Indonesia Refrigerator Market Study and Policy Analysis

Final Report

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CLASP
Environmental Design Solutions

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Contents

List of Tables

List of Figures

List of Abbreviations

APEC	Asia Pacific Economic Cooperation
B2B	Business-to-business
BAU	Business-as-usual
BSN	Badan Standardisasi Nasional Indonesia National Standardization Agency
CAGR	Compounded Annual Growth Rate
CO_2	Carbon Dioxide
EBTKE	Direktorat Jenderal Energi Baru, Terbarukan, dan Konservasi Energi Directorate General of New Renewable Energy and Energy Conservation
EDS	Environmental Design Solutions Pvt. Ltd.
EE	Energy Efficiency
EU	European Union
GABEL	Gabungan Perusahaan Industri Elektronik dan Alat-alat Listrik Rumah Tangga Indonesia Association of Indonesian Electronics and Electrical Equipment Industry Companies
GDP	Gross Domestic Product
GHG	Greenhouse Gases
HPMP	Hydrofluorocarbons Phase-out Management Plan
HS	Harmonized (Commodity Description and Coding) System
Hz	Hertz
IDR, Rp	Indonesian Rupiah
IEC	International Electrotechnical Commission
INSW	Indonesia National Single Window (Trade Statistics)
ISO	International Organization for Standardization
KAN	Komite Akreditasi Nasional Indonesian National Accreditation Committee
KESDM	Kementrian Energy dan Sumber Daya Mineral (also MEMR)
kWh	Kilowatt-hour
LSPro	Lembaga Sertifikasi Produk / Product Certification Body
MBOE	Million Barrels of Oil Equivalent
MEMR	Ministry of Energy and Mineral Resources of the Republic of Indonesia (also KESDM)
MEPS	Minimum Energy Performance Standard (also SKEM)
Mt	Megatonne
NDC	Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
PLN	Perusahaan Listrik Negara Indonesia State-owned Electric Company
SASO	Saudi Arabian Standard Organization
SKEM	Standar Kinerja Energi Minimum (also MEPS)
SNI	Standar Nasional Indonesia Indonesian National Standard
TWh	Terawatt-hour
USD	United States Dollar

Executive Summary

Indonesia is the 4th largest country in the world, with over 265 million people in 2018.[1] Gross domestic product (GDP) has been growing by around 5% annually over the past decade,[2] while per-capita income has been concurrently growing by almost 4% annually.[3] The country's steady economic growth has contributed to a doubling in electricity consumption, from 129 TWh in 2008 to 256 TWh in 2018.

The residential sector is the primary electricity user, responsible for nearly 40% of consumption, followed by industrial (37%), commercial (23%), and transportation (0.11%).[4] Coal is the main fuel in electricity generation, responsible for 58% of primary energy consumed, followed by natural gas (27%), renewables (hydro, geothermal, solar, and wind; 8%) and oil (6%).[5]

Under the Paris Agreement, Indonesia committed to reducing greenhouse gas (GHG) emissions by 29% below a business-as-usual (BAU) baseline by 2030, or by 38% below BAU by 2030 with international support. Reaching these unconditional and conditional targets, will require reductions in energy consumption of 19% and 24% below BAU.[6]

The Ministry of Energy and Mineral Resources (MEMR or KESDM), through its Directorate General of New Renewable Energy and Energy Conservation (EBTKE), aims to reduce national energy consumption across all sectors by 17% in 2025 relative to BAU through various policies,[7] including energy efficiency standards and labeling for household electric appliances. Energy efficiency regulations for air conditioners and compact fluorescent lamps are already in place, and MEMR plans to issue additional Ministerial Regulations this year to further reduce household energy consumption.

As the leading international voice and resource for appliance efficiency policies and market acceleration initiatives, CLASP, together with partners Environmental Design Solutions, Market Xcel, and ASHA, conducted a comprehensive study of electric fans in Indonesia. The goal of the study was to characterize the market; inform the development of appropriate and robust fans testing, standards, and labeling requirements; and assess the potential impacts of these energy efficiency policies.

The team contacted over 8 manufacturers and importers, received data and inputs from the trade association GABEL and six major manufacturers responsible for 48% of the market, and visited 13 retail stores around Jakarta. The team also collected government data, reviewed past studies, reviewed manufacturers' websites, and incorporated the findings of CLASP's forthcoming 5000-household, nationwide residential end-use survey. Finally, the team developed policy recommendations and analyzed them using CLASP's Policy Analysis Modeling System (PAMS).

The key findings, summarized below, will inform EBTKE of the opportunity for ambitious energy efficiency policies for fans that save money and reduce energy and CO_2 while taking into account the current range of products on the market.

[1] MEMR, Handbook of Energy & Economic Statistics of Indonesia, 2018, p. 3.
[2] GDP Growth (annual %) - Indonesia. (n.d.). World Bank Open Data | Data. https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2018&locations=ID&start=1961&view=chart
[3] Indonesia Economic Snapshot. http://www.oecd.org/economy/indonesia-economic-snapshot/
[4] MEMR, Handbook of Energy & Economic Statistics of Indonesia, 2018, pp. 41-53.
[5] Statistics Report 2018. PLN. https://www.pln.co.id/stakeholder/laporan-statistik
[6] Government of Indonesia, First Nationally Determined Contribution Republic of Indonesia, November 2016, p.10.
[7] President of Indonesia, Presidential Regulation Number 22 of 2017 about National Energy General Plan (RUEN), p. 30.

Key Findings in the Market Study

As the largest growing economy in Southeast Asia, demands for refrigerators and other home appliances in Indonesia are expected to continue to grow in the coming years, given the increasing number of households at a CAGR of 1.2%, and consumer expenditure increase at 3% CAGR.[8,9] There were approximately 2.48 million refrigerator sales in 2018 and the installed residential stock in the country as of 2019 is estimated to be around 47 million units.[10]

Despite household, income, and GDP growth in Indonesia, the sales of refrigerators have been declining over the past five years, as shown in Figure 1. Meanwhile, nationwide surveys conducted by the Indonesia Statistics Bureau BPS have found *increasing* household ownership, rising by 3 percentage points per year from 48% in 2015 to 57% in 2018.[11] This increase in the ownership rate of refrigerators is consistent with CLASP's experience in other developing countries with high electrification rate and population and income growth: as people grow richer, a refrigerator is one of the first appliances they buy.

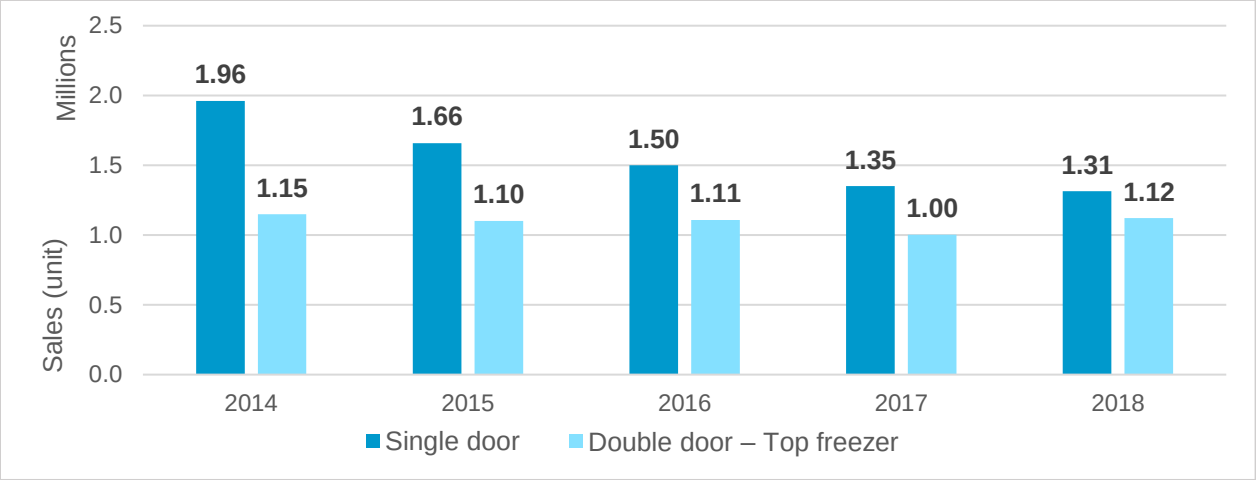

Figure 1: Sales of single and double-door with top-freezer refrigerator[12]

One potential explanation for these two conflicting findings is that the lifetime of refrigerators in Indonesia is increasing.[13] While shipments may grow slowly, as households keep refrigerators in service longer than their 10-year average lifetime, the stock will grow at a higher rate. The team modeled this increase in stock through a 5% sales growth scenario (Figure 2), which results in approximately 2 percentage point increases in household ownership through 2030 when the stock would be 70.7 million units (compared to 74.8 million households; Figure 3).

[8] Euromonitor, Indonesia fact file; https://www.euromonitor.com/indonesia/country-factfile

[9] Statista, Indonesia household appliances; https://www.statista.com/outlook/256/120/household-appliances/indonesia

[10] CLASP 5,000-Household Residential End-use Survey.

[11] BPS, Survei Sosial Ekonomi Nasional (SUSENAS), 2015–2018..

[12] Other types of refrigerators constitute less than 2% of sales.

[13] A similar effect is occurring in the lighting market, where the introduction of longer-lived light-emitting diode (LED) lamps is causing sales to plummet even while the installed stock is rising.

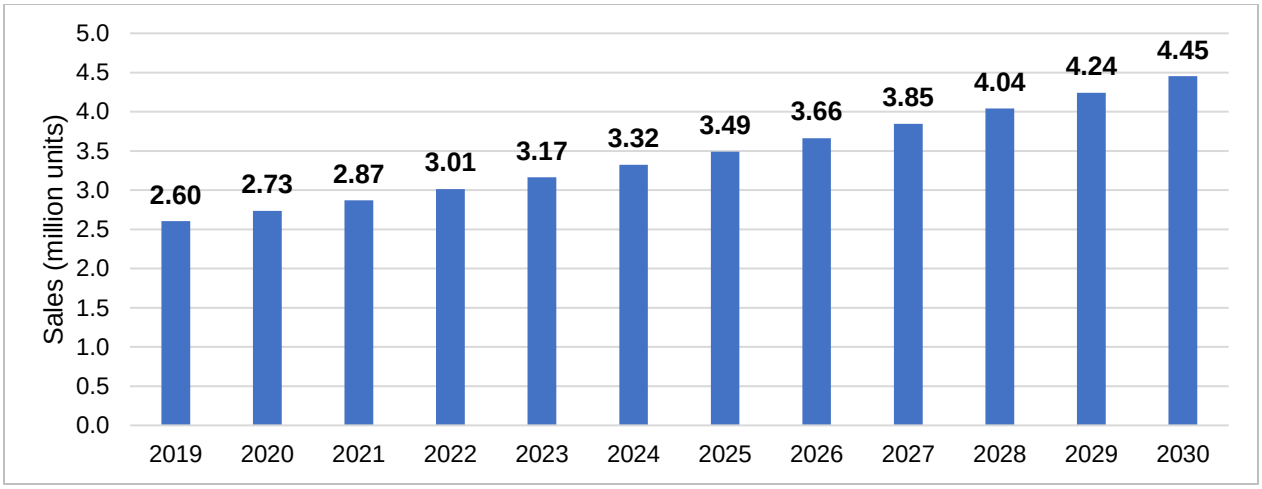

Figure 2: Refrigerator sales forecast, under a compound annual growth rate (CAGR) of 5%

