



REVIEW OF SOUTH AFRICA'S APPLIANCE ENERGY CLASSES AND IDENTIFICATION OF THE NEXT SET OF ELECTRICAL EQUIPMENT FOR INCLUSION IN THE NATIONAL STANDARDS AND LABELLING PROJECT: NEW ELECTRICAL APPLIANCES

**Electric Motor Industry Stakeholder Workshops** 

4 April 2019







## Agenda

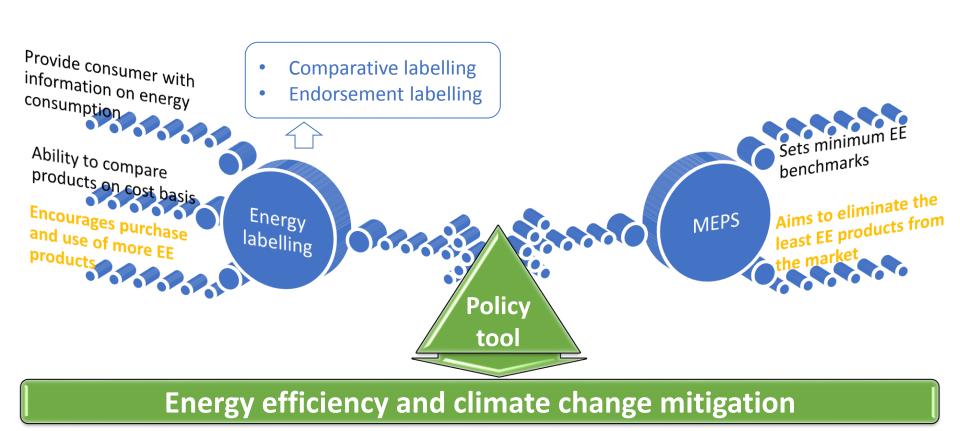
- 1. Policy tools considered
- 2. Scope of work and boundaries
- 3. Screening process
- 4. Methodology
- 5. International MEPS trends
- 6. SA analysis
- 7. Recommendations
- 8. Open discussion



## 1. Policy tools considered



## **Energy labelling and MEPS**





## Policy options to improve energy efficiency

- Two main policy options considered are energy labelling and Minimum Energy Performance Standards (MEPS)
- These are typically enacted through government legislation and regulations
- When is labelling most effective?
  - When consumers purchase products and pay the energy bills
  - When products are on display at purchase and can be compared
  - Where there is a wide range of energy efficiency on the market
- Labelling creates market pull to encourage suppliers to offer more efficient products to the market

## Policy options to improve energy efficiency

- When is MEPS most effective?
  - When product purchasers do not pay energy bills (can be different parts of a company, landlord and tenant)
  - When products are not on display for sale (purchased on specifications or from catalogues)
  - When there is a significant range of efficiency available (internationally) but this is not always present on the local market
- MEPS is a market push to ensure that all products offered for sale meet a minimum efficiency level



## 2. Scope of work and boundaries



## Study objectives (as per TOR)

- To <u>identify a new set of electrical equipment (residential or commercial)</u> to which compulsory minimum energy efficiency MEPS and/or labelling could be introduced
- To <u>recommend timelines for implementation</u> of improved and new minimum energy performance levels for the next set of electrical equipment
- 3. To <u>conduct an impact assessment analysis</u> of the proposed mandatory requirements for each appliance on <u>consumers</u>, <u>retailers</u>, <u>South African manufacturers</u>, and <u>importers</u>
- 4. To <u>quantify the potential energy and greenhouse gas</u> <u>emission savings</u> that could be achieved through new MEPS and/or labelling over a 10 and 30-year period



### Project Scope (UNDP and DOE)

#### 1. Purpose:

 Identify new electrical appliances that could be considered for a Standards & Labelling Programme

#### 2. Key considerations:

- 4-10 products (residential and commercial)
- Must include distribution transformers
- Main goal reduce electricity usage and GHG emissions

