Experience Sharing from Egypt Energy Efficiency Projects

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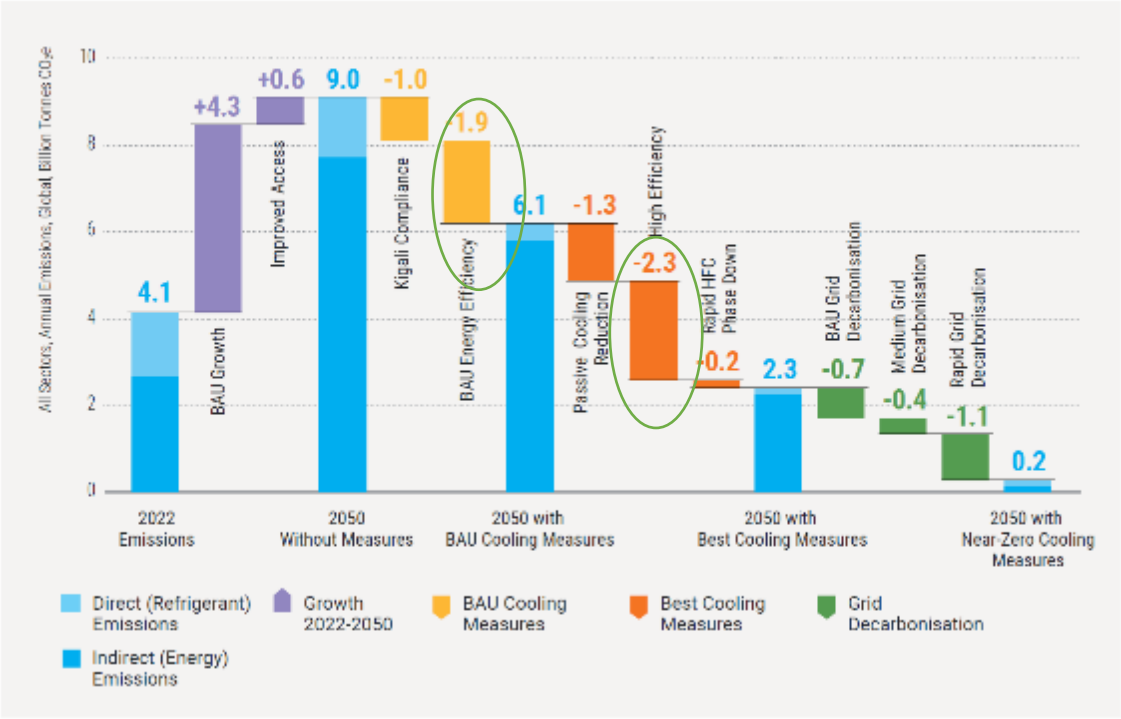
Why enhancing EE is equally important with HFCs phase down for KA

- Through legally binding national targets and timelines, the Kigali Amendment aligns with the goals of the Paris Agreement, aiming to prevent a global temperature rise of up to 0.5°C by 2100.
- Refrigerants emissions (direct emission) account for 36%. While indirect emissions contribute to 64%.
- By 2050, the improvement of EE could potentially contribute to 47% GHG reduction in the cooling sector

Figure ES-1: Global pathway and key steps to achieve near-zero GHG emissions from cooling, 2022-2050



Financial opportunities for enhancing EE provided by MLF

Three Funding Windows

Decision 91/65 | Dec 2022

- $20 million for EE pilot project

Decision 94/60 | May 2024

- $100 million for EE incentive project

Decision 95/87 | Dec 2024

- $40 million for EE Revolving Fund for end-user
- Expand the scope of $100 million to support manufacturers of compressor, heat exchanger, and heat pump

Decision 91/65

Pilot projects on energy efficiency available to all

- For all countries and projects in the context of HFC phase-down
- Country commitments on certain aspects needed for project consideration
- Institutional coordination of NOU with energy efficiency authorities ensuring no duplication of funds with other projects
- For consideration up to 100th ExCom (servicing)
- 20M USD funding window
- Three years from time of approval

Decision 94/60
Operational framework for energy efficiency while phasing down HFCs