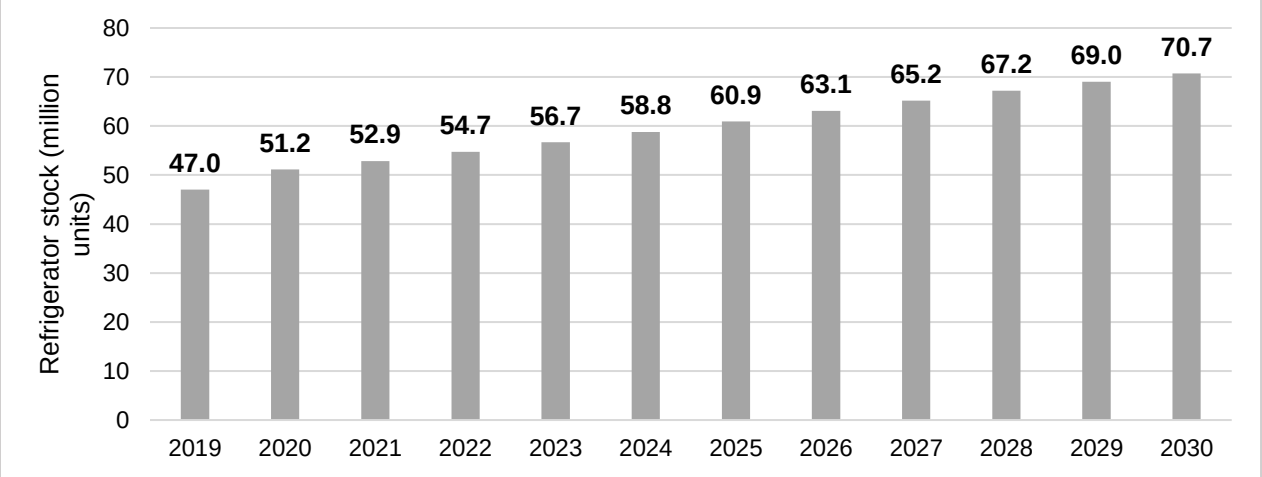

Figure 3: Refrigerator stock forecast, taking into account new sales and retirements

The overwhelming majority of refrigerators sold in Indonesia are single and double door. The sales of double-door, top-freezer and larger refrigerators are increasing, albeit from a miniscule base. Over 70% of refrigerators had less than 200 L gross volume. Over three quarters of refrigerators use R-134a refrigerant, which has a large environmental impact with a global warming potential of 1300,[14] while the remainder use R-600a refrigerant, with a significantly lower global warming potential of 3.

205,000 units were imported in 2018, or 8.7% of the annual sales. Imports from China and Thailand combined account for more than 80% of the total. Meanwhile, 841,000 units were exported, or over four times the imports, and 35% of annual sales.

Refrigerators from Indonesia have been exported to nearly 130 countries over the last five years. The Republic of Korea, Philippines, Japan, Vietnam, Egypt, Malaysia, Thailand, Saudi Arabia, Australia and Peru are the top ten export destinations (based on volume), accounting for more than 60% of the total.

[14] 1300 times more potent than carbon dioxide over 100 years.

Korea, Philippines, and Japan have energy efficiency standards, indicating that refrigerator manufacturing facilities in Indonesia are capable of manufacturing energy efficient refrigerators that meet global standards.

Policy Options, Recommendations, and Impact Assessment

EBTKE had drafted an energy efficiency regulation for refrigerators in 2018. This draft regulation references SNI ISO 15502:2008 test standard, which has been superseded by the recently adopted SNI 8557-1:2018, SNI IEC 62552-2:2016, and SNI 8557-3:2018 test standards. These are based on the latest international test standard, IEC 62552:2015. While test laboratories are not yet accredited to the new test standards, they have the capabilities and the capacity to test refrigerator models to them. CLASP recommends referencing these latest standards.

CLASP analyzed the energy performance of 34 refrigerator models from four popular brands. The energy consumption of all 34 models qualified for a 4-star rating (the highest performance category in the draft regulation). In contrast, CLASP recommends requirements that more effectively recognize the most efficient models in the market while excluding the least efficient 35% of models. Although some local models would be excluded, the majority would continue to meet the standard, reducing energy consumption while benefiting consumers through lifecycle savings.

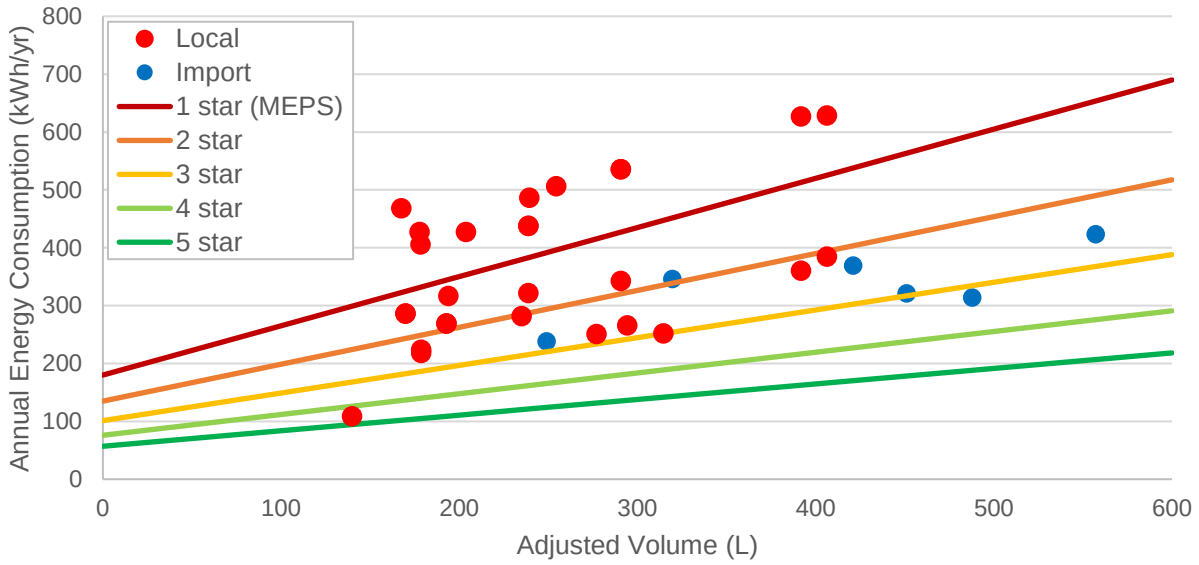

Figure 4: CLASP recommended MEPS and labeling criteria compared to model performance.

Table 1. Summary of national impacts from policies under consideration

	Final Energy Savings (TWh)		CO_2 Mitigation (Mt)	
	2020-2030	Annual in 2030	2020-2030	Annual in 2030
EBTKE Draft MEPS	0	0	0	0
Recommended CLASP MEPS	4.4	0.8	3.9	0.7

CLASP presented the preliminary findings of this market study to a wide audience in a National Workshop in Jakarta held on November 20, 2019, to validate the results. On January 29, 2020, EBTKE held a Focus Group Discussion (FGD) and invited CLASP to present these recommendations to a smaller group of key stakeholders, namely major manufacturers, approved testing facilities, government research laboratories,

and technical experts. The stakeholders could voice their opinions, provide inputs, and state possible concerns regarding CLASP's recommendations.

During the January FGD, EBTKE and stakeholders agreed on CLASP's recommended reference test standards: SNI 8557-1:2018, SNI IEC 62552-2:2016, and SNI 8557-3:2018, which are aligned IEC 62552:2015. The stakeholders also agreed to include a wider range of refrigerators within the scope of the regulation: up to 600 L gross volume. While still larger refrigerators exist in the market, there were concerns that these would be difficult to fit through the doors of current test chambers.

However, CLASP's recommended requirements were considered too stringent and hence the MEPS requirements were revised to be 90 kWh/year higher than the proposed values. FGD attendees considered this new MEPS level more closely aligned those of ASEAN members Singapore, Malaysia, and Vietnam. The comparative labeling criteria were increased proportionally. The agreed levels are presented in Figure 5. EBTKE is currently incorporating these requirements into the draft regulation.

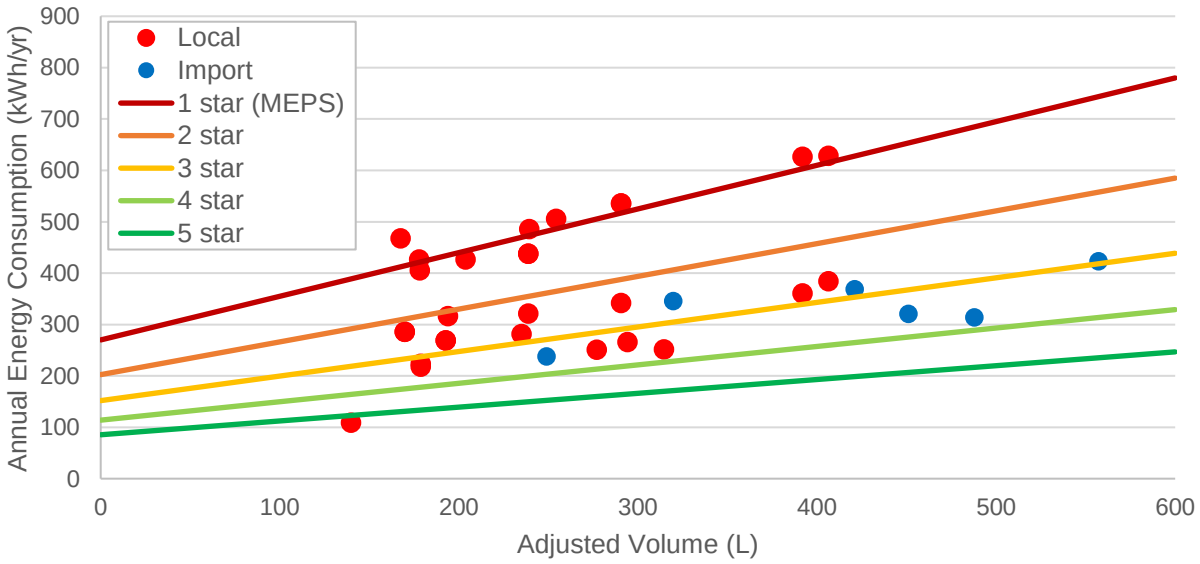

Figure 5: MEPS and comparative labeling requirements agreed on during the Focus Group Discussion on January 29th, 2020

As these levels would result in higher pass rates for refrigerators with lower efficiency rates, the national level impacts would be much lower than the initial estimates. Under CLASP's recommended levels, GHG emissions mitigation of at least 4.4 MtCO2 from 2020 to 2030 and 0.8 MtCO2 in 2030 would be achieved. However, under these agreed levels, the mitigated emissions would be reduced to 1.1 MtCO2 from 2020 to 2030 and 0.1 MtCO2 in 2030.

Nonetheless, the introduction of refrigerator policy in Indonesia would be beneficial by eliminating the least efficient products from the market and increasing consumers' awareness of energy consumption of refrigerators, an appliance that operate continuously for 24 hours a day. Finally, policy will lead to data collection, which will make it possible to establish more ambitious requirements in a future revision, ensuring energy conservation targets are achieved at the national level while bringing further monetary benefits to households.

Ringkasan Eksekutif

Indonesia adalah negara ke 4 terbesar di dunia, dengan lebih dari 265 juta jiwa pada tahun 2018.[15] Produk Domestik Bruto (PDB) telah tumbuh sekitar 5% per tahun selama dekade terakhir,[16] sementara pendapatan per kapita telah secara bersamaan tumbuh hampir 4% per tahun.[17] Pertumbuhan ekonomi yang stabil di Indonesia telah berkontribusi menaikkan konsumsi listrik sebanyak dua kali lipat, dari 129 TWh pada tahun 2008 menjadi 256 TWh pada tahun 2018.