#### 3. Approach:





## 3. Screening



## Screening process

All lights, appliances

- List all lights and appliances products
- MEPS and labelling in 75 countries

0. Scope

- Boundaries Remove products out of scope
- Products covered by MEPS in SA already
- Remove any non-electric products

1. MEPS elsewhere

- Globally regulated products
- At least two countries/economic blocks
- EU MEPS/Ecodesign counted as one

2. Energy Savings

- Likley future energy savings from new MEPS
- Efficiency range, sales, usage levels and power
- Relative significant future potential energy savings

3. Ease of adoption

- Check for adoption, implementation and operation issues
- Relevant test procedures in place, ideally SAN (or IEC, ISO)
- MVE issues, especially any verification issues

4. Other barriers

- SA appropriate technical or other barriers
- Technologies, increased purchase costs, rate of market change, local manufacturing impacts

96

**72** 

24

9



### Shortlisted electric equipment



Household appliances

Chiller systems

None



Office equipment and electronics

Computers
Televisions
External Power Supplies



Motors - 3 Phase
Pool Pumps
Refrigerators – Commercial
Distribution Transformers

Note: Large ACs (>7.1kW) to be covered in a separate study



## 4. Methodology



### Methodology

#### Data sources:

- In-house developed database of electric appliances (web crawling, brochures, etc.)
- Interviews with the industry representatives

#### Approach:

Development of product database Interviews with industry representatives

Analysis of MEPS in other countries
Product testing requirements
Identifying MEPS for consideration in S.A.

Country related impacts
Consumer-specific impacts

Recommendations

Implementation plan



#### Data sources

- Stakeholder engagements
- Trade info (TradeMap data portal)
- International MEPS programs covered
- Field data collection
  - Online shops
  - Web crawling/catalogues

#### In-house product database:

- 23 brands and 245 models
- Suppliers, supplier type and contact info
- Frame type, motor size, rated speed
- Efficiency class, frequency, voltage, rated torque
- Motor dimensions, weight, poles
- Price and motor applications

