



energy

Department:
Energy
REPUBLIC OF SOUTH AFRICA



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

Chiller System Industry Stakeholder workshops

5 April 2019

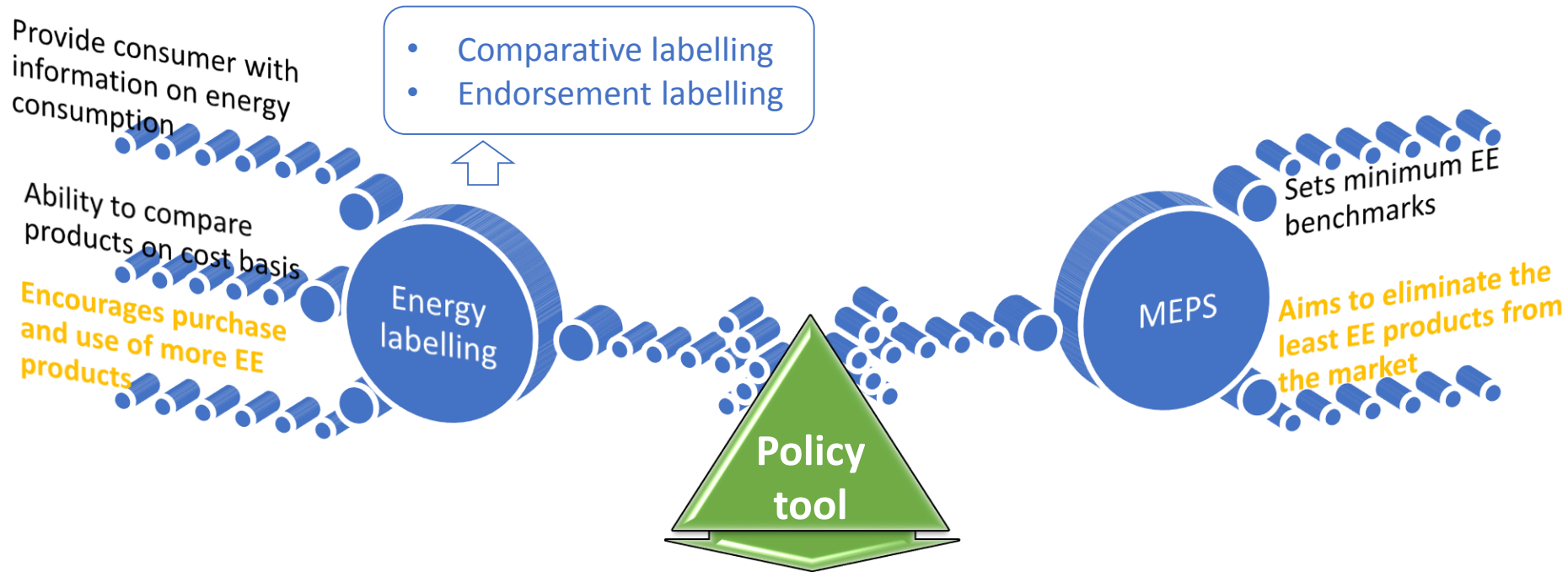


Agenda

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



Energy efficiency and climate change mitigation

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)

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

Project Scope (UNDP and DOE)

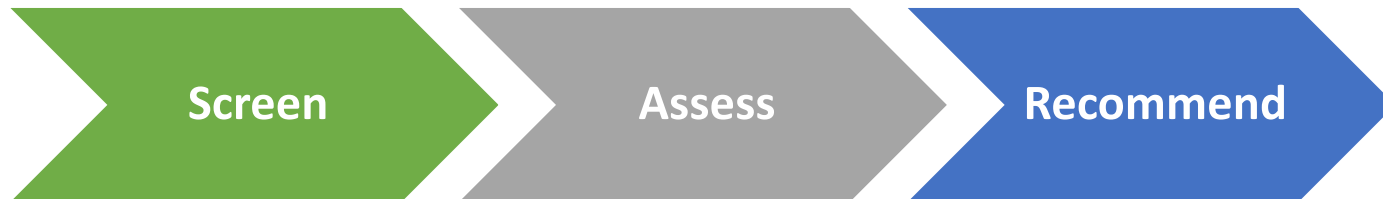
1. Purpose:

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

2. Key considerations:

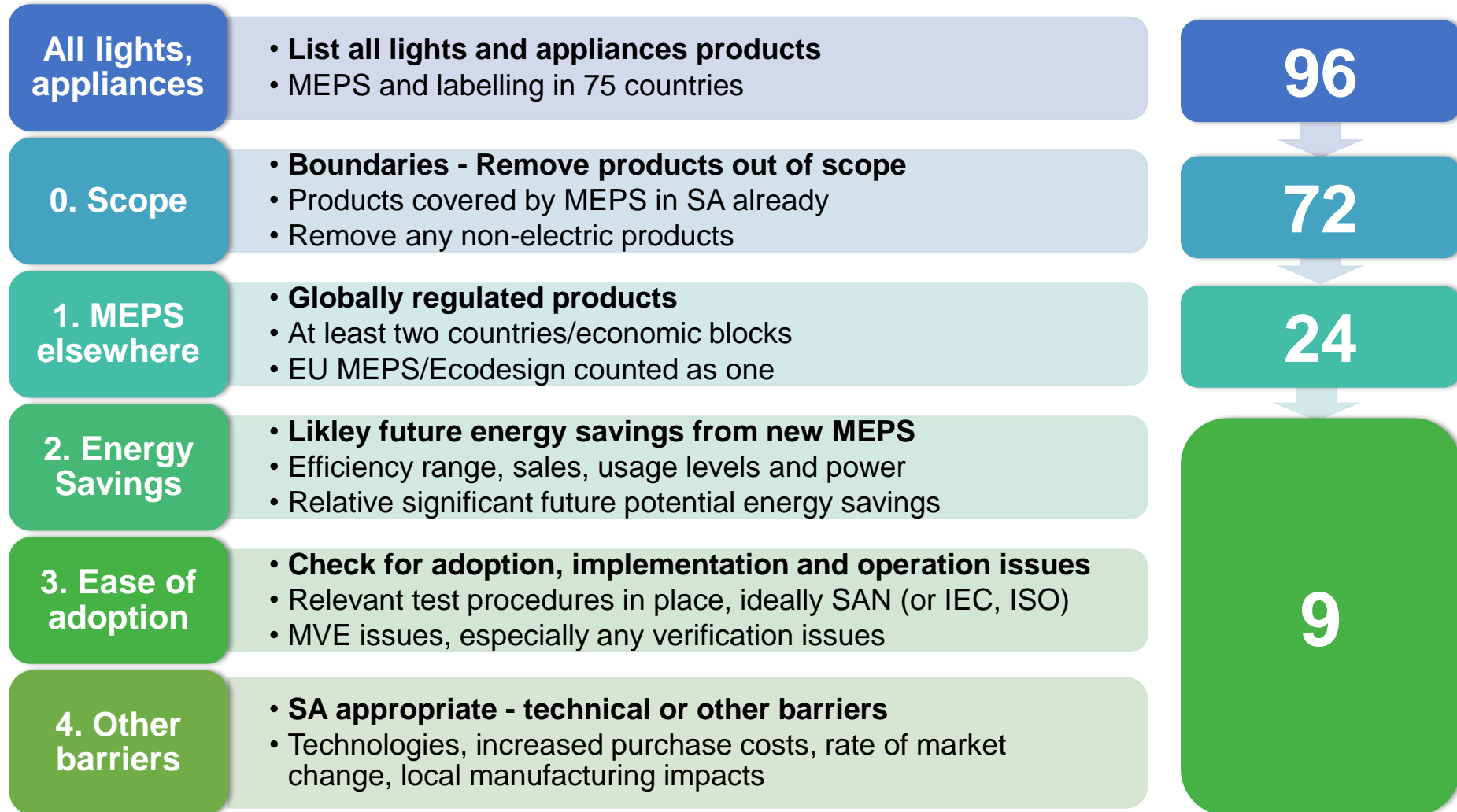
- 4-10 products (residential and commercial)
- Must include distribution transformers
- Main goal – reduce electricity usage and GHG emissions

3. Approach:



3. Screening

Screening process



Shortlisted electric equipment



Heating and
cooling equipment

Chiller systems



Household
appliances

None



Office equipment
and electronics

Computers
Televisions
External Power Supplies



Other equipment
(mostly commercial
and industrial)

