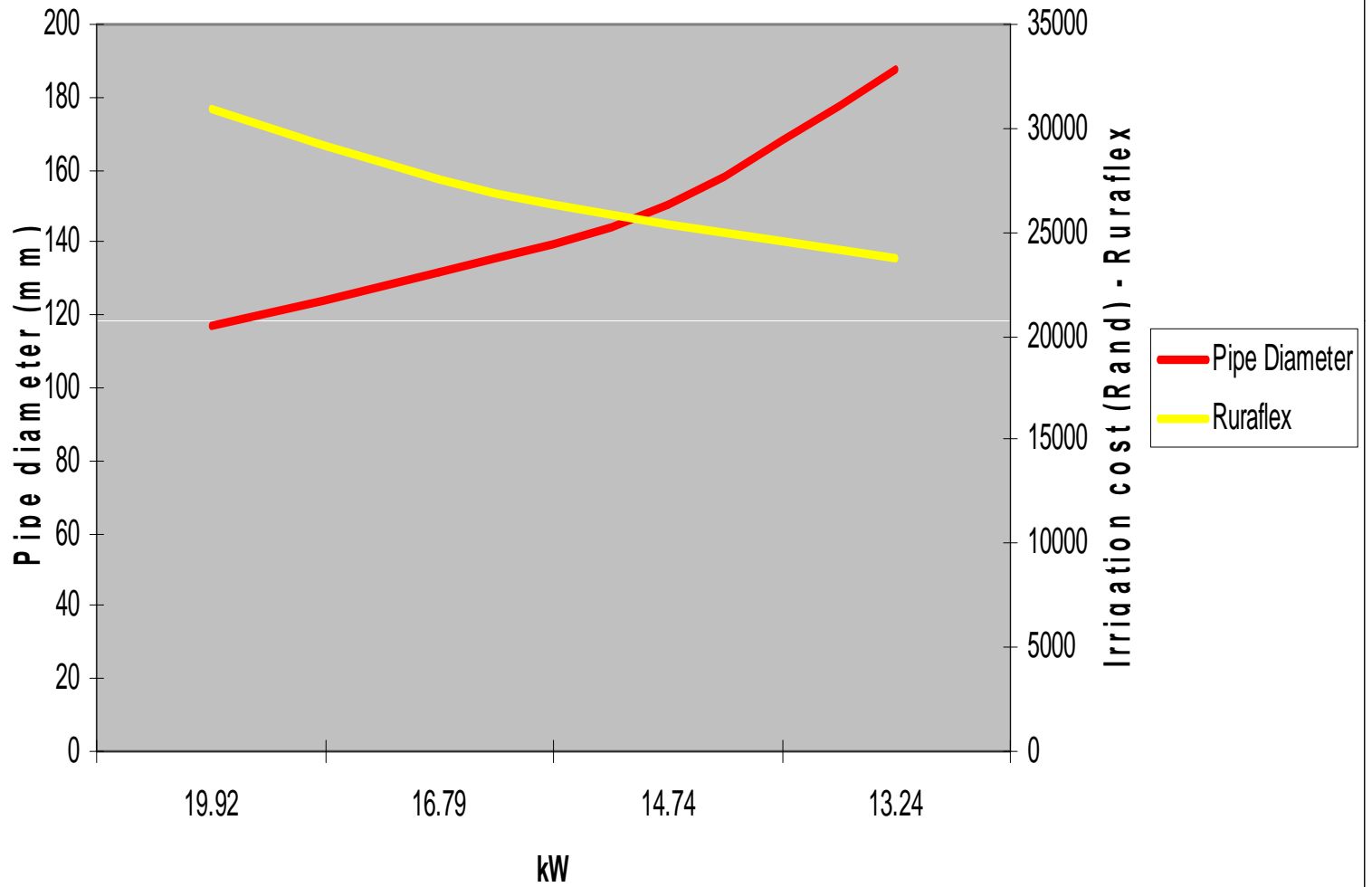


- Increasing Pressure
- Larger Impellor
- Increasing kW

### Pipe Friction vs. kW 78 m<sup>3</sup>/h



### Pipe diameter vs. Cost



# Pipe sizes



**Pipe friction – 0,35%**



**Pipe friction - 4,4%**

# System Design

	<b>System 1</b>	<b>System 2</b>	<b>System 3</b>
Transformer	100kVA	50kVA	50kVA
Hectares	29ha	18ha	25ha
Installed kW	44kW	22kW	22kW
Pipe diameter	250mm	150mm	200mm
Power Factor	0,8	0,855	0,88
Pump Efficiency	78,2%	63%	50%
Pump delivery	170m <sup>3</sup> /h	78m <sup>3</sup> /h	91m <sup>3</sup> /h