	Supplex light	Contact details	Brand	Madel	Name	LW .	Rated speed (spee)	Efficiency class	Preparty	Voltage	Palacity	Frice Transactions
		Mark 5/3+0 (001 - 892 1289)										
coord: Electric Motors	Supplier (Strapoter)	mark@mutorell.co.za) Dear Schell	Microsoft			1 1000 - 10000						
		(021 - 556 6376)										
		dean ground relicious) - DIRECTORS										
ver touth Africa												
				WZZ	Card tree	T up to 335 KW		Super Pressure Efficiency (E.G.		580-615/860 V	2.6.6and 8	
										220-263/580-623 Vitter frame spec 63 to 2003		
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												machines, Presses, Elevators, Packaging equipment.
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				W23	PSS CHIC YOU	22 up to 690 kW		Mandard efficiency (83)		220-260/880-615V / 880-615/660V		
				WZZ	Card tree	2.12 up to \$10 for		Prenoum Efficiency (EEE)		129-150 V (Some use 65 to 355M/L)		
										\$25 Y (for frame size \$555/8)		
				W22	Card tron	NO up to 660 kW					2, 4, 6 and 8	
				W22				Prenaum Efficiency (ES)			2, 4, 6 and 8	
				W23				High efficiency (#2)		208-210/660V	2.6. 6 and 8	
												Pumps, Fans, Kreader and miser machines, Cutting
				cor		13 up to 220 kW		Standard efficiency (85)	50.10	580-633/960V		Gaving machines, Pressing machines, Industrial equi
				WDwitte		2.37 up to 7.5 Km		Super Pressure Efficiency (E.G.		121 or 110 Y	Cand to	
												Pumos, Elmators, Compressors, Consevor Selts, W.
				WMagnet Drive System		53 up to 560 kW	1500 and 5000 year			430 at 125 V		drawing Extruders, Others
										220-260/680-625V (value to 2001) / 680-625/660-690V		and the same of th
				W11	Numerous	2.12 up to 11 kW		High efficiency (#2)		(from 112M and above)		
										William 220 200/300-613V (up to 1000) / 500-		
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T WISS SUICTRIC (PTV) LTD												
				W21	Summer	1,12 up to 9,2 WW	Mandard effic	Mandard efficiency (83) 9	50.80	220-265/580-625V (up to 2001)		machines, Presses, Elevators, Packaging equipment.
										580-615/860V (from 112M and self		and others
				WIND		130 kW to 1250 kW			30 at 60 Hz	1.2 KY 10 BANY	210.8	
				WING		79KW 14 1000KW			30 at 90 Hz		219 12	
				HOT MUDONS	Cast tree	70 KW to 3110 KW			50.19		2.6.6.8.10 and 12	
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				W22	Card Iron							
											Dahlander K/G Pule -	machines, Presses, Elevators, Packaging equipment,
				W23	Call Iron	2,15/0,60 up to 100/120 file					Dahlander K/G Pule -	Pumps, Pans, Crusters, Consepor Setts, Mills, Cer machines, Presses, Elevators, Packaging equipment, and others
				W22	Call Iron	3,15/0,60 up to 100/130 file				580V, 525V or 550V	Calclander K/G Pule - Variable Torque Two Speed 6/G Pule -	machines, Presses, Elevators, Packaging equipment,
										5804, 5204 or 5504 5804, 5204 or 5504	Dahlander X/S Pule - Sarable Torque Two Speed 6/S Pule - Constant Torque	machines, Presses, Elevators, Packaging equipment,
				W23	Cast tree	1,11/0,60 up to 100/120 for 1,22/0,12 up to 75/110 Kw				580V, 525V or 550V 580V, 525V or 550V	Estionder X/S Pule - Sarable Torque Two Speed S/S Pule - Constant Torque Two Speed S/S Pule -	machines, Presses, Elevators, Packaging equipment,
				W22 W22	Call tree Call tree Call tree	3, 15/0,60 up to 100/130 No 3, 20/0,52 up to 75/110 No 3, 1/1,1 up to 65/161 No				580, 520 o 550 580, 520 o 550 580, 520 o 550	Eshiander X/E Puis- tarsable Torsuse Taxo Speed 6/E Puis- Constant Torsuse Taxo Speed 6/E Puis- Sarsable Torque	machines, Presses, Elevators, Packaging equipment,
				W22 W22 W23	Card treat Card treat Card treat Card treat	3, 13/5,80 up to 100/120 flux 3,23/5,82 up to 75/110 flux 3,1/1,1 up to 65/105 flux 320 MW up to 1000 flux				SECV, SERVICE SECV SECV, SERVICE SECV SECV, SERVICE SECV	Eahlander R/G Pute - Variable Torrisor Variable Right Pute - Constant Torrisor Two Spend R/G Pute - Variable Torrisor 2 and 6	machines, Presses, Elevators, Packaging equipment,
				W22 W23 W23 W40	Call tree Call tree Call tree Call tree Call tree Call tree	3,13/0,60 up to 100/130 Nw 3,12/0,32 up to 73/110 Nw 3,1/0,3 up to 63/101 Nw 330 NW up to 1000 Nw 11 NW up to 2000 NW			50.90	580V, 3,319 or 530V 580V, 3,319 or 530V 580V, 3,319 or 530V 1,3,910 5 80 580-413/680 V	Estrander X/E Pate - Socialist Torque Two Speed 6/E Pate - Socialist Torque Two Speed 6/E Pate - Socialist Torque 2 and 6 2 and 6	machines, Presses, Elevators, Packaging equipment,
				W22 W22 W23	Card treat Card treat Card treat Card treat	3, 13/5,80 up to 100/120 flux 3,23/5,82 up to 75/110 flux 3,1/1,1 up to 65/105 flux 320 MW up to 1000 flux			50 NO 50 NO	580V, 3,319 or 530V 580V, 3,319 or 530V 580V, 3,319 or 530V 1,3,910 5 80 580-413/680 V	Eahlander R/G Pute - Variable Torrisor Variable Right Pute - Constant Torrisor Two Spend R/G Pute - Variable Torrisor 2 and 6	machines, Presses, Elevation, Packaging equipment, and others
				W22 W23 W23 W40	Call tree Call tree Call tree Call tree Call tree Call tree	3,13/0,60 up to 100/130 Nw 3,12/0,32 up to 73/110 Nw 3,1/0,3 up to 63/101 Nw 330 NW up to 1000 Nw 11 NW up to 2000 NW		Prenam Efficiency (EE) high-efficiency (EE)		580V, 3,319 or 530V 580V, 3,319 or 530V 580V, 3,319 or 530V 1,3,910 5 80 580-413/680 V	Estrander X/E Pate - Socialist Torque Two Speed 6/E Pate - Socialist Torque Two Speed 6/E Pate - Socialist Torque 2 and 6 2 and 6	machines, Presses, Elevators, Packaging equipment,