Sektor perumahan adalah pengguna listrik yang utama, menyumbang hampir 40% dari konsumsi, diikuti oleh industri (37%), komersial (23%), dan transportasi (0,11%).[18] Batubara adalah bahan bakar utama dalam pembangkit listrik, yang tercatat sebanyak 58% dari energi primer yang dikonsumsi, diikuti oleh gas alam (27%), energi terbarukan (air, panas bumi, tenaga surya, dan angin; 8%) dan minyak bumi (6%).[19]

Berdasarkan Perjanjian Paris, Indonesia berkomitmen untuk mengurangi emisi gas rumah kaca (GRK) sebesar 29% di bawah *baseline* Bisnis-Seperti-Biasa (BSB) di tahun 2030, atau 38% di bawah BSB dengan dukungan internasional. Mencapai target tanpa syarat dan bersyarat ini, akan memerlukan pengurangan konsumsi energi 19% dan 24% di bawah BSB.[20]

Kementerian Energi dan Sumber Daya Mineral (KESDM), melalui Direktorat Jenderal Energi Baru Terbarukan dan Konservasi Energi (EBTKE), bertujuan untuk mengurangi konsumsi energi nasional di semua sektor sebesar 17% pada tahun 2025 dibandingkan dengan kondisi BSB melalui berbagai kebijakan,[21] termasuk kebijakan efisiensi energi untuk peralatan listrik umum rumah tangga. Peraturan efisiensi energi untuk AC dan lampu neon ringkas (*Compact Fluorescent Lamp*, CFL) sudah berjalan, dan KESDM berencana untuk mengeluarkan Peraturan Menteri tambahan pada tahun ini untuk mengurangi konsumsi energi rumah tangga lebih lanjut.

Sebagai perwakilan suara dan sumber daya internasional terkemuka untuk kebijakan efisiensi alat dan inisiatif perkembangan pasar, CLASP, bersama dengan mitranya Environmental Design Solutions, Market Xcel, dan ASHA, telah melakukan studi komprehensif kulkas di Indonesia. Tujuan dari penelitian ini adalah untuk mengkarakterisasi pasar; menginformasikan perkembangan uji kulkas, standar, dan persyaratan pelabelan yang tepat dan kuat, serta menilai potensi dampak kebijakan efisiensi energi ini.

Tim menghubungi lebih dari 8 produsen dan importir, menerima data dan masukan dari asosiasi perdagangan GABEL dan enam produsen besar yang mengendalikan 48% dari pasar, dan mengunjungi 13 toko ritel di sekitar Jakarta. Tim juga mengumpulkan data pemerintah, meninjau kembali studi sebelumnya, mengulas informasi dari produsen, dan memasukkan temuan survei nasional yang dilakukan oleh CLASP tentang penggunaan akhir pada konsumsi energi rumah tangga yang meliputi 5000-rumah tangga. Akhirnya, tim mengembangkan rekomendasi kebijakan dan melakukan analisis dengan menggunakan Sistem Pemodelan Analisis Kebijakan (PAMS) dari CLASP.

Temuan utama yang dirangkum di bawah ini akan memberikan informasi kepada EBTKE tentang kesempatan dalam kebijakan efisiensi energi yang kuat untuk kulkas, yang dapat memberikan penghematan uang, mengurangi konsumsi energi serta CO_2, sambil memperhitungkan kisaran produk saat ini di pasar.

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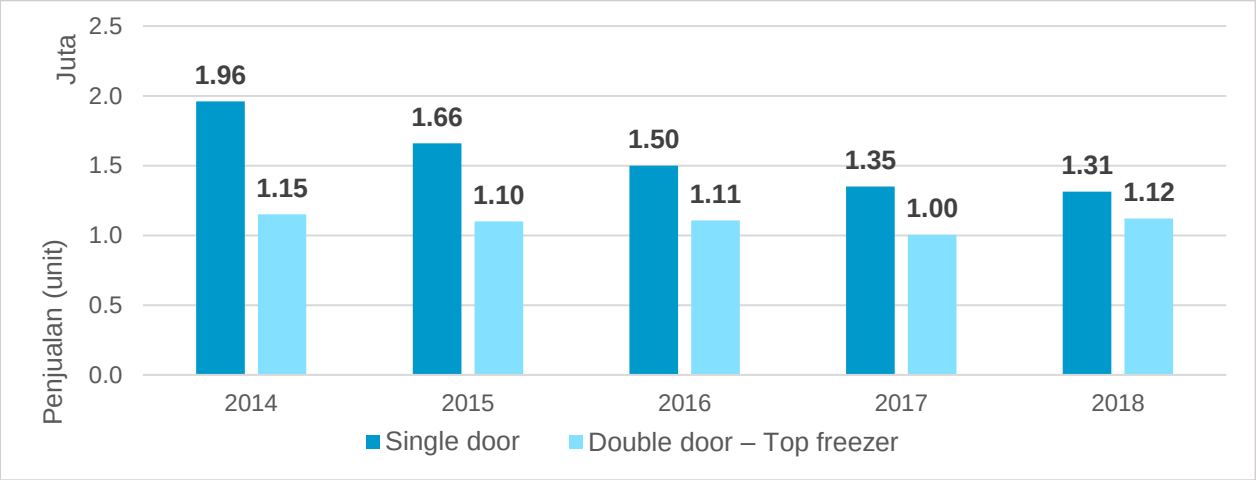
[15] KESDM, Buku Pegangan Statistik Energi & Ekonomi Indonesia, 2018, p. 3.
[16] Pertumbuhan PDB (tahunan %) - Indonesia. (n.d.). Data Terbuka Bank Dunia | Data. https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2018&locations=ID&start=1961&view=chart
[17] Cuplikan Ekonomi Indonesia. http://www.oecd.org/economy/indonesia-economic-snapshot/
[18] KESDM, Buku Pegangan Statistik Energi & Ekonomi Indonesia, 2018, pp. 41-53.
[19] Laporan Statistik 2018. PLN. https://www.pln.co.id/stakeholder/laporan-statistik
[20] Pemerintah Indonesia, Kontribusi Republik Indonesia yang Pertama Ditentukan Secara Nasional , November 2016, p.10.
[21] Presiden Indonesia, Peraturan Presiden Nomor 22 tahun 2017 tentang Rencana Umum Energi Nasional (RUEN), p. 30.

Temuan Utama dalam Studi Pasar

Sebagai negara dengan pertumbuhan ekonomi terbesar di Asia Tenggara, permintaan untuk kulkas dan alat rumah lain di Indonesia diperkirakan akan terus tumbuh di tahun-tahun mendatang, mengingat meningkatnya jumlah rumah tangga sebesar CAGR 1,2%, dan peningkatan pengeluaran konsumen di CAGR 3% .[22.23] Ada sekitar 2,48 juta penjualan kulkas tahun 2018 dan populasi peralatan tersebut yang terpasang di rumah tangga di Indonesia pada tahun 2019 diperkirakan sekitar 47 juta unit.[24]

Meskipun adanya pertumbuhan rumah tangga, pendapatan, dan PDB di Indonesia, penjualan kulkas telah menurun selama lima tahun terakhir, seperti yang ditunjukkan pada Gambar 6. Sementara itu, survei nasional yang dilakukan oleh Biro Pusat Statistik (BPS) Indonesia telah menemukan meningkatnya kepemilikan rumah tangga yang naik sebesar 3 persen per tahun dari 48% pada tahun 2015 menjadi 57% pada tahun 2018.[25] Kenaikan tingkat kepemilikan kulkas ini konsisten dengan pengalaman CLASP di negara-negara berkembang lainnya yang mempunyai tingkat elektrifikasi, pertumbuhan penduduk, dan pendapatan yang tinggi: ketika tingkat kesejahteraan rakyat bertambah, kulkas adalah salah satu alat rumah tangga pertama yang dibeli.



Gambar 6: Penjualan kulkas satu-pintu dan dan dua-pintu dengan freezer-atas[26]

Salah satu pertimbangan yang dapat menjelaskan dua temuan yang bertentangan ini adalah umur pakai kulkas di Indonesia yang semakin meningkat.[27] Walaupun penjualan kulkas bertambah secara perlahan dikarenakan oleh pemakaian kulkas yang lebih dari rata-rata 10 tahun, jumlah populasi kulkas yang digunakan di rumah tangga akan berkembang di tingkat yang lebih tinggi. Dari pertimbangan ini, tim membuat model peningkatan penjualan and stok kulkas dengan skenario 5% pertumbuhan penjualan (Gambar 7). Model ini menghasilkan sekitar 2% peningkatan kepemilikan kulkas di rumah tangga secara nasional pada tahun 2030, dimana estimasi jumlah stok kulkas akan menjadi 70,7 juta unit (untuk perbandingan dengan 74,8 juta rumah tangga; Gambar 8).

[22] Euromonitor, File Fakta Indonesia; https://www.euromonitor.com/indonesia/country-factfile

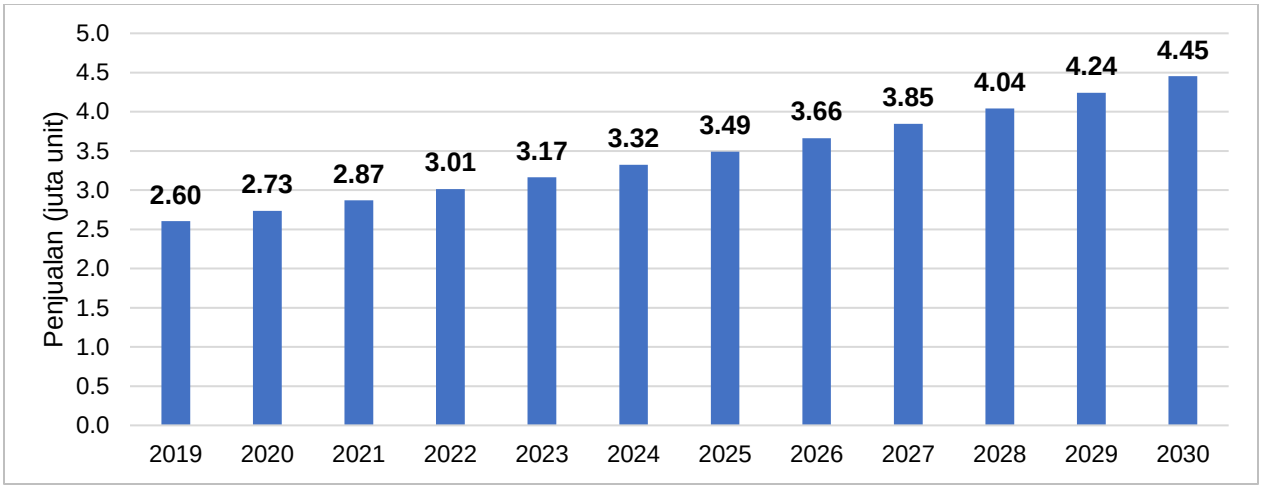
[23] Statista, alat rumah tangga Indonesia; https://www.statista.com/outlook/256/120/household-appliances/indonesia

[24] CLASP, Survei Nasional Penggunaan Akhir Perumahan Indonesia 5000-Rumah tangga, yang akan datang.