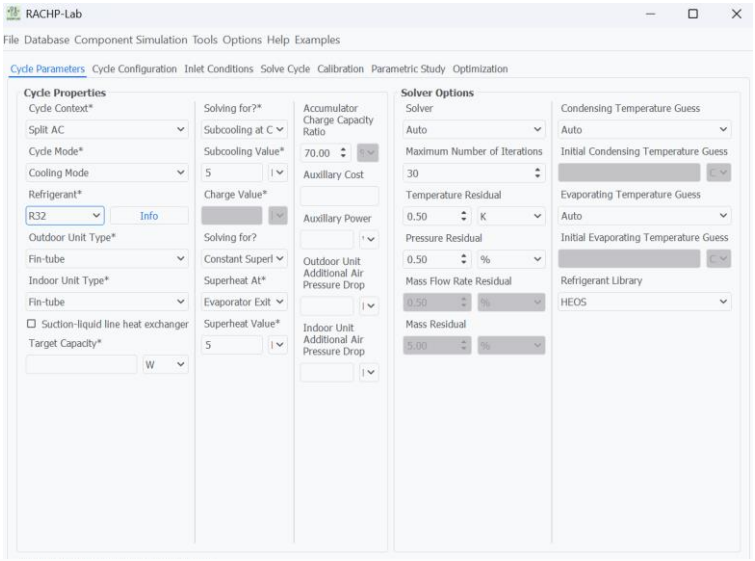
- Enhancing energy efficiency when phasing down HFCs in the manufacturing of:
  1. Domestic refrigerators
  2. Commercial refrigeration display cabinets
  3. Commercial refrigeration chest freezers
  4. Residential air conditioners
  5. Commercial air conditioners
- Investment projects submitted under decision 91/65
- Includes country commitments and enterprise commitments
- 100M USD funding window
- Three years from time of approval
- Two years monitoring period from the date of completion of the project

Decision 95/87
Further elaboration on the operational framework on energy efficiency while phasing down HFCs

- Includes manufacturing activities for compressors, heat exchangers and heat-pumps
- Duration of decision 91/65 extended to 100th meeting – only for servicing activities
- 40M Funding window for two energy-efficiency end-user projects using a revolving fund mechanism with eight years implementation period

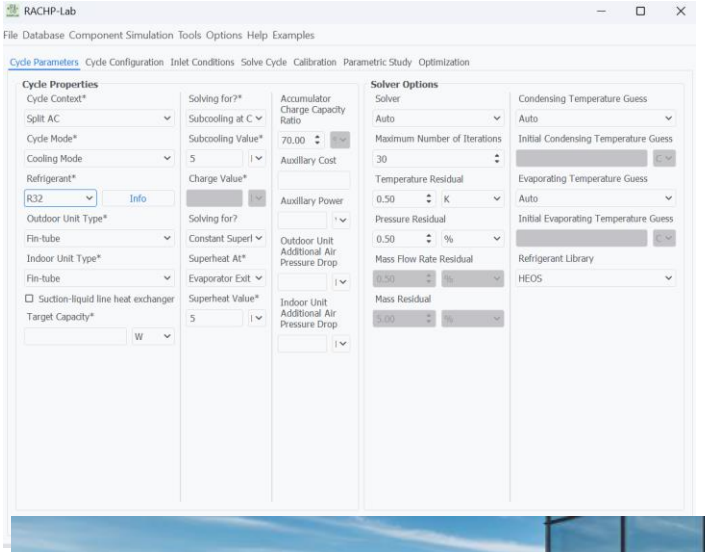
Technical options to improv EE for Residential Air Conditioners

- Compressors
  - Higher efficiency compressors
  - Two-stage compressors (60/100)
  - Variable speed compressors
- Heat exchangers
  - 5 mm coils
  - MCHX
  - Condenser precooling (sling fan)
- Expansion valve (Replace capillary/short tube with)
  - TXV
  - EXV
- Fans/motors
- Improved controls (IoT, Predictive Controls + Maintenance)



Commercial Air Conditioners (RTU)

- Compressors
  - Dual compressors
  - Include 1 variable speed compressor
- Heat exchangers
  - 5 mm coils
  - MCHX
  - Condenser precooling
- Expansion valve (Replace capillary/short tube with)
  - TXV
  - EXV
- Design features: economizer
- Fans/motors
- Improved controls (IoT, Predictive Controls + Maintenance)



How to calculate EE?

