



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



SUSTAINABLE DEVELOPMENT GOAL 9
INDUSTRY, INNOVATION AND INFRASTRUCTURE

Sustainable Technologies for Air Conditioning – workshop

Transition to low-GWP technologies in A5 countries

Montreal, November 18, 2017

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Outline

- Overview;
- A/C manufacturing conversions; and
- Outlook.





Overall picture

- Industries are moving away from R-22; and towards especially R-410;
- A5 still mainly R-22;
- R-410 products are being optimized – R-22 to less extent (if at all);
- Dependency on CKD/SKD kits from especially China.



Residential A/C refrigerant options

Refrigerant	GWP	Pe (bar)	Pc (bar)	Vol. cap. (kJ/m ³)	Flammability
R-22	1,810	7.9	15.3	6,419	No
R-410	2,088	12.5	24.8	9,267	No
R-290	3	7.3	13.7	5,564	Yes (A3)
R-32	675	12.8	24.8	10,209	Yes (A2L)
HFO/HFC 1	150-1,000	Like R-22			Yes (A2L)
HFO/HFC 2	150-1,000	Like R-410			Yes (A2L)
R-744 (CO ₂)	1	50.8	121.8	28,371	No



Intervention – A/C manufacturing

Eligible actions:

- No capacity upgrade
 - One-to-one replacement;
- Only processes affected by change of refrigerant;
- Cost effectiveness (US\$/kg)
 - In relation to ODS phase-out



UNIDO factory conversions

- Argentina, China and Jordan – completed;
 - Algeria, China, Saudi Arabia, Syria and Tunisia, – ongoing;
 - Brazil, China and Pakistan – start in 1-2 years;
 - China, Egypt and Nigeria – pipeline 2018-2020.
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- Technology transfer required





FINDINGS – A/C MANUFACTURING

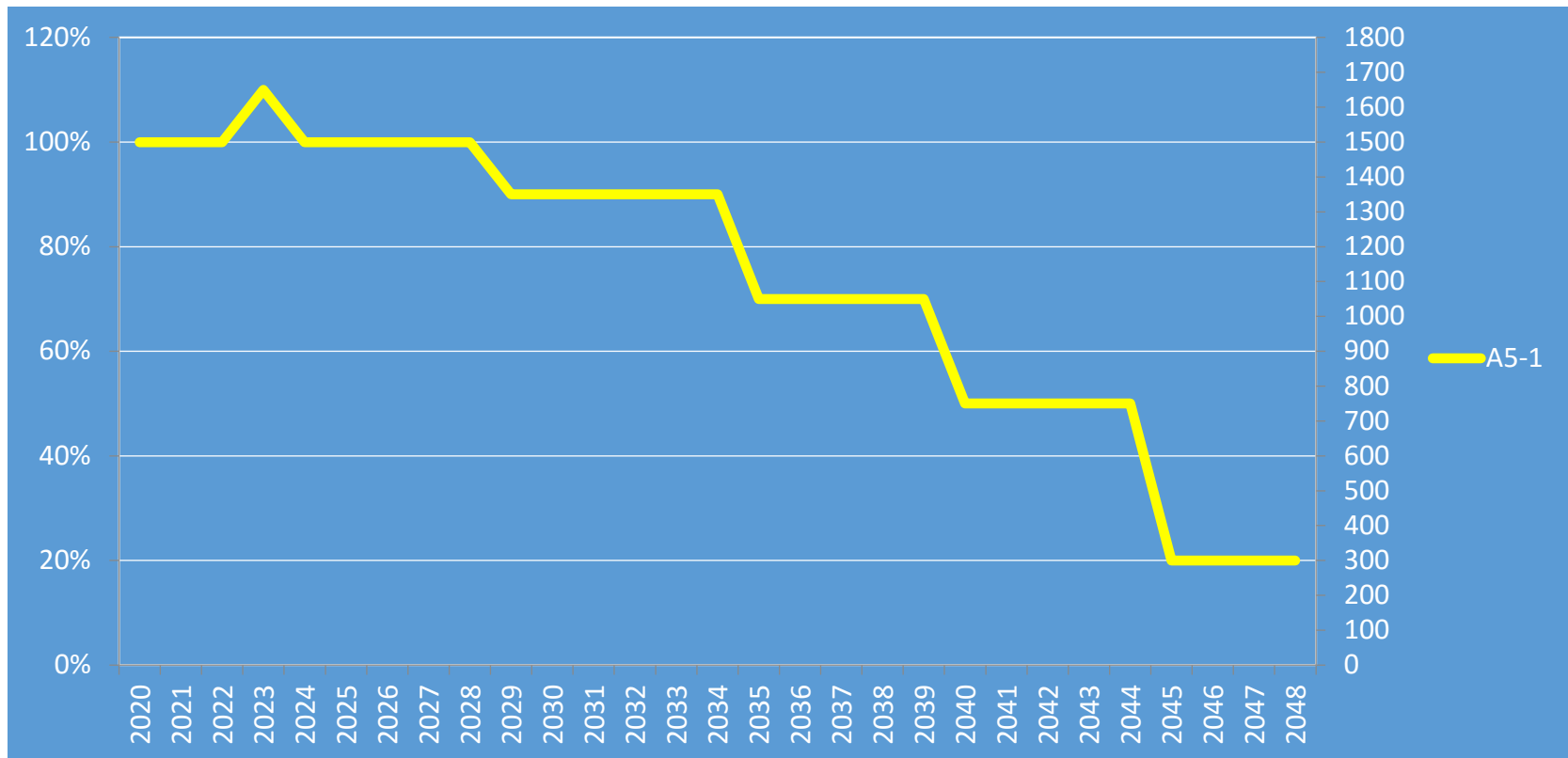
- Factory conversions for flammable - relatively unproblematic;
- 3rd party safety verification of full installation (e.g. TÜV);
- Safety concepts may have opportunities for revision;
- Post production requires attention:
 - Installation, maintenance and de-commissioning;
 - Applicable safety standards.



28th MOP in Kigali



HFC phase-down schedule: A5-1





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Thank you for your attention