# System Design

	<b>System 1</b>	<b>System 2</b>	<b>System 3</b>
Liter/s/ha	1,63	1,2	1,01
Pipe friction	0,30%	0,85%	0,29%
Pump Pressure	25,96m	43,83m	23,44m
System power needed	15,4kW	14,74kW	11,61kW
System kW/ha	0,53kW/ha	0,82kW/ha	0,46kW/ha
Installed kW/ha	1,52kW/ha	1,22kW/ha	0,88kW/ha

# Irrigation costs

	Tariff	System 1 (29 ha)	System 2 (18 ha)	System 3 (25 ha)
<b>2009</b>	Landrate	R26 501	R31 639	R30 761
	Ruraflex	R17 683	R21 535	R21 945
	Nightsave Rural	R61 205	R63 483	R63 094
<b>2010</b>	Landrate	R31 332	<b>R37 393</b>	R36 358
	Ruraflex	R20 868	<b>R25 404</b>	R25 897
	Nightsave Rural	R72 526	R75 194	R74 738

# Transformer Size

---

Accumulated Power requirement:

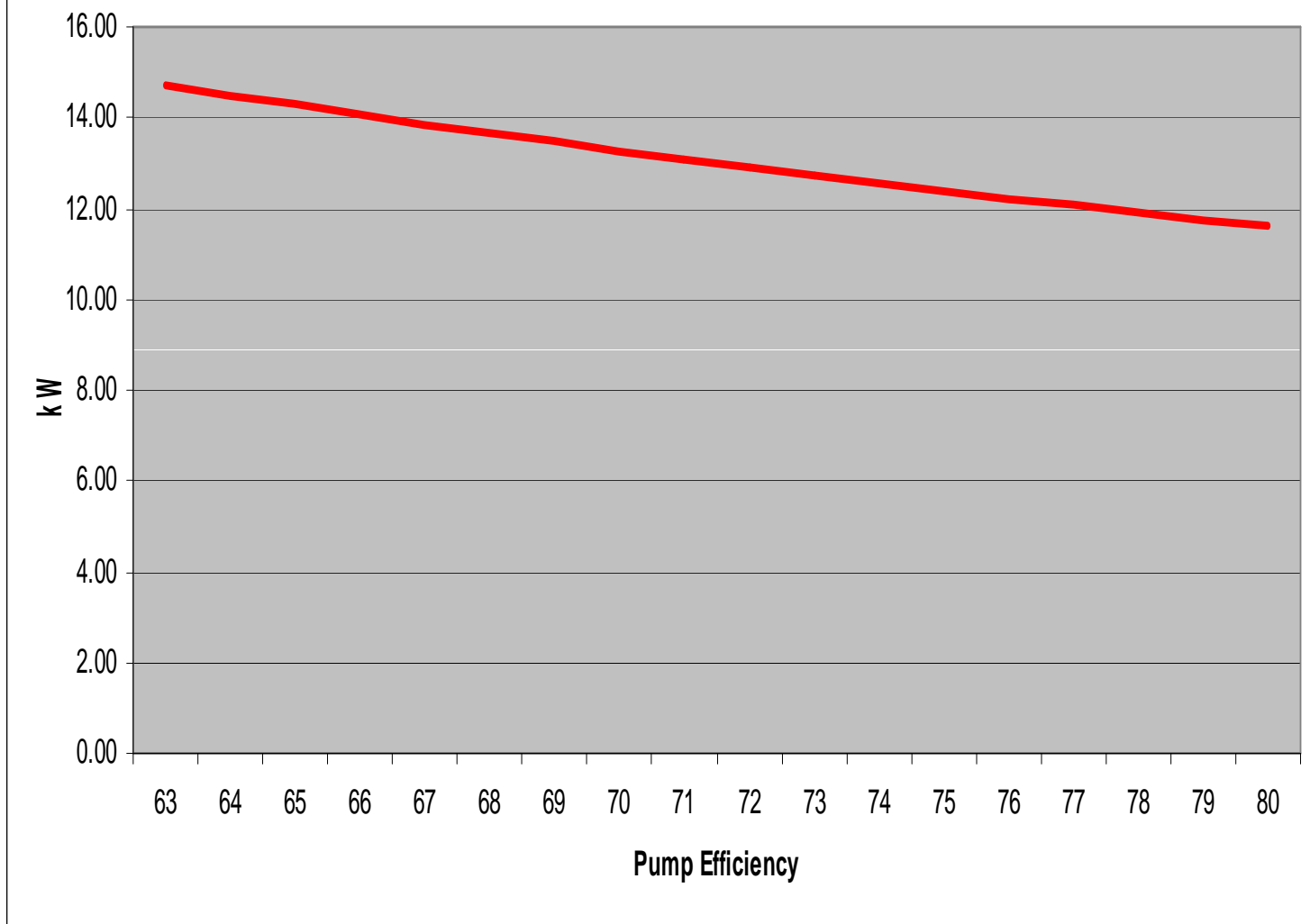