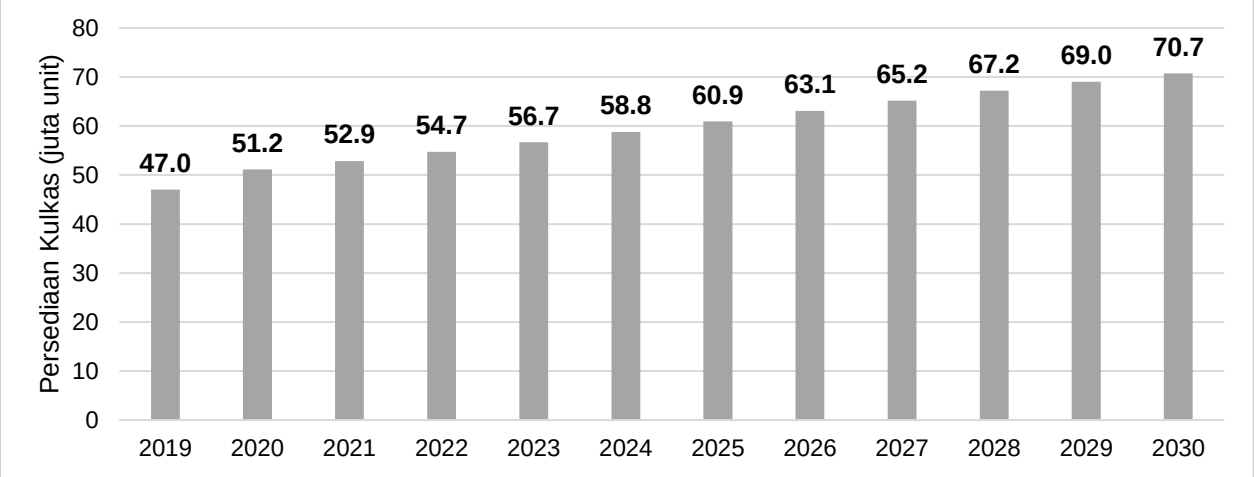
[25] BPS, Survei Sosial Ekonomi Nasional (SUSENAS), 2015–2018.

[26] Kulkas jenis lainnya membentuk kurang dari 2% penjualan.

[27] Efek serupa terjadi di pasar pencahayaan, di mana pengenalan lampu dioda pemancar cahaya (LED) yang lebih lama menyebabkan penjualan menurun drastis bahkan ketika persediaan terpasang meningkat.



Gambar 7: Perkiraan penjualan kulkas, dalam laju pertumbuhan tahunan majemuk (CAGR) 5%



Gambar 8: Perkiraan persediaan kulkas, dengan mempertimbangkan penjualan kulkas baru dan pengakhiran pemakaian

Mayoritas kulkas yang dijual di Indonesia adalah kulkas dengan tipe satu-pintu dan dua-pintu. Penjualan kulkas dua-pintu dengan kompartemen pembekuan atas, dan kulkas dengan volume yang lebih besar meningkat, meskipun dalam jumlah yang sangat kecil. Lebih dari 70% kulkas memiliki volume kotor yang kurang dari 200 L. Lebih dari tiga perempat kulkas menggunakan refrigeran atau zat pendingin R-134a, yang memiliki dampak lingkungan yang besar dengan potensi pemanasan global (GWP) di angka 1300,[28] sedangkan sisanya menggunakan refrigeran R-600a, dengan GWP yang jauh lebih rendah di angka 3.

Ada 205.000 unit kulkas yang diimpor pada tahun 2018, yang merupakan 8,7% dari penjualan tahunan. Gabungan impor dari China dan Thailand tercatat lebih dari 80% dari jumlah total. Sementara itu, 841.000 unit diekspor, yang berjumlah lebih dari empat kali volume impor, atau 35% dari penjualan tahunan.

Kulkas dari Indonesia telah diekspor ke hampir 130 negara selama lima tahun terakhir. Republik Korea, Filipina, Jepang, Vietnam, Mesir, Malaysia, Thailand, Arab Saudi, Australia dan Peru adalah sepuluh tujuan ekspor terbanyak yang tercatat lebih dari 60% dari jumlah total berdasarkan volume. Korea, Filipina, dan

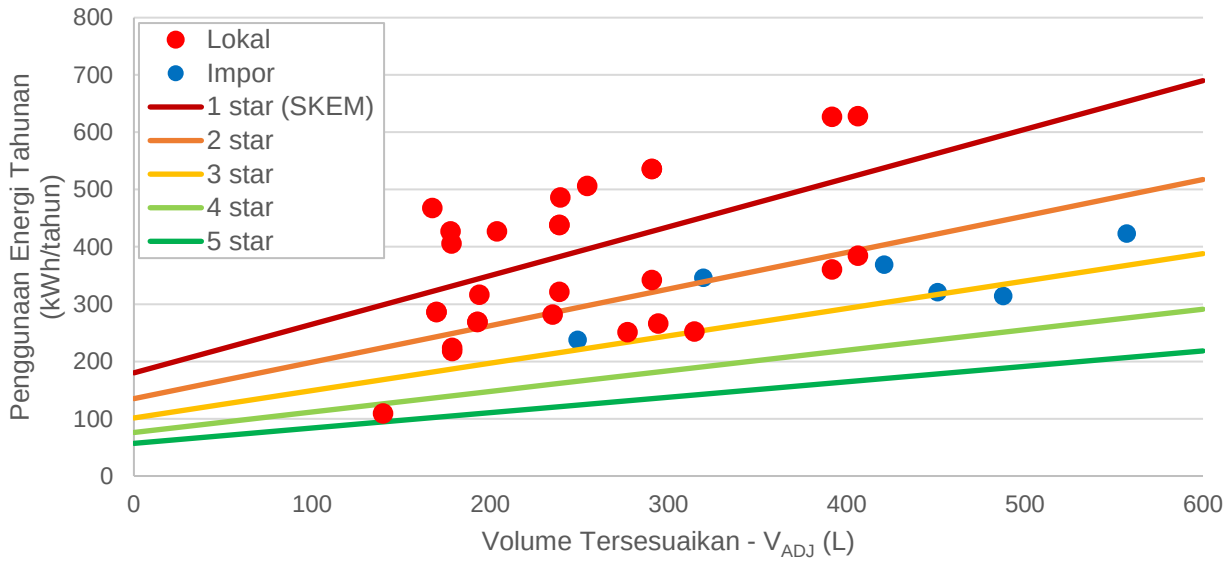
[28] 1300 kali lebih kuat daripada karbon dioksida selama 100 tahun

Jepang termasuk dalam daftar negara yang memiliki standar efisiensi energi untuk kulkas. Hal ini menunjukkan bahwa fasilitas manufaktur kulkas di Indonesia mampu memproduksi kulkas hemat energi yang memenuhi standar global.

Pilihan Kebijakan, Rekomendasi, dan Penilaian Dampak

EBTKE telah menyusun suatu peraturan efisiensi energi untuk kulkas di tahun 2018. Rancangan peraturan ini mengacu ke SNI ISO 15502:2008 standar uji, yang telah digantikan dengan standar uji nasional SNI 8557-1:2018 SNI IEC 62552-2:2016, dan SNI 8557-3:2018 yang baru saja diadopsi. Standar-standar ini didasarkan pada standar uji internasional kulkas yang terbaru, yaitu IEC 62552: 2015. Meskipun mayoritas dari laboratorium uji masih belum terakreditasi dengan standar uji baru, fasilitas pengujian memiliki kemampuan dan kapasitas untuk menguji model kulkas kepada mereka. CLASP merekomendasikan untuk mendasarkan acuan pada standar-standar terbaru ini.

CLASP telah melakukan analisa kinerja energi akan 34 model kulkas dari empat merek populer. Konsumsi energi dari semua 34 model memenuhi persyaratan kinerja energi bintang 4 (yang merupakan kategori kinerja tertinggi dalam rancangan peraturan). Oleh karena ini, CLASP merekomendasikan persyaratan Standar Kinerja Energi Minimum (SKEM) yang lebih efektif dalam memperkenalkan model yang paling efisien di pasar sembari meniadakan 35% model yang paling tidak efisien. Meskipun persyaratan ini akan berdampak terhadap beberapa model dalam negeri, mayoritas dari model lokal akan tetap memenuhi standar. Dengan ini, konsumsi energi dapat dikurangi dan konsumen dapat diuntungkan melalui penghematan siklus hidup.



Gambar 9: SKEM dan kriteria pelabelan yang direkomendasikan CLASP terhadap kinerja model

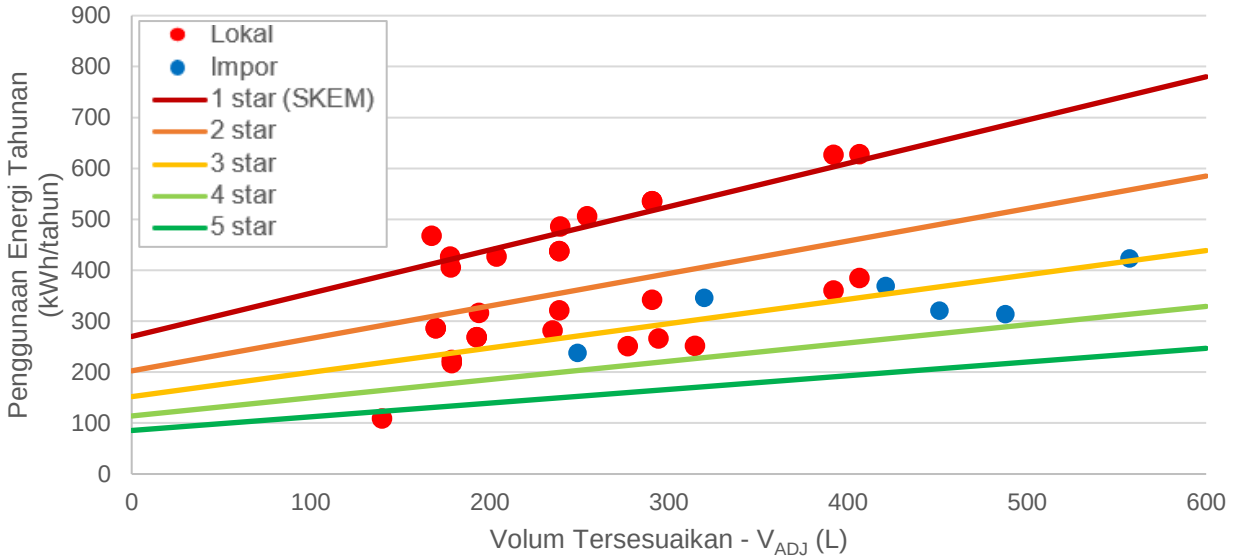
Tabel 2. Ringkasan dampak nasional dari kebijakan yang dipertimbangkan

	Penghematan Energi (TWh)		Mitigasi CO_2 (Mt)	
	2020-2030	Tahunan pada tahun 2030	2020-2030	Tahunan pada tahun 2030
Rancangan peraturan EBTKE	0	0	0	0
Rekomendasi CLASP	4,4	0,8	3,9	0,7

CLASP memaparkan temuan awal dari studi pasar ini kepada khalayak luas dalam Lokakarya Nasional di Jakarta yang diadakan pada tanggal 20 November 2019 untuk memvalidasi hasil. Pada tanggal 29 Januari, 2020, EBTKE menggelar *Focus Group Discussion* (FGD) dan mengundang CLASP untuk menyampaikan rekomendasi ini kepada kelompok pemangku kepentingan utama yang lebih kecil, yaitu produsen besar, fasilitas pengetesan yang diakui, laboratorium penelitian pemerintah, dan para ahli teknis. Pemangku kepentingan bisa menyampaikan pendapat mereka, memberi masukan, dan menyatakan kemungkinan-kemungkinan yang harus diperhatikan terkait rekomendasi CLASP ini.

Selama FGD Januari, EBTKE dan pemangku kepentingan telah bersepakat atas standar pengujian acuan yang direkomendasikan CLASP, yaitu SNI 8557-1:2018, SNI IEC 62552-2:2016, dan SNI 8557-3:2018, yang diselaraskan dengan IEC 62552:2015. Pemangku kepentingan juga bersepakat untuk memasukkan cakupan kulkas yang lebih luas ke dalam lingkup pengaturan, untuk mencakup volume kotor sampai 600 L. Walaupun masih ada kulkas dengan volume lebih besar yang ditemukan di pasar, ada kekhawatiran bahwa kulkas berukuran besar tersebut akan sulit untuk masuk melalui pintu fasilitas ruang uji saat ini.