Motors - 3 Phase
Pool Pumps
Refrigerators – Commercial
Distribution Transformers

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

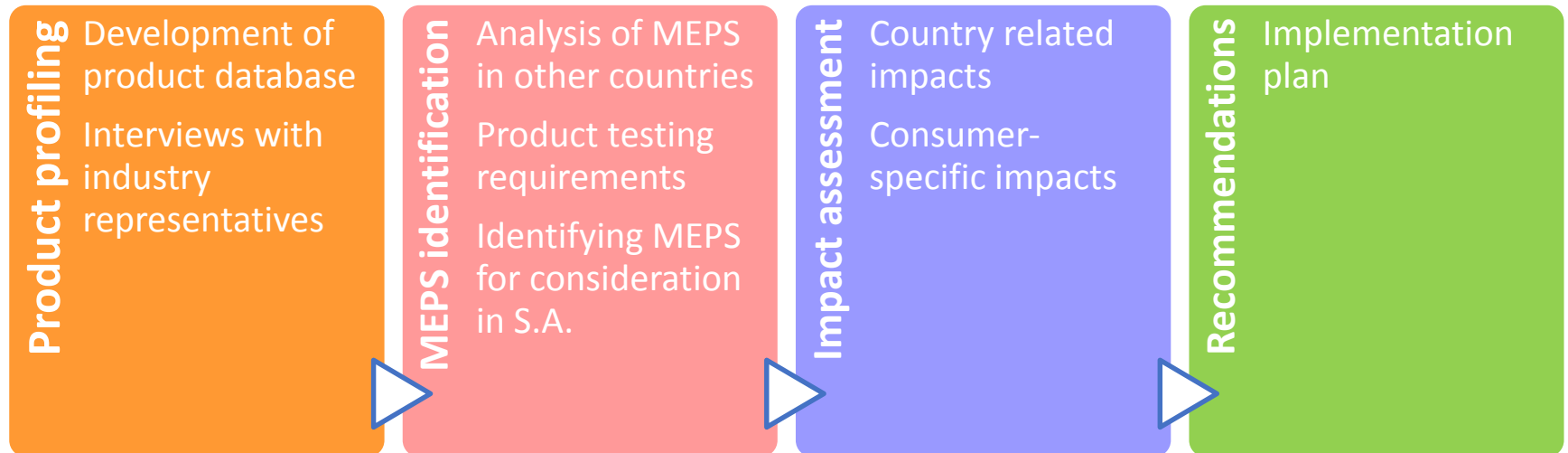
4. Methodology

Methodology

1. Data sources:

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

2. Approach:



Data sources

- Stakeholder engagements
- International MEPS programs covered

- Field data collection
 - Web crawling
 - Catalogues



In-house product database of 285 chillers:

- Supplier and supplier type
- Brand , product description, sectoral category
- Compressor type, TCC, refrigerant type
- Power supply, power input
- nominal cooling and heating capacities
- Dimensions, weight, and performance (EER & COP)

| Product ID | Supplier | Brand | Model | Capacity (kW) | Refrigerant | Compressor Type | Power Input (kW) | EER | COP | Dimensions (mm) | Weight (kg) | Notes |
|------------|----------|-------|-------|---------------|-------------|-----------------|------------------|-----|-----|-----------------|-------------|-------|
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5. International MEPS trends