$$= 37,51 + 37,53 + 13,07$$

$$= 88,13\text{kW}$$

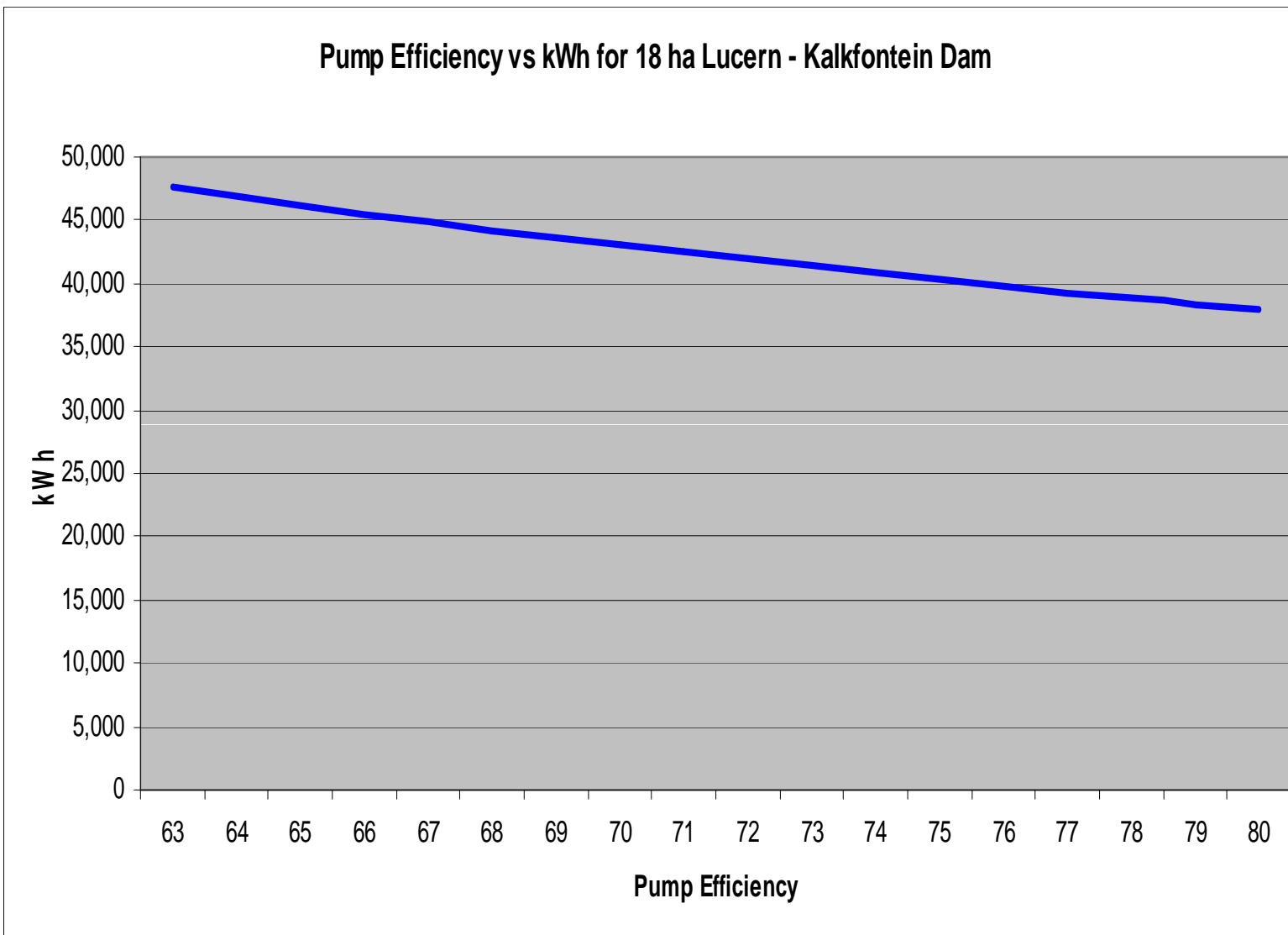
Installed Transformer size = 315 kVA

With available technologies like soft starters, VSDs and capacitors, a 100 to 150 kVA transformer could be used

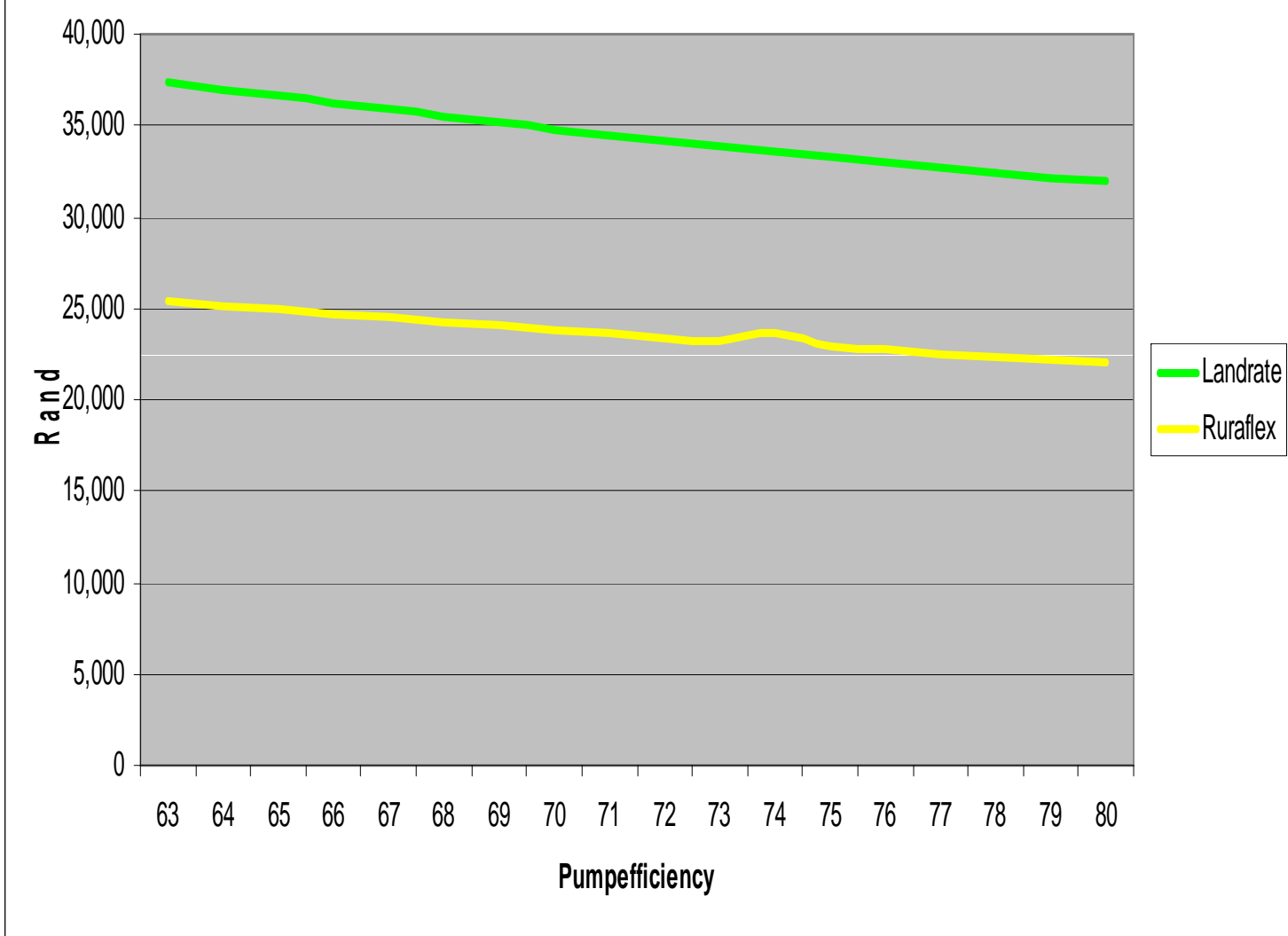
Pump Efficiency vs kW for 18 ha Lucern - Kalkfontein Dam