Namun demikian, persyaratan yang direkomendasikan CLASP dianggap terlalu ketat. Oleh sebab itu, persyaratan SKEM direvisi menjadi 90 kWh/tahun lebih tinggi dari nilai-nilai yang diusulkan. Peserta FGD menganggap tingkat SKEM baru ini lebih selaras dengan anggota ASEAN yaitu Singapura, Malaysia, dan Vietnam. Kriteria pelabelan komparatif juga ditingkatkan secara proporsional. Tingkat kinerja energi yang telah disepakati ini ditampilkan dalam Gambar 10. EBTKE saat ini telah menggabungkan persyaratan tersebut ke dalam rancangan peraturan.



Gambar 10: SKEM dan persyaratan pelabelan komparatif yang disetujui pada Focus Group Discussion tanggal 29 Januari 2020

Karena level tersebut akan menghasilkan tingkat lulus lebih tinggi untuk kulkas dengan tingkat efisiensi yang lebih rendah, dampak nasional diestimasi akan jauh lebih rendah dari perkiraan awal. Dengan tingkat kinerja energi awal yang direkomendasikan CLASP, mitigasi emisi gas rumah kaca minimal 4,4 MtCO2 dari tahun 2020 sampai 2030 dan 0,8 MtCO2 pada tahun 2030 akan tercapai. Namun dengan tingkat yang disepakati ini, emisi yang dimitigasi akan berkurang menjadi 1,1 MtCO2 dari tahun 2020 sampai 2030 dan 0,1 MtCO2 pada tahun 2030.

Meskipun demikian, pengeluaran kebijakan kulkas di Indonesia akan sangat bermanfaat akan peniadaan produk yang paling tidak efisien dari pasar dan peningkatan kesadaran konsumen terhadap konsumsi energi kulkas, sebuah alat yang beroperasi terus menerus selama 24 jam per hari. Akhirnya, kebijakan ini

akan menggiring pengumpulan data kinerja energi, yang akan melancarkan proses formulasi regulasi dan penetapan persyaratan yang lebih kuat dalam revisi peraturan di masa yang akan datang. Dengan ini, KESDM dapat memastikan target konservasi energi bisa tercapai di tingkat nasional sembari membawa manfaat moneter yang lebih besar untuk rumah tangga.

1 Background and Introduction

Indonesia is home to over 265 million people.[29] It is the fourth most populous country in the world and its rapidly expanding economy is the largest in Southeast Asia. GDP per capita has risen by 70% during the past two decades and while the end of the commodity price boom weighed on incomes and government revenues, GDP has continued growing at around 5% per year, while per capita income has grown at almost 4% per year.[30]

The manufacturing sector has played an important role in the country's development and it is positioned to continue as an engine of economic growth for the national economy.[31] The home appliances segment in particular has benefited from increasing investments in the country by multinationals such as LG, Sharp, and Panasonic. According to the Ministry of Trade, Indonesia was home to 235 companies in the electronics and home appliance manufacturing business (including component makers) in 2014.[32] The country has one of the strongest manufacturing sectors in the world, accounting for 20.5% of GDP in 2018.[33] The Asian Development Bank expects Indonesia's GDP growth rate to average around 6% between 2020 and 2024 due to its growing manufacturing sector.[34]

Growth in the manufacturing sector has also been attributed to the change in consumption patterns in the country. The middle-class consumer segment is anticipated to grow from 88 million people in 2014 to 140 million by 2020.[35] Retail sales grew by 3.7% in 2018 and household consumption grew 5.5% in 2018, up from 4.9% the year before.[36]

Economic growth has been accompanied by a rise in energy consumption and greenhouse gas (GHG) emissions. Electricity consumption has doubled over the past decade, from 129 TWh in 2008 to 256 TWh in 2018. The residential sector is the primary electricity user, responsible for nearly 40% of consumption, followed by industrial (37%), commercial (23%), and transportation (0.11%) sectors.[37] Coal is the main fuel in electricity generation, responsible for 58% of primary energy consumed, followed by natural gas (27%), renewables (hydro, geothermal, solar, and wind; 8%) and oil (6%).[38]

Indonesia is the world's 11th highest CO_2 emitter when considering only emissions due to energy.[39] Indonesia's success in achieving its national climate pledges will be critical to keeping the planet's temperature rise below the 2 °C (3.6 °F) threshold called for in the Paris Agreement. Per the Nationally Determined Contributions (NDCs) of Indonesia, energy efficiency is one of the key measures to reduce GHG (greenhouse gas) emissions from the energy sector. In its NDC, Indonesia committed to reducing greenhouse gas (GHG) emissions by 29% against a business-as-usual (BAU) baseline by 2030, or to reach 38% below BAU by 2030 with international support.[40]

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[29] Ministry of Energy and Mineral Resources, Republic of Indonesia, Handbook of Energy & Economic Statistics of Indonesia, 2018
[30] Indonesia Economic Snapshot. http://www.oecd.org/economy/indonesia-economic-snapshot/
[31] The Jakarta Post, Business; https://www.thejakartapost.com/news/2019/02/11/manufacturing-sector-to-drive-indonesias-economy-bappenas.html (accessed on 22 May 2019)
[32] Global Business Guide, Indonesia; http://www.gbgindonesia.com/en/manufacturing/article/2015/electronics_and_home_appliances_manufacturing_in_indonesia_finding_its_edge_11128.php (accessed on 22 May 2019)
[33] The Jakarta Post, Business; https://www.thejakartapost.com/news/2018/12/31/manufacturing-sectors-contribution-to-gdp-above-world-average-minister.html (accessed on 22 May 2019)
[34] The Jakarta Post, https://www.thejakartapost.com/news/2019/02/11/manufacturing-sector-to-drive-indonesias-economy-bappenas.html (accessed on 22 May 2019)
[35] Consumer Durables study by BCG, November 2015
[36] Oxford Business Group; https://oxfordbusinessgroup.com/analysis/loosening-belt-growing-middle-class-boosts-consumer-spending (accessed on 23 May 2019)
[37] Handbook of Energy & Economic Statistics of Indonesia, 2018, pp. 41-53.
[38] Statistics Report 2018. PLN. https://www.pln.co.id/stakeholder/laporan-statistik
[39] Energy Information Administration, 2017 International Emissions, https://www.eia.gov/international/data/world/other-statistics/emissions-by-fuel (accessed 27 February 2020).
[40] Government of Indonesia, First Nationally Determined Contribution Republic of Indonesia, November 2016, p.10.

To achieve these reductions and mitigate the effects of climate change on island countries such as Indonesia, EBTKE under MEMR is implementing policies targeted at both energy supply and demand, including the efficiency of household products. MEMR aims to reduce energy consumption across all sectors by 17% in 2025 relative to BAU through various policies, including minimum energy efficiency standards (MEPS) and comparative labeling for energy-using products.[41]

MEPS currently exist for compact fluorescent lamps and room air conditioners, and standards for other products are either in development or pending approval. However, limited or non-existent data on the appliance market makes it challenging for EBTKE to estimate the CO_2 reduction potential of other products, to be used as the basis for product selection for new MEPS levels and compliance efforts. Therefore, CLASP and its partners undertook market studies for four products—fans, lighting, refrigerators, and rice cookers—to inform EBTKE's analysis of the market and the characteristics of these products, and to calculate the energy and CO_2 reduction potential from setting ambitious efficiency policies.

As the leading international voice and resource for appliance efficiency policies and market acceleration initiatives, CLASP, together with local partner Environmental Design Solutions, conducted a comprehensive market study in Indonesia. This study assesses the potential impact of energy efficiency policies for refrigerator products in Indonesia based on product-level data and the market characteristics. The market assessment is based on data from 6 manufacturers representing 48% market share.

This report first describes the results of the market assessment, and then looks at the policy options and their impacts.

Market Assessment:

- **Section 1** provides an introduction, background and study objectives;
- **Section 2** describes the approach including scope and key activities;
- **Section 3** provides the overview of the market including key players and a discussion on supply chain and describes the market assessment findings; and
- **Section 4** presents data on market characteristics.

Policy Options and Impacts Assessment:

- **Section 5** summarizes the current draft MEPS and labeling requirements;
- **Section 6** summarizes the current test method referenced by the draft MEPS and compares it to international test methods as well as lab capacity;
- **Section 7** describes the approach to analyzing alternative policies;
- **Section 8** presents the policy options;
- **Section 9** reviews the impacts on consumers, manufacturers, and the nation; and finally
- **Section 10** contains conclusion and recommendations.

[41] President of Indonesia, Republic of Indonesia Presidential Regulation Number 22 of 2017 about National Energy General Plan (RUEN), p. 30.

Market Assessment

2 Market Assessment Methodology

Market assessment is the first step in designing and implementing energy efficiency policies for any appliance. It helps policymakers and other stakeholders understand:

- Product characteristics, market segments, and core issues of the sector;
- Past, present, and future trends in the sector; and
- Impacts of energy efficiency policies.

To collect all pertinent information required to ensure high reliability in CLASP's policy analysis efforts, EDS applied the following steps to achieve the defined objectives.

Step 1 – Product Categories in Scope

Table 3 lists the refrigerator types that were the focus of this study. The included both standalone refrigerators and refrigerator-freezers, though most refrigerators (even single-door types) had a frozen food compartment. The study did not include standalone freezers. Further details on Harmonized Commodity Description and Coding System (HS) codes used to source data are provided in **Appendix A.**

Table 3. List of refrigerator categories included in this study

Type	Details
Refrigerator categories	1. Single-door 2. Double-door (top-freezer) 3. Double-door (bottom-freezer) 4. French-door 5. Side-by-side door

Step 2 – Key Data and Stakeholders

The key pieces of data and their sources are listed in Table 4. EBTKE and CLASP coordinated with EDS to identify and contact the relevant stakeholders. EDS held discussions with a majority of the stakeholders identified and supplemented the primary research with published sources. A full list of stakeholders consulted is in **Appendix B**, while a list of retail stores visited is in **Appendix C**.

Table 4. Data collection strategy

Data	Collection Strategy
Product trends and shares based on door-types, capacity, refrigerant-types, and price	• Data from 13 retailers and 5 manufacturers • Technical specifications from 150 refrigerator models
Historical sales and forecast	• Data from 8 manufacturers and importers; trade association Gabel
Imports & exports	• UN Comtrade reported trade monetary values for the refrigerator HS Codes (see Appendix A)

	• Data from the Ministry of Trade and BPS on weight and monetary trade values
Level of local content value	• Input from 3 brands with local manufacturing facilitie
Test procedure and testing infrastructure	• Standards; IEC 62552:2015, ISO 15502:2008 • Inputs from LSPro, Sucofindo, and Qualis

EDS developed separate questionnaires and distributed them to the following stakeholder groups:

- Trade Association Gabel
- Manufacturers
- Importers
- Customs, Import and Control
- Retailers
- Test Facilities

Step 3 – Secondary Sources

For collection of data a holistic approach which included both desk research and primary research techniques were defined. Desk research covered the information related to market size, growth rate, test standard, energy efficiency standard, etc., based on review of various reports, articles, journals, databases and industry publications. A few examples of the contents reviewed are shared below:

1. Global statistics and market data portals
2. Reports published by various development organizations focusing on Indonesian Refrigerator sector (e.g., Green Chillers NAMA Project report from 2017)
3. Reports focusing on the ASEAN region (e.g., GfK)
4. Web portals of various stakeholders such as manufacturers about their products specs, BSN about Indonesian national standards, etc.

Step 4 – Data Validation

Data were combined from several independent sources, strengthening the team's confidence in the total market picture. In addition to collecting market data from six manufactures/importers and energy consumption data from four, the team also reviewed the results with Gabel and compared them with published sources.

Once the data were collected, reviewed, and combined to obtain an aggregate market picture—without identifying any single manufacturer—the CLASP team validated the conclusions with key stakeholders at a National Workshop held on November 20, 2019 in Jakarta, and a Focus Group Discussion with manufacturers and other technical experts on January 30, 2020.