## 5. International MEPS trends



#### Product overview

- Major component of electricity consumption in the industrial sector
- Responsible for 45% of global electricity demand
- Significant saving potential:
  - Long operating hours
  - Despite small differences in efficiencies



#### International Review of MEPS for motors

- 42 countries have MEPS
  - Incl 28 European countries
- Most cover three phase 0.75kW to 375kW
- A few cover single phase and small motors (US, Mexico, China)
- IEC60034 is widely used as the test method around the world
- IEC now also defines efficiency levels (IE1- IE4) in IEC60034-30-1 by frequency, poles and size



Minimum Requir	ements Electric I	Motors worldwide			
Efficiency Levels	Efficiency Classes	Testing Standard	Performance Stan	dard	
3-phase induction motors	IEC 60034-30-1, 2014	IEC 60034-2-1, 2014	Mandatory MEPS <sup>Ⅲ</sup>		
(Low Voltage < 1000 V)	Global classes IE-Code	incl. stray load losses	National Policy Requirement		
Super Premium Efficiency	IE4	Preferred Method II	1		
Premium Efficiency	IE3		Canada	(0.75 - 150 kW)	
_			Mexico	(0.75 - 375 kW)	
			USA	(0.75 - 375 kW)	
			USA ***	(0.18 - 2.2 kW)	
			South Korea	(0.75 - 375 kW)	
			EU 28*	(0.75 - 375 kW)	
			Switzerland*	(0.75 - 375 kW)	
			Turkey*	(0.75 - 375 kW)	
			Japan Toprunner	(0.75 - 375 kW)	
			Israel	(7.5 - 375 kW)	
		Summation of losses with	Taiwan	(0.75 - 200 kW)	
		load test:	Saudi Arabia	(0.75 - 375 kW)	
High Efficiency	IE2	Additional losses P <sub>LL</sub>	Australia	(0.75 - 185 kW)	
		determined	Brazil **	(0.75 - 185 kW)	
		from residual loss	Canada	(151 - 375 kW)	
			Chile	0.75 - 375 kW	
			China	(0.75 - 375 kW)	
			Colombia	(7.5 - 373 kW)	
			EU 28*	(IE2 + VFD)	
			New Zealand	(0.75 - 185 kW)	
			Israel	(0.75 - 5.5 kW)	
Standard Efficiency	IE1		Costa Rica		
			Chile	(0.75 - 7.5 kW)	
			Vietnam		
28 05 2018 Impact Energy Inc. & TPA advisors	I) Output power: 0.12 kW - 1000 kW, 50 and 60 Hz, line operated	II) for 3-phase machines direct online, < 1 kV, rated output power < 1000 kW	*) European Union, Norway: IE3 or IE2 + VFD; **) IE3 per 30-8-2019; 0.12 - 370 kW	0.75 - 375 kW	

III) Minimum Energy Performance Standard

\*\*\*) Polyphase: eq. to IE3; single phase: IE2 levels or above

2-, 4-, 6- and 8-poles

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## 5. SA analysis



#### Market Overview

- Over 23 brands identified
  - All motors are imported
- Different sizes supplied to the market
  - 0.09kW to 1 500kW
  - Majority of the multiphase motors IEC low voltage categorisation
- Some motors already complying with IEC efficiency codes
  - Among the IE rated:
    - IE1: 60%
    - o IE2:10%
    - IE3: 30% (mainly large industrial users; long operating hours)
- Market size (low voltage industry motors) > 200 000 units p.a.