- Refrigerators/Freezers and SCCR ➔ reduced kWh/year
- AC ➔ increased SEER
- During the project design stage,
  - use modeling tools to evaluate the performance of the baseline and develop the MEPS values (kWh/year or SEER)
  - Develop different design options with interventions (e.g., using variable speed compressor, new fan, larger HX, etc.) and evaluate the impact on EE (kWh/year or SEER)
  - Develop a cost – benefit curve

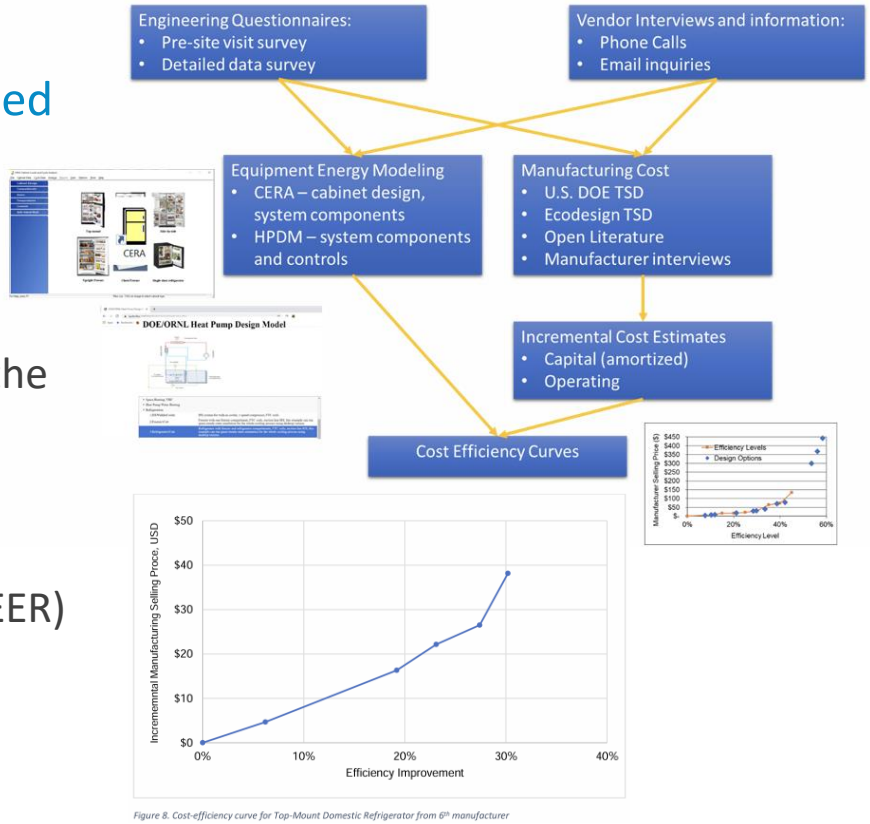


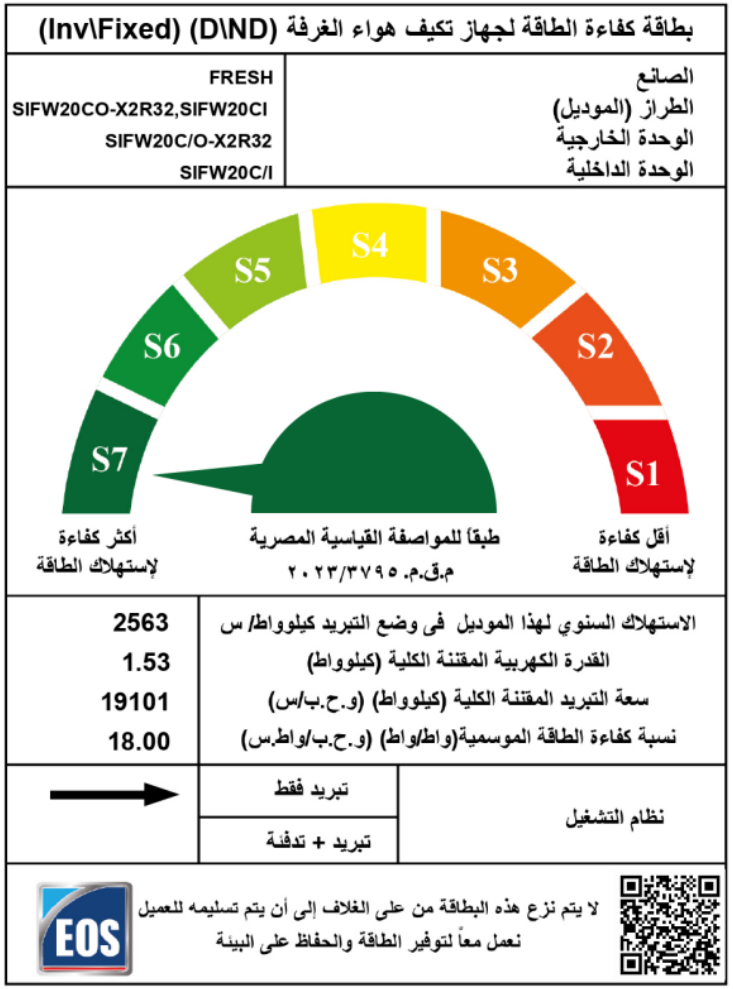
Figure 8. Cost-efficiency curve for Top-Mount Domestic Refrigerator from 6th manufacturer

Detailed information of the EE projects in Egypt

Sector	Domestic Refrigerators	Chest Freezers	Residential AC	Total
Number of Manufacturing Facilities	11	6	11	28
Improve EE	Reduce kWh/yr/l from 1.464 to 1.051 30.0%	Reduce kWh/yr/l from 1.825 to 1.286 28.3%	Improve average SEER from 10.38 to 14.13 31.3%	-
Annual Indirect Emissions Reduction, CO_2e tonnes/year	121,772	51,624	447,162	620,558
Annual direct Emissions Reduction, CO_2e tonnes/year	245,876	88,405	192,255	526,536
Total direct & indirect emission reduction CO2e tonnes/year	367,648	140,029	639,417	1,147,094
Total Additional Capital Cost, US$	2,650,000	900,000	1,427,550	5,576,750
Total Additional Component Incentive, US$	1,950,330	1,195,166	7,591,235	8,182,068
Total EE Incentive, US$	4,600,330	2,095,166	9,018,785	15,714,281
Project average cost US$/$CO_2e$ tonnes/year	12.5	15.0	14.1	13.7

Integtrated strategy to improve EE in AC in Egypt

Activities	Changes needed for improving EE