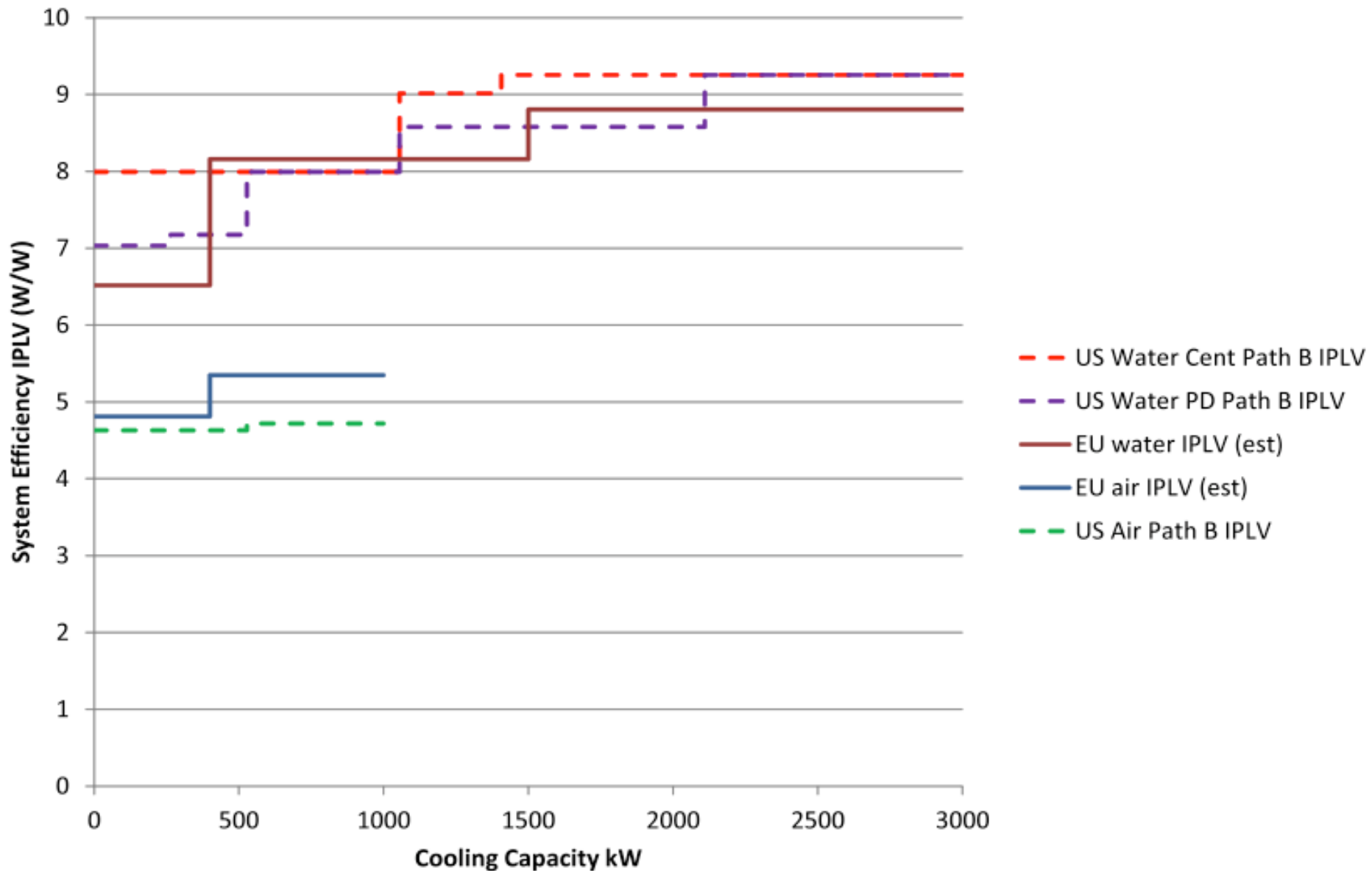
Product overview – chillers

- **Very large systems** used to supply chilled water for cooling in large commercial buildings
 - Typically 200kW to 3,000kW in capacity
 - All use the vapour compression cycle
- **Many customised products**
- **Limited number of global suppliers**
- Products are **far too large to test normally**
- Certification is the only practical approach to assess efficiency and MEPS

International Review of MEPS for chillers

- MEPS for chillers in North America, Europe and Australia/NZ
- Two main approaches to test and define efficiency:
 - US approach
 - Full load EER and IPLV (integrated part load value) with two compliance pathways
 - European approach
 - Specifies only SEER (Seasonal EER)
- Test methods are very roughly similar but somewhat different
- MEPS levels appear to be broadly equivalent

Comparison of EU and US MEPS - chillers



6. SA market analysis

Market Overview

- Ranges:
 - Nominal cooling capacity range: 2kW to 2 400kW
 - Weight range: 380kg to 17 838kg
 - EER range: 2.68 to 5.932
 - COP range: 3.07 to 3.38
- Over 15 chiller brands available
- 19 chiller suppliers
 - All imports (Korea, Japan, Italy, France, Asia)
- Market segments:
 - Build to own
 - Build to rent
- Some local installers prefer Eurovent certified
- Sales - difficult to estimate:
 - 100 enquiries per annum for chiller installation design projects
 - Mall of Africa: 28 chillers with a capacity of 14MW
 - Park Central in Rosebank: 2 chiller systems installed