Step 5 – Data Analysis

Finally, CLASP used the Policy Analysis Modeling System (PAMS)—a spreadsheet impacts model developed by CLASP and Laurence Berkeley National Laboratory—to estimate energy, emissions, and consumer cost savings under different MEPS scenarios. This analysis informed policy recommendations for refrigerators in Indonesia.

3 Refrigerator Industry at a Glance

The refrigerator industry overview and market scenario are based on both primary and desk research. The primary research data presented in the report is based on survey results from 19 respondents, which include 13 retailers and 6 manufacturers/importers (LG, Sanken, Sharp, Hitachi, Panasonic, and Mitsubishi).

3.1 Supply Chain Analysis

Refrigerators are either imported or manufactured locally. They are then typically sold to distributors, then to wholesale and retail stores, and finally to the end users. However, some manufacturers, importers, and licensed distributors conduct business-to-business (B2B) sales, selling directly to procuring organization, such as hotels. This supply chain is shown in Figure 11.

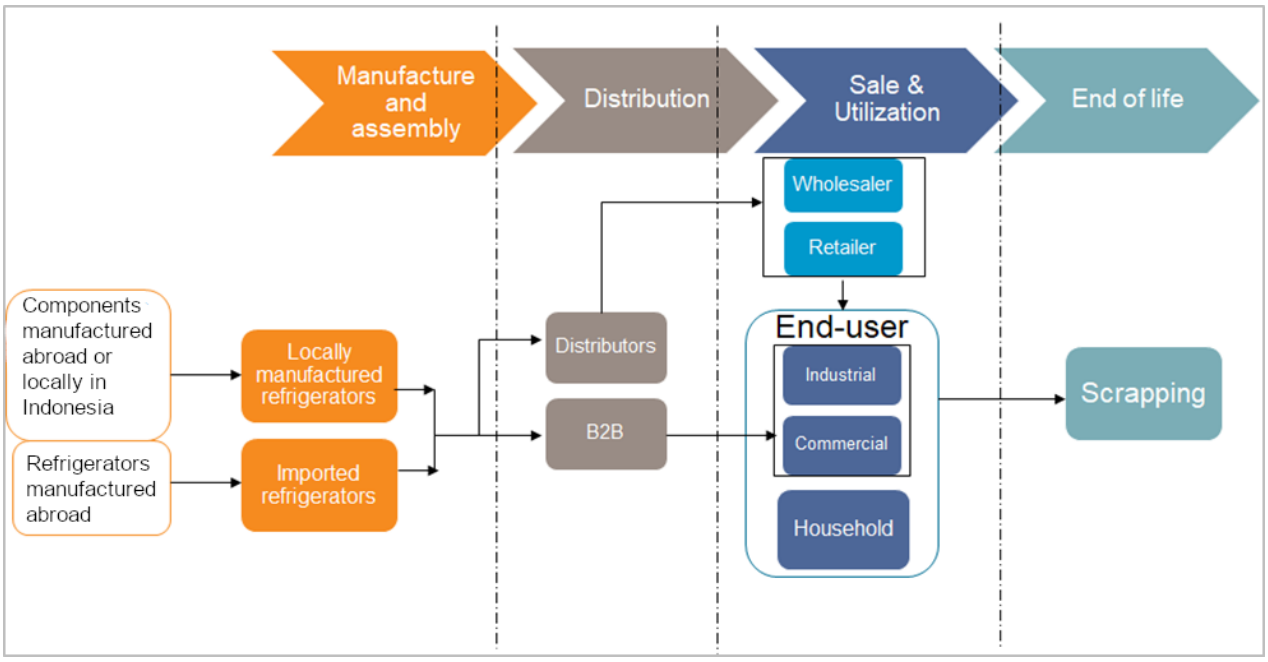

Figure 11: Typical supply chain diagram for refrigerators in Indonesia

3.1.1 Import

Refrigerator imports in 2018 were 205,000 units,[42,43] or approximately 8.7% of total sales by. The import of refrigerators has grown with a compounded annual growth rate (CAGR) of 8.3% from 2014 to 2018. The import data of past 5 years is presented in Figure 12.

[42] UN Comtrade. https://comtrade.un.org/Data/ for the following Harmonized System (HS) commodity codes:
841810 (Refrigerators and freezers; combined refrigerator-freezers, fitted with separate external doors, electric or other);
841821 (Refrigerators; for household use, compression-type, electric or other);
841829 (Refrigerators; household, electric or not, other than compression-type); and
841822 (Refrigerators; for household use, absorption-type, electrical)

[43] Appendix B for details on HS codes, based on which the data has been collected.

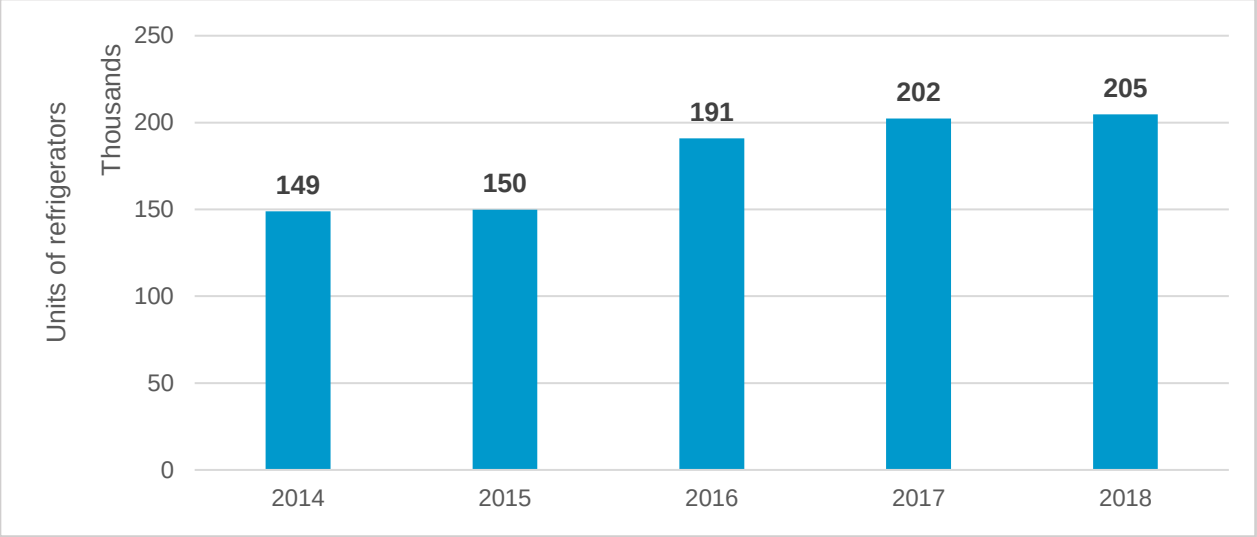

Figure 12: Historical imports of refrigerators (2014-2018)

One of the key drivers for the increase in imports is the lack of import duty on fully assembled refrigerators.[44] This makes it economical for brands like Hitachi and Mitsubishi to completely depend on imports to meet demand in Indonesia. The list of countries from which refrigerators are imported is presented in Table 5.

While refrigerators were imported from nearly 30 countries over the past five years, the majority of imports came from China, Thailand, Vietnam, Japan, and the Republic of Korea. Refrigerator **imports from China and Thailand combined account for more than 80% of the total imports.** Over the past five years, the share of imports from China has increased, whereas the imports from Thailand, Korea and Japan have decreased. From the year 2016, the imports from Vietnam have grown from 0 to 11% of total imports.

Table 5. List of countries representing refrigerator imports in Indonesia in the last five years

Imports from country	2014	2015	2016	2017	2018
Thailand	99,500	102,000	118,000	95,600	98,000
China	28,900	37,000	55,000	73,600	73,500
Vietnam	-	-	9,260	23,300	23,200
Rep. of Korea	12,000	6,420	2,250	1,150	1,300
Japan	2,400	3,270	3,620	2,000	2,370
Other countries	6,100	1,520	2,950	6,540	6,270
Total	**149,000**	**150,000**	**191,000**	**202,000**	**205,000**

[44] INSW data. https://eservice.insw.go.id/index.php.

3.1.2 Export

The export data for the past 5 years is presented in Figure 13. The export of refrigerators has decreased with a CAGR of -5.7% from 2014 to 2018. In 2018, refrigerator exports (by volume) from Indonesia stood at 841,000 units.[45] This is more than 4 times the import volume, accounting for 35% of the annual sales in 2018.

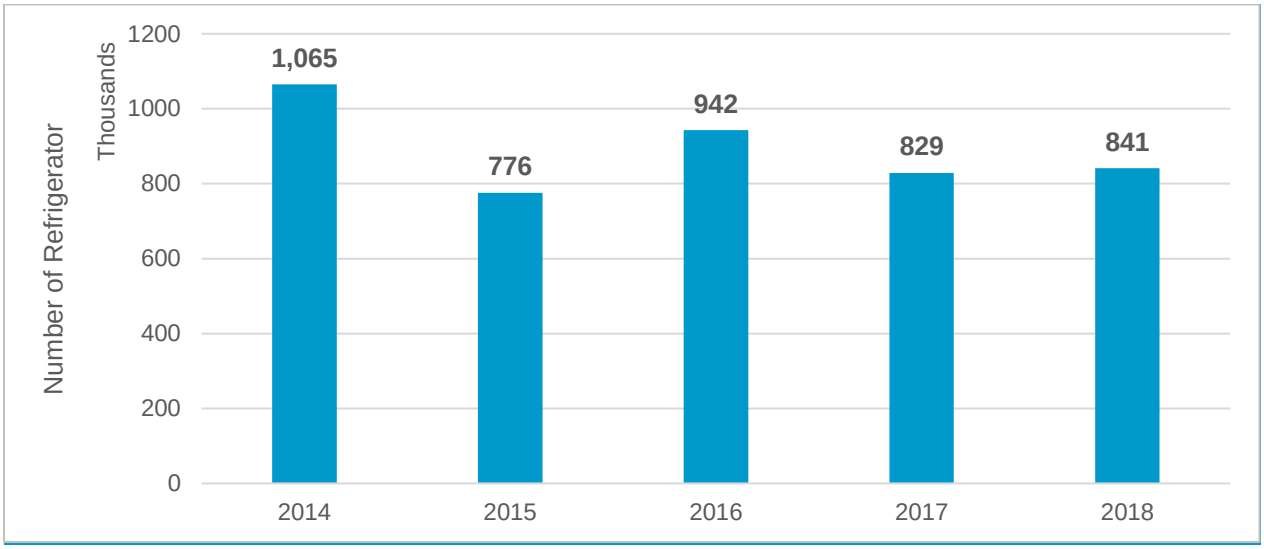

Figure 13: Historical exports of refrigerators (2014-2018)

Refrigerators from Indonesia have been exported to nearly 130 countries over the last five years. The Republic of Korea, Philippines, Japan, Vietnam, Egypt, Malaysia, Thailand, Saudi Arabia, Australia, and Peru are the top ten export destinations based on volume. Refrigerator exports to these top ten countries account for more than 60% of the total.

Figure 14 presents the percentage of refrigerator exports to top ten countries broken out into two periods: 2014–2018 and only 2018. This shows that exports to the Republic of Korea, Japan, Vietnam, Thailand, and Australia have grown.

Among Indonesia's top ten refrigerator export destinations, eight countries (Australia, Egypt, Rep. of Korea, Malaysia, Peru, Philippines, and Vietnam) have mandatory energy efficiency standards for refrigerators. Hence, it can be concluded that refrigerator manufacturing facilities in Indonesia are capable of manufacturing energy efficient refrigerators that meet global standards.