Additional investment cost (up to USD 250,000)	Product design and development • Tools to support industries in designing new prototype. Manufacturing facility modification • Tooling for compressor housing, • Crankcase, crankshaft, and piton, • Cylinder head and suction Prototype manufacturing and testing • Manufacturing of a prototype for a small run • Compressor calorimetry test • Laboratory setup for high efficiency compressor and certification
Additional component cost (SEER compared to MEPS level)	• Compressor • Heat exchanger • Electronically commutated motors (ECM) • Others
MEPS	• SEER for RAC Equipment According to ES3795-2023 • 10>SEER≥9 (Btu/Wh) • Will be updated in 2027 and 2030 • 11>SEER≥10 (Btu/Wh)



Impacts of the MP projects in Egypt

Activities	Changes needed for improving EE
Environmental and climate benefits	• HCFC reduction: 484.61 ODP tonnes • HFCs reduction: 15,422,311CO_2eq tonnes • GHG reduction: 1,147,094 CO_2eq tonnes per year • Improved chemical and wate management: RRR
Economic benefits	• Improved Industrial competitiveness through technology upgrades and access to export market ○ 17 foam manufacturing companies ○ 11 residential AC manufacturing companies ○ 9 Domestic refrigerator manufacturing companies ○ 5 freezer manufacturing companies ○ 1 compressor manufacture company • Lower electricity cost through enhance energy efficiency
Social benefits	• Job creation and skills development (8,000 technicians and custom officers) • Empower female CEO and technicians in RAC sector • Better thermal comfort, health, and resilience

Thank you for your attention!