Impact Analysis – Assumptions

- Chiller types modelled mirror the categories in European regulation plus one ‘very large’ US category
- Market share by category based on analysis of in-house database
- Average product life of 20 years
- Annual chiller sales of 500
- Chiller usage of 8760 hours per year
- Loading IPLV of 0.58 for all chiller types
- IPLV base and IPLV MEPS (European and Australian docs)

| Type | Size (kW) | Representative size | Market share | IPLV base | IPLV MEPS |
|-------------------------|--------------|---------------------|--------------|-----------|-----------|
| Air source small | <400 | 300kW | 47% | 3.5 | 4.2 |
| Air source large | ≥ 400 | 700kW | 26% | 3.5 | 4.2 |
| Water source small | <400 | 300kW | 7% | 5 | 6.2 |
| Water source medium | 400 to 800 | 700kW | 8% | 5.2 | 6.5 |
| Water source large | 800 to 1600 | 1250kW | 8% | 5.5 | 7.5 |
| Water source very large | 1600 to 3000 | 2500kW | 4% | 5.7 | 8 |

Impact Analysis – Energy Savings

$$\text{Annual energy consumption} = \frac{P_{\text{rated}}}{\text{IPLV}_{\text{scenario}}} * \text{loading IPLV} * 8760$$

- Individual savings:

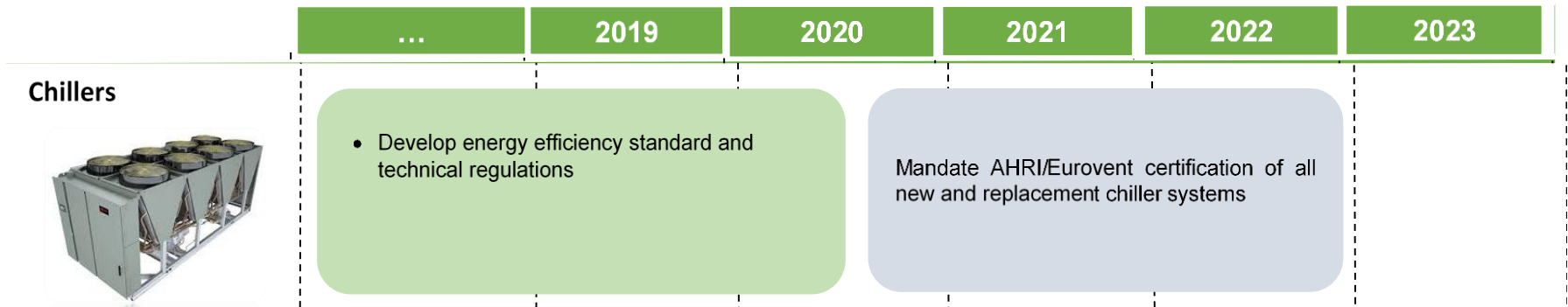
| Type | Rep size (kW) | Loading IPLV (AHRI) | IPLV | | Annual energy consumption (GWh) | | Annual energy savings (MWh) |
|------------------------|---------------|---------------------|------|------|---------------------------------|--------|-----------------------------|
| | | | Base | MEPS | Base | MEPS | |
| <i>Air source S</i> | 300 | 0.58 | 3.5 | 4.2 | 435.5 | 363.9 | 72.6 |
| <i>Air source L</i> | 700 | 0.58 | 3.5 | 4.2 | 1016.2 | 846.8 | 169.4 |
| <i>Water source S</i> | 300 | 0.58 | 5 | 6.2 | 304.8 | 245.8 | 59 |
| <i>Water source M</i> | 700 | 0.58 | 5.2 | 6.5 | 684 | 547.2 | 136.8 |
| <i>Water source L</i> | 1250 | 0.58 | 5.5 | 7.5 | 1154.7 | 846.8 | 307.9 |
| <i>Water source VL</i> | 2500 | 0.58 | 5.7 | 8 | 2228.4 | 1587.8 | 640.7 |

- Total annual MEPS savings : 72 GWh

7. Recommendations

Celebrate **Development** Diversity

Recommendations for chillers



- Proposed MEPS for South Africa:
 1. Certification by Eurovent for compliance with EU requirements **OR**
 2. Certification by AHRI for compliance with ASHRAE Standard 90.1
- Allows maximum flexibility for global suppliers
- Ensures all products are reasonably efficient
- Small differences in efficiency between EU and US schemes not important

8. Discussion



Thank you

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