Pump Efficiency vs kWh for 18 ha Lucern - Kalkfontein Dam



### Cost of Irrigation for 18 ha Lucern - Kalkfontein Dam



# **LIFE LONG BATTLE**

---

**FARMERS BUY PUMPS AND  
MOTORS AT AUCTIONS**

**SYSTEM DESIGN MUST THEN  
SUIT PUMP & MOTOR**



---

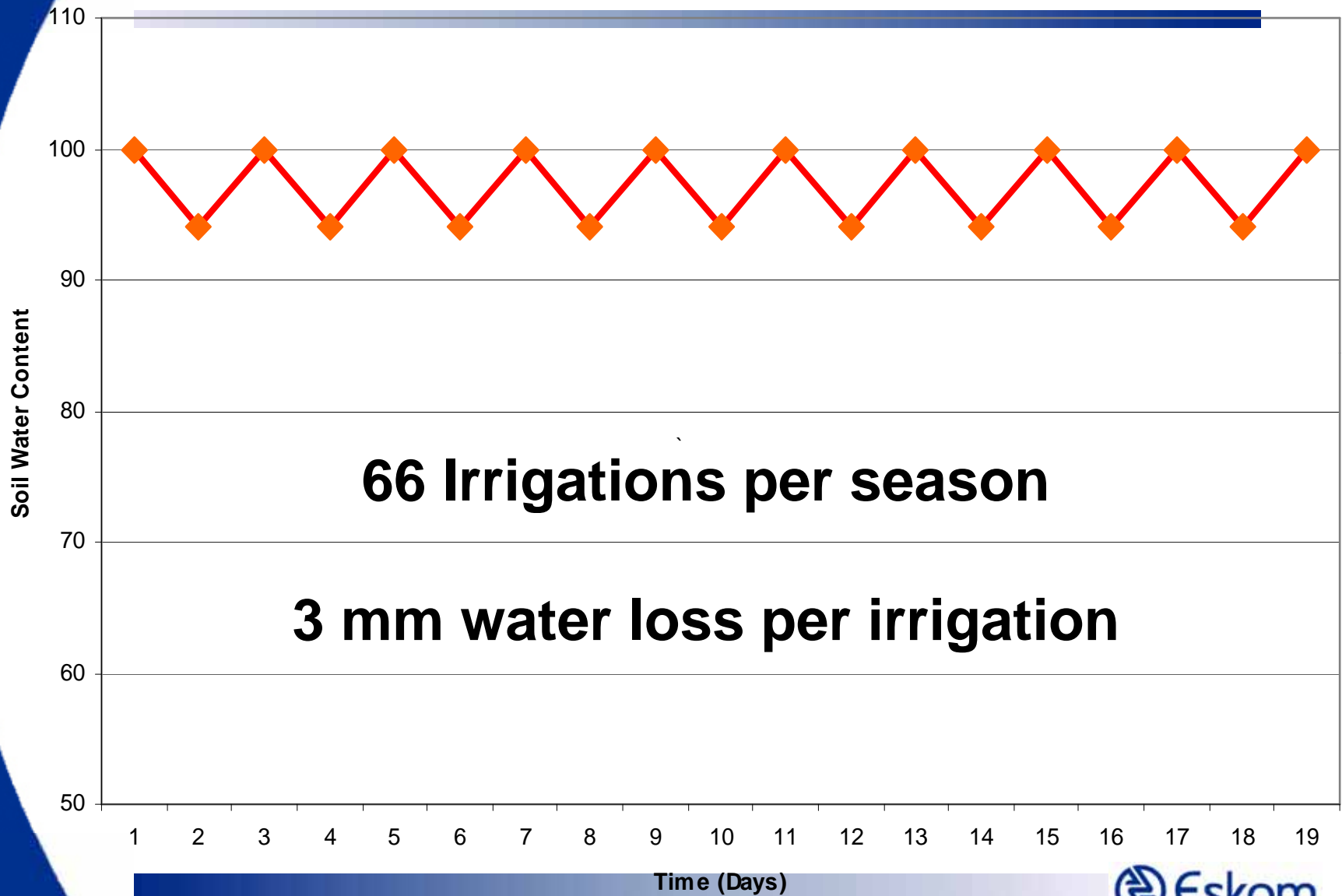
# **WATER MANAGEMENT**







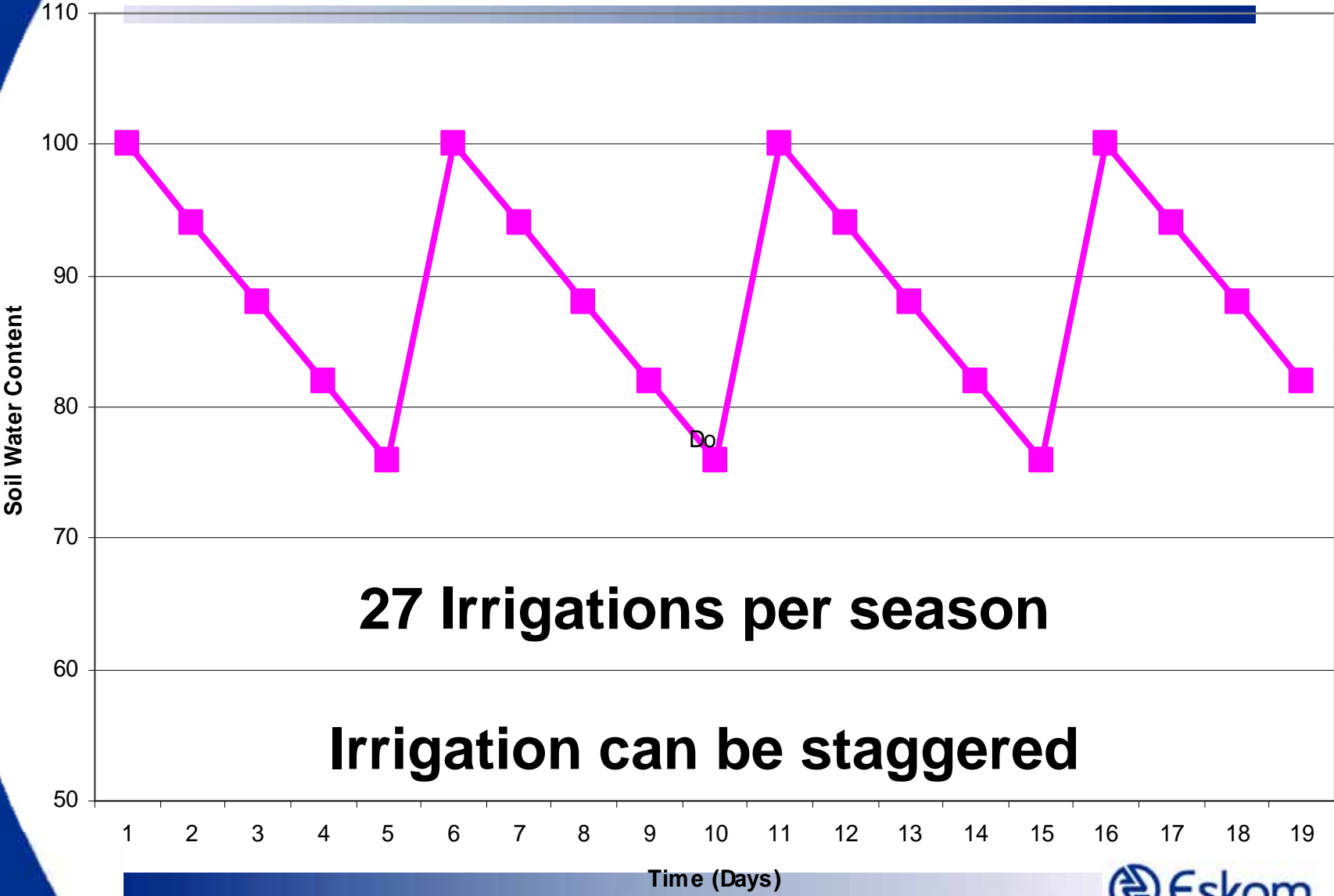