[45] UN Comtrade. https://comtrade.un.org/Data/; HS code 841810; 841821; 841829 and 841822

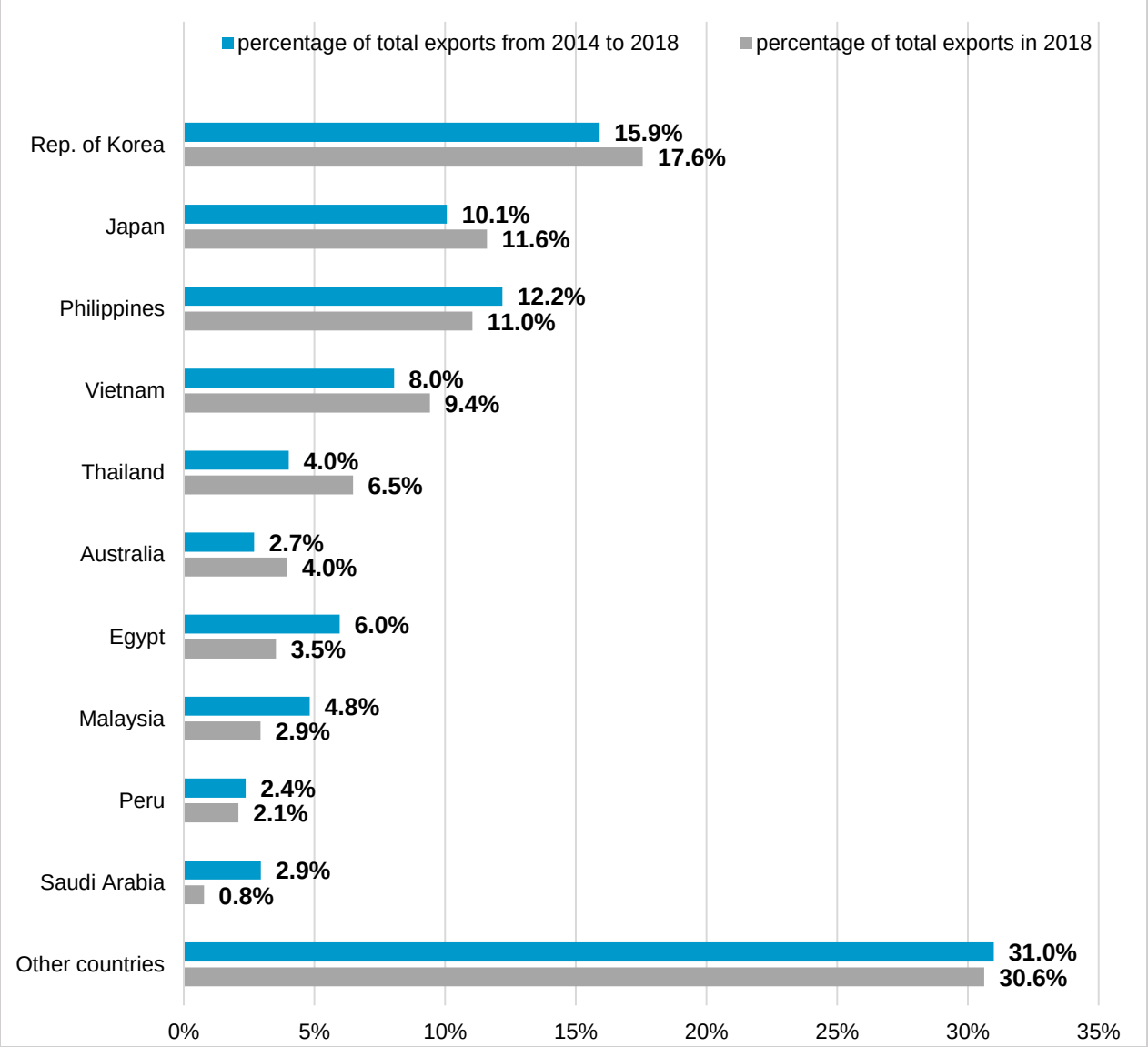

Figure 14: Export of refrigerators to various countries (2014-2018)

3.1.3 Local Manufacturing

Among the six manufacturers that participated in the survey (LG, Sanken, Sharp, Hitachi, Panasonic, and Mitsubishi), LG, Sanken, Panasonic and Sharp have local manufacturing facilities. Since Indonesia exported 841,247 units in 2018 while importing 204,706 units, Indonesia is a net exporter, and Indonesian manufacturers can produce more than the demand within the Indonesian market.[46]

There is currently no Indonesian government regulation mandating a minimum level of local content in refrigerators (TKDN). Three manufacturers interviewed have local manufacturing. These manufacturers reported that local content is 65–70% of product value. The compressor is imported by all manufacturers interviewed.

3.1.4 Data Validation

The national sources that collect trade data in Indonesia (Ministry of Trade and Badan Pusat Statistik (BPS)) only report them in terms of weight (kg) and value (USD). Unit data are not available. Therefore, in the previous sections, the team relied on United Nations Commodity Trade Database (Comtrade), which estimates the number of units from weight and value for over 170 reporting countries/areas.

To validate the United Nations data, the team compared the data from UN Comtrade against the data received from the Ministry of Trade and BPS a subset of the data points (such as trade from selected countries). It was observed that the data from UN Comtrade and the data from Indonesian government departments were consistent.

Also, APEC's 2018 report similarly indicated that, 90% of refrigerator-only models and 73% of refrigerator-freezer models were manufactured domestically in Indonesia.

3.2 Key Players

The five major brands are Sharp, Polytron, Sanyo/Aqua, LG and Panasonic. Together, these brands hold nearly 88% of the market share by volume,[47] as shown below in Figure 15. Polytron and Aqua are the market leaders.

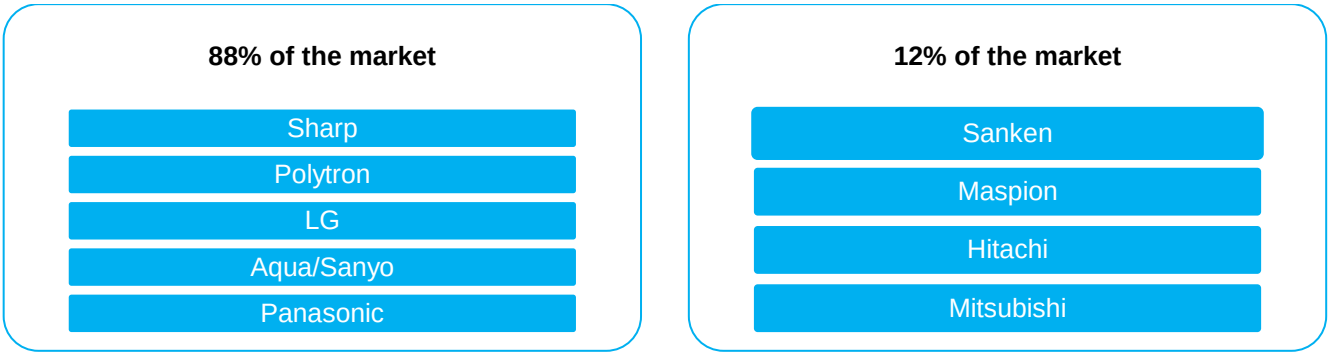

Figure 15: Market share by different brands

[46] APEC, "Refrigerator/Freezer Energy Efficiency Improvement in the APEC Region: Review of Experience and Best Practices", December 2018, pp. 8-9.

[47] This data was captured in primary research through questionnaire-based interview.

4 Market Characteristics

4.1 Refrigerator Types

The Indonesian domestic refrigerator market in most common forms can be broadly segmented based on product type (refrigerator-only or refrigerator-freezer), air circulation, door type, and capacity. While products that are solely refrigerators do exist, they are specialized and few in number. For example, Euromonitor estimates them at approximately 1% of total shipments[48]. The vast majority of products sold include a compartment for frozen food, even if it is not accessible through a separate door and does not freeze food below a temperature of -18 °C.[49]

4.1.1 Air Circulation and Defrost

Refrigerators on the Indonesian market are characterised as “direct cooling” or “fan cooling”. In direct cool refrigerators, the air is cooled through a natural convection process. Consequently, frost is formed over the coils and manual defrosting is required. Some products may have fans to minimize internal condensation but are not claimed as fan cooled.

Refrigerators are qualified as “fan cooled” if the air inside the compartment(s) is circulated through forced circulation with the help of fans. The fan achieves an even temperature thus avoiding the build-up of frost over the cooling coils.

Separately, a refrigerator may have a heating system integrated into the cooling coils to avoid the build-up of frost on the cooling coils. Those products are called “frost free” or “automatic defrost”. While this is technically separate from the issue of fan cooling discussed above, in practice, “manual defrost” seems to be most often found and used interchangeably with “direct cooling” and “frost free” with “fan cooling”.

4.1.2 Door type

The domestic refrigerator market is segmented as single-door, double-door (top-freezer or bottom-freezer), side-by-side and French-door model types. Generally, the single-door refrigerators (including those with a frozen food compartment) are direct cool/manual defrost. All the multi-door types are fan cooled/frost free.

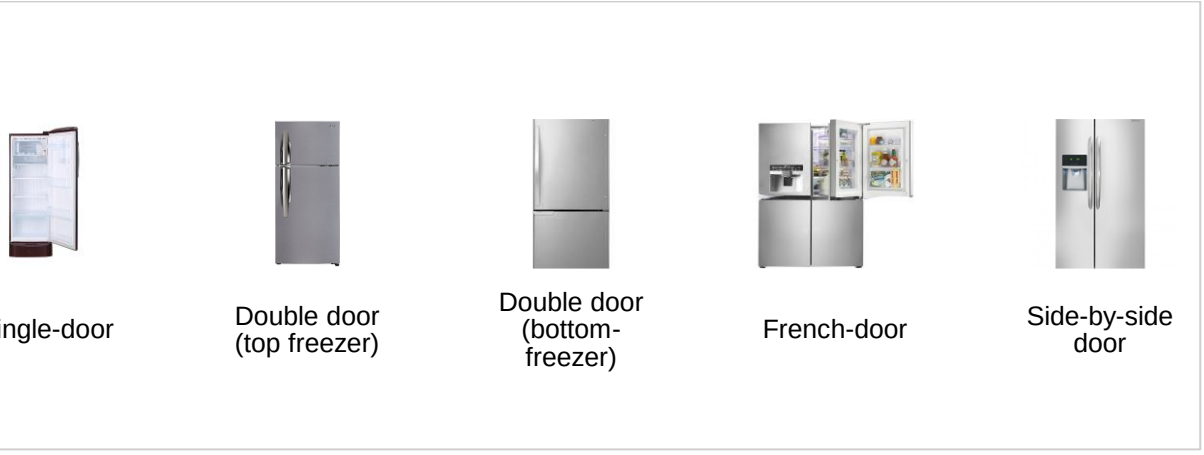

Figure 16: Door types on the Indonesian market

[48] Euromonitor, *Passport: Market Sizes: Historical/Forecast for Refrigerators and Refrigerator Freezers in Indonesia, 2019*.
[49] International standards require a frozen food compartment to reach at least -18 °C (four star freezing performance classification) for a product to be called a refrigerator-freezer. Frozen food compartments of single-door products only reach -6 or -12 °C.

4.2 Market Size

4.2.1 Market Demographics at a Glance

The household appliances market depends on various factors and demographics is one among them. The increases in population, number of households, and spending power together contribute to the demand for refrigerators and other home appliances in Indonesia.

1. The number of households in Indonesia is increasing with CAGR of 1.2%[50,51]
2. The population is increasing with CAGR of 1.14%
3. Consumer expenditure is rising with CAGR of 3%

4.2.2 Sales Trend and Forecast

The market size is estimated to be around 2.5 million units per year. As can be seen in Figure 17. Over the last five years (from 2014 to 2018) refrigerator sales have decreased with a CAGR of -5.8%.[52] However, the refrigerator sales grown by 3.5% in 2018 compared to 2017.