### Usage and supply

#### **Suppliers**

- Most popular brands -WEG, ABB, Siemens, and Regal
  - Small companies (5,000 upa)
  - Large companies (50,000 upa)
- All imported
- Distribution:
  - Directly to end-user
  - Wholesalers/dealers

#### **Usage/application**

- Mainly industrial sector
- Wide application: pumps, fans, elevators, conveyors, power packs, grinders, pressing machines, compressors, industrial equipment, blowers, extruders, machinery, etc.
- End-users:
  - Small motors with limited usage: highly sensitive to initial costs
  - Medium and large motors with continuous usage: prioritise efficiency



### **Prices**

- Positive correlation between efficiency and price :
  - Better quality lamination
  - More copper
  - Better cooling fan
  - Precise machining of the air gap
- Local prices at par:
  - China < Brazil & Europe</p>
  - Chinese motors: +20% import duty
  - Brazilian motors: +18% import duty
- Price:
  - IE3 > IE1 by 15%
  - IE3 and IE2 small difference



### Impact analysis – assumptions

- Standard sizes across the full range were selected
- Supplementary data: EMSA and MEPS Reg Impact Assessments in Australia

Electr motor	Assumed market share	Assumed Usage	Assumed	Assumed current IEC energy efficiency rating shares				
size (kW)	Illarket Share	(Hrs/yr)	Loading	IE0	IE1	IE2	IE3	
0.75	19%	2500	75%	70%	20%	7%	3%	
1.5	15%	2500	75%	70%	20%	7%	3%	
3	13%	2500	75%	70%	20%	7%	3%	
5.5	12%	3000	75%	70%	20%	7%	3%	
11	10%	3500	75%	65%	20%	10%	5%	
18.5	9%	4000	75%	60%	20%	10%	10%	
45	8%	4500	75%	55%	20%	10%	15%	
90	6%	5000	75%	50%	20%	10%	20%	
160	5%	5500	75%	45%	20%	10%	25%	
300	3%	6000	75%	40%	20%	10%	30%	



## Impact analysis – assumptions

- Total annual electric motor sales of 200 000 (industry rep estimates)
- Market share by poles: 40% 2 pole, 30% 4 pole and 30% 6 pole
- Average efficiency a composite of various poles
- IE0 efficiency credentials estimated based on known IE1 and IE2 figures

Electric	Electric Loading impact 50%		Looding	Efficiency					
motor size (kW)	Full efficiency	50% efficiency	Loading impact	IE0	IE1	IE2	1E3		
0.75	0.77	0.67	87.0%	65.3%	71.5%	77.6%	80.7%		
1.5	0.8	0.715	89.4%	71.9%	76.6%	81.3%	84.0%		
3	0.825	0.75	90.9%	77.4%	81.0%	84.5%	86.8%		
5.5	0.86	0.8	93.0%	81.5%	84.2%	86.9%	89.0%		
11	0.885	0.835	94.4%	85.2%	87.2%	89.3%	91.0%		
18.5	0.9	0.85	94.4%	87.3%	89.1%	90.8%	92.3%		
45	0.925	0.89	96.2%	90.3%	91.6%	92.9%	94.0%		
90	0.93	0.905	97.3%	91.8%	93.0%	94.1%	95.0%		
160	0.93	0.9	96.8%	92.8%	93.8%	94.8%	95.7%		
300	0.93	0.9	96.8%	93.0%	94.0%	95.0%	95.9%		



## Impact analysis – energy savings potential

$$Annual\ total\ energy\ consumption = \left(\frac{kW_{output}}{Efficiency*Loading\ impact}\right)*\ Year\ hours*\ Loading$$