## Soil Water Content Over Time



**66 Irrigations per season**  
**3 mm water loss per irrigation**



Soil Water Content Over Time

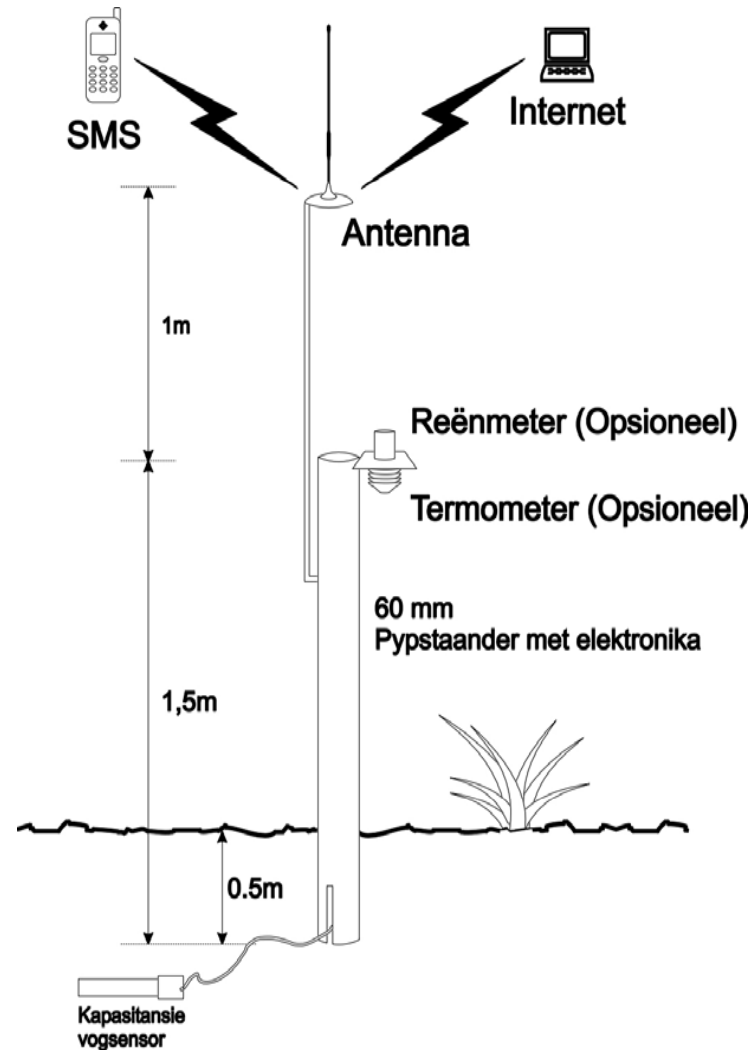


**27 Irrigations per season**

**Irrigation can be staggered**

Irrigate more

# Telemetric Moisture Measurement



## Luckhoff - Actual data

- Two lands where scientific irrigation scheduling were applied, were compared with 3 other neighbouring lands where no scientific scheduling were applied in the Luckhoff area
- Irrigation with scheduling (Land 1 & Land 2)
  - Maize followed by wheat were irrigated under each of the 2 centre pivots in one year.
- Irrigation with no scheduling
  - Land 3 – Two year wheat and 1 year maize figures
  - Land 4 & land 5 – Two year maize and 1 year wheat.
- For wheat, the figures for 2008 and 2009 were used
- For maize, the figures for 2009 and 2010 were used