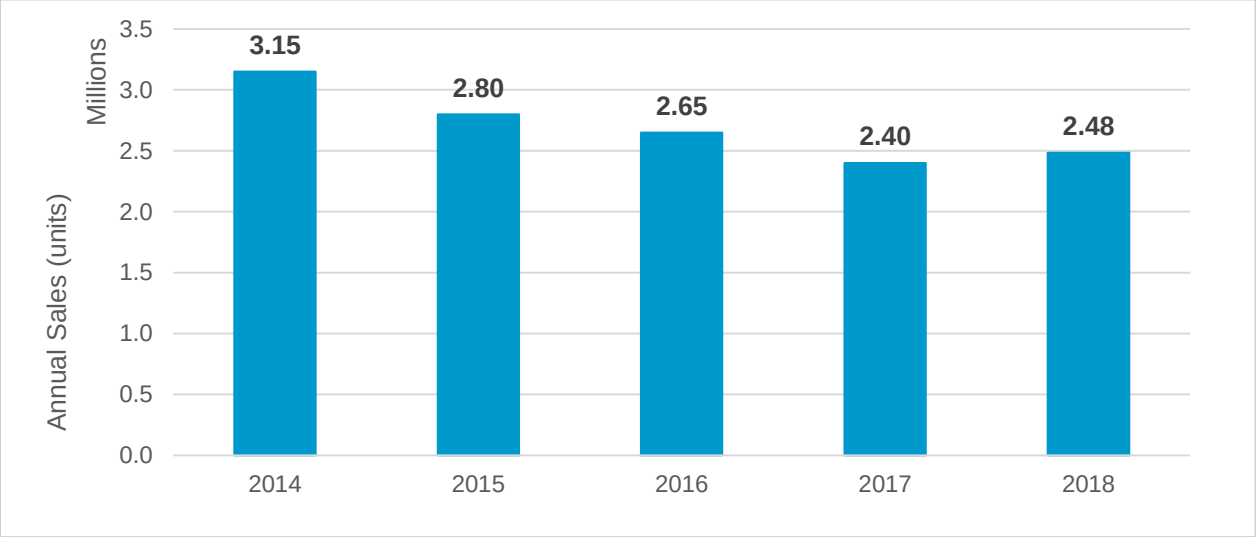

Figure 17: Refrigerator sales (2014 to 2018)

The manufacturers and trade association Gabel shared that the market has been shrinking for a majority of home appliances including refrigerators from 2014 to 2017. In the case of refrigerators, one reason which might have affected the sales is a change in the eating habits of urban households.

[50] Euromonitor, Indonesia fact file; https://www.euromonitor.com/indonesia/country-factfile

[51] Statista, Indonesia household appliances; https://www.statista.com/outlook/256/120/household-appliances/indonesia

[52] Data on overall sales is presented based on information collected through questionnaire-based survey from a leading brand during stakeholder interview. This information is further corroborated on a report from market research firm GfK and industry association Gabel. Gabel reports that refrigerator sales fell from 3.5 million in 2013 to 2.5 million in 2016, a CAGR of -10.6%.

Ready-to-eat food is conveniently available around the country: it is available for all meals of the day and being cooked in a large quantity makes it is usually available at a much lesser cost. The trend of eating out is increasing overall and especially among the younger generation.[53] Consequently, the foodservice industry grew at 6.9% in 2017[54] and is forecast to continue growing at 7% between 2018 and 2023.[55]

Despite this trend of eating outside the home, the refrigerator is still considered an essential household appliance because of the climatic conditions and the need for refrigerating essential daily items such as milk, vegetables, and meat. Nationwide surveys conducted by the Indonesia Statistics Bureau BPS have found *increasing* household ownership, rising by 3 percentage points per year from 48% in 2015 to 57% in 2018.[56] This increase in the ownership rate of refrigerators is consistent with CLASP's experience in other developing countries with high electrification rate and population and income growth: as people grow richer, a refrigerator is one of the first appliances they buy.

One potential explanation for these two conflicting findings is that the lifetime of refrigerators in Indonesia is increasing.[57] While shipments may grow slowly, as households keep refrigerators in service longer than their 10-year average lifetime, the stock will grow at a higher rate. The team modeled this increase in stock through a 5% sales growth scenario (Figure 18), which results in approximately 2 percentage point increases in household ownership through 2030 when the stock would be 70.7 million units (compared to 74.8 million households; shown later in Figure 20).

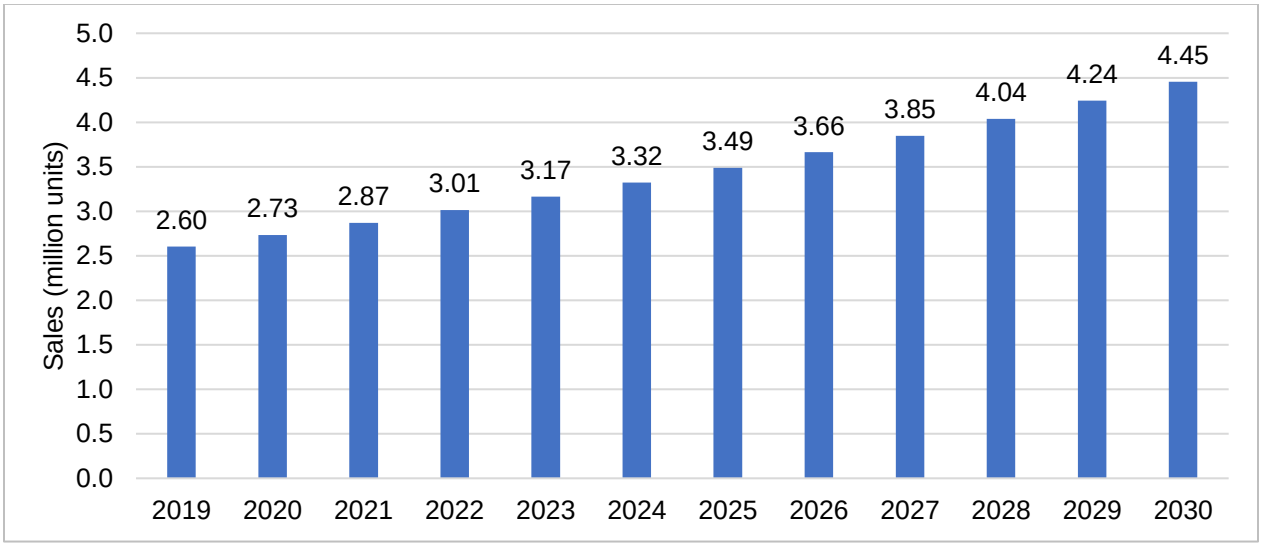

Figure 18: Refrigerator sales forecast, under a compound annual growth rate (CAGR) of 5%

[53] Global Business Guide Indonesia 2017. http://www.gbgindonesia.com/en/services/article/2017/indonesia_s_restaurant_and_food_franchise_sector_technology_and_innovation_key_to_future_growth_11800.php (accessed on 22 September 2019)

[54] Hotel Restaurant Institutional Update. https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Food%20Service%20-%20Hotel%20Restaurant%20Institutional_Jakarta_Indonesia_2-26-2019.pdf (accessed on 22 September 2019)

[55] Investments, Indonesia. "Outlook on the Food Service Industry in Indonesia." Investing in Indonesia | Indonesia Investments, 11 2018, www.indonesia-investments.com/id/business/business-columns/outlook-on-the-food-service-industry-in-indonesia/item9001 . Accessed 22 Sept. 2019.

[56] BPS, Survei Sosial Ekonomi Nasional (SUSENAS), 2015–2018.

[57] A similar effect is occurring in the lighting market, where the introduction of longer-lived light-emitting diode (LED) lamps is causing sales to plummet even while the installed stock is rising.

4.2.3 Stock

As reported in a recent study, the stock of refrigerator in the Indonesian economy was approximately 33 million units in 2015.[58] Figure 19 shows the domestic refrigerator stock in the period 2011-2015.

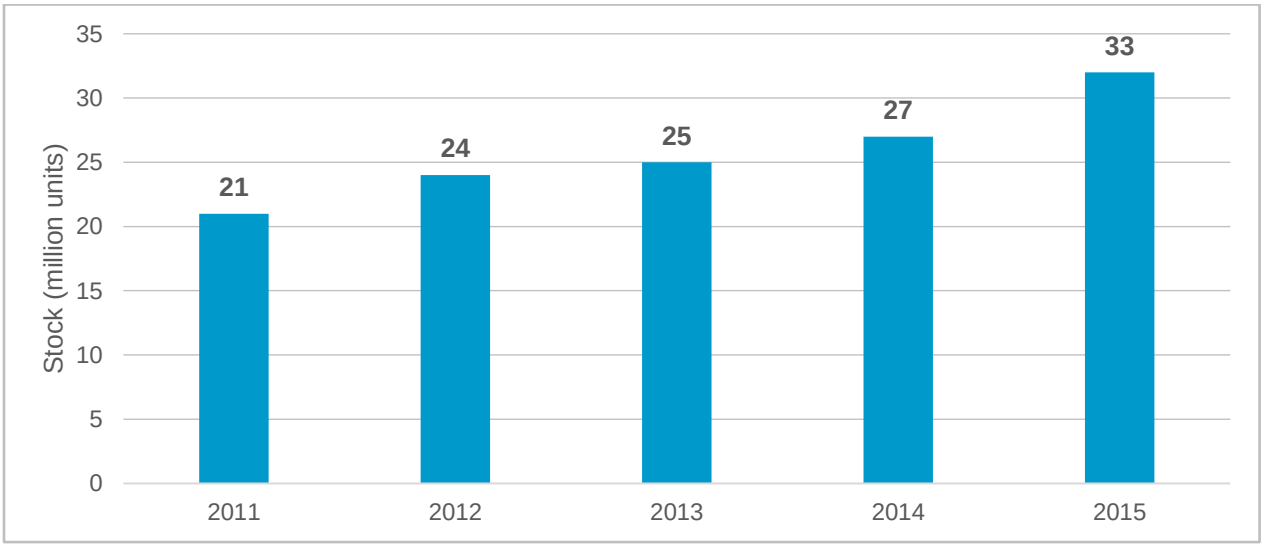

Figure 19: Domestic refrigeration unit stock in the years 2011-2015

In order to further evaluate the installed stock, stakeholders were asked about installed stock data during the interview as a part of primary research. One of the leading refrigerator manufacturers shared that presently 58% of households have a refrigerator. With Indonesia's population at 268 million in 2018 and approximately 4 persons per household,[59] this would result is 39 million refrigerators installed.

In contrast, CLASP's 5000-household Indonesia-wide residential end-use study found penetrations of 71%, resulting in a stock of 47 million in 2019. CLASP's end-use survey included urban and per-urban households, and rural households are less likely to have a refrigerator. At the same time, it is expected that refrigerators are used in large numbers in commercial buildings such as hotels, offices, and small shops (including commercial use of homes), which were not included in the CLASP survey. To account for these additional uses, CLASP used the higher stock estimate of 47 million units.

To forecast the stock into the future, EDS progressively retired the models in the existing stock at a rate of 2.5% per year. EDS then added future sales (section 4.2.2, above), which were also progressively retired. The stock forecasting process through 2030 is explained in **Appendix D**.

Figure 20 presents the estimated stock of refrigerators from 2019 to 2030. The surviving stock in the year 2030 is estimated to be 26.6 million from units sold from 2019 to 2030, and 35.6 million from the 47 million units sold before 2019 and currently in stock.

[58] Refrigeration and Air Conditioning Greenhouse Gas Inventory for Indonesia, study supported by GiZ, published in 2017 (Green Chillers NAMA Project Indonesia)

[59] Population census: The World Bank.