Motor Size	Typical an	nual energy	consumpti	Annual consump scenario	Annual energy savings		
(kW)	IE0	IE1	IE2	IE3	BAU	MEPS	(kWh/yr)
0.75	2 474	2 261	2 082	2 003	2 390	2 003	387
1.5	4 377	4 108	3 871	3 745	4 269	3 745	523
3	7 990	7 643	7 324	7 126	7 848	7 126	722
5.5	16 317	15 796	15 307	14 954	16 101	14 954	1 147
11	35 933	35 080	34 267	33 635	35 481	33 635	1 846
18.5	67 283	65 961	64 690	63 702	66 401	63 702	2 699
45	174 765	172 304	169 911	167 977	172 769	167 977	4 792
90	377 639	373 049	368 569	364 962	373 278	364 962	8 316
160	735 151	727 079	719 182	712 942	726 388	712 942	13 446
300	1 500 484	1 484 043	1 467 957	1 455 247	1 480 372	1 455 247	25 125



### Impact analysis – consumer impact

		1E1 Motors			IE3 Motors		Impact: 1E1 to 1E3			
Motor Size (kW)	Energy Consumption (kWh/yr)	Energy cost (based on R3/kWh tariff)	Average motor cost price (2, 4, 6 pole)	Energy Consumption (kWh/yr)	Energy cost (based on R3/kWh tariff)	Average motor cost price (2, 4, 6 pole)	Energy Savings (kWh)	Energy Savings Value	Cost Implications	
0.75	2 261	R6 783	R3 601	2 003	R6 009	R4 141	258	R774	R540	
1.5	4 108	R12 324	R4 638	3 745	R11 235	R5 337	363	R1 089	R699	
3	7 643	R22 929	R6 750	7 126	R21 378	R7 763	517	R1 551	R1 013	
5.5	15 796	R47 388	R9 359	14 954	R44 862	R10 792	842	R2 526	R1 434	
11	35 080	R105 240	R12 311	33 635	R100 905	R14 191	1 445	R4 335	R1 880	
18.5	65 961	R197 883	R29 640	63 702	R191 106	R34 093	2 259	R6 777	R4 453	
45	172 304	R516 912	R72 388	167 977	R503 931	R83 256	4 327	R12 981	R10 868	
90	373 049	R111 9147	R124 918	364 962	R1 094 886	R143 679	8 087	R24 261	R18 762	
160	727 079	R2 181 237	R197 294	712 942	R2 138 826	R227 062	14 137	R42 411	R29 768	
300	1 484 043	R4 452 129	R296 832	1 455 247	R4 365 741	R353 878	28 796	R86 388	R57 047	

- Savings based on non-residential tariff of R3/kWh
- For continuous users: higher costs of the unit for the smaller sized motor - offset by operational savings
- For intermittent users: negligible savings



#### Other considerations

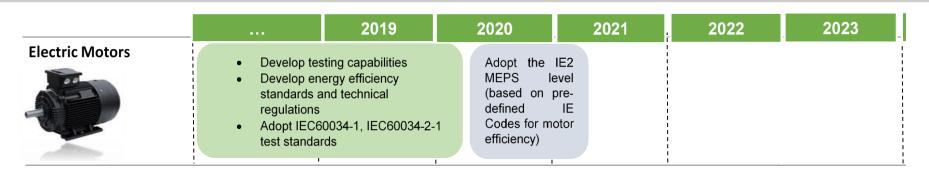
- Local manufacturing industry non existent
   BUT
- Motors inputs into other products
  - Might be negatively impacted
  - Risk of inflated prices to cover increased costs



## 7. Recommendations



#### Recommendations for electric motors



- Tier 1 = IE2 in 2020 with Tier 2 = IE3 in 2022
  - This would bring South Africa into line with major economies in many parts of the world
  - Scope initially three phase 0.75kW to 375kW
  - Scope to cover 2, 4 and 6 pole motors (could consider 8 pole motors as well)
- To align with Europe, allow an IE3 motor or an IE2 motor with a variable speed drive for Tier 2
- For small motors 0.18kW to <0.75kW and single phase motors ≥0.75kW:
  - Consider only after regulation of three phase
  - Large quantity = difficult to monitor and enforce
  - Will require adoption of US levels (IEC does not cover single phase)



# 8. Discussion and questions?



## Thank you

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