Actual water usage (mm/crop)

	Land	Wheat 2008	Wheat 2009	Maize 2009	Maize 2010
<b>Scheduling</b>	1	541	232	458	313
	2	556	281	545	497
	<b>Ave</b>	<b>549</b>	<b>257</b>	<b>502</b>	<b>405</b>
<b>No Scheduling</b>	3	883	540	822	n/a
	4	691	n/a	696	794
	5	795	n/a	819	546
	<b>Ave</b>	<b>790</b>	<b>540</b>	<b>779</b>	<b>670</b>
<b>Difference (mm)</b>		<b>241</b>	<b>283</b>	<b>277</b>	<b>265</b>

## Luckhoff – Savings per year

### mm water saving:

- Average saving for wheat = 262 mm/season
- Average saving for maize = 271 mm/season
- Total saving per year/centre pivot = 533 mm (Double cropping)

### m<sup>3</sup> water saving: (mm/1000 \* area (m<sup>2</sup>))

- Water saving on wheat = 2 620 m<sup>3</sup>/ha/season
- Water saving on maize = 2 710 m<sup>3</sup>/ha/season
- Total water saving = 5 330 m<sup>3</sup>/ha/year (Double cropping)

### Pump hours saved: (m<sup>3</sup>/ha water ÷ 4,2 m<sup>3</sup>/h/ha)

- Pump hours saved for wheat = 624 hrs/season
- Pump hours saved for maize = 645 hrs/season
- Total water saving = 1 269 hrs/yr (Double cropping)

### kWh saved: (1,14 kW/ha x pump hours)

- kWh saved for wheat = 711 kWh/ha/season
- kWh saved for maize = 735 kWh/ha/season
- Total kWh saving = 1 446 kWh/year (Double cropping)

### Saving for farmer: (kWh x 50c/kWh)

- Saving on wheat = R355-50/ha/season
- Saving on maize = R367-50/ha/season
- Total saving for farmer = R723/ha/year (Double cropping)

## Savings

- **kWh and Electricity Cost saving @ 50c/kWh per double crop:**

- Per hectare: 1 446 kWh = R 723/ha/year
- Per 20ha centre pivot: 28 920 kWh = R 14 460/year
- Per 35ha centre pivot: 50 610 kWh = R 25 305/year
- Per 60ha centre pivot 86 760 kWh = R 43 380/year

- **KWh Saving in South Africa**

According to the figures obtained from the Water Research Commission, SA irrigates approximately 1,6 million ha. An estimation by the Institute of Agricultural Engineering is that approximately 70% of irrigation farmers are **not** irrigating scientifically. If we assume that 50% of the above cultivate 1 crop per year under a centre pivot and the other 50% cultivate 2 crops under 1 centre pivot per year, the estimated saving through scientific irrigation scheduling could be as follows:

- 1 Crop – 560 000 ha x 723 kWh/ha = 405 GWh
- 2 Crops – 560 000 ha x 1 446 kWh/ha = 810 GWh

**Total = 1 215 GWh**

**NB: Since irrigation contributes approximately 80% of the usage of electricity in agriculture, it is through irrigation where Eskom will obtain the most saving of electricity in agriculture.**

# FARMING

- By using available technologies to **schedule** irrigation water efficiently, **up to 30% savings** on water and electricity can be achieved.
- Technology is available to **automatically restart** pumps by computer or cellular phone.
- With **correct management**, more than **90%** of irrigation can be done **outside the peak hours** of Eskom. – Provided that your system is **designed correct**.
- Where **high ground** is available, irrigation water can be pumped into a **storage dam** during **off peak** hours and **gravitate** the water back into the irrigation system **any time** needed. If the static head is not enough for gravitation, considerable **less energy** is needed to pump from the storage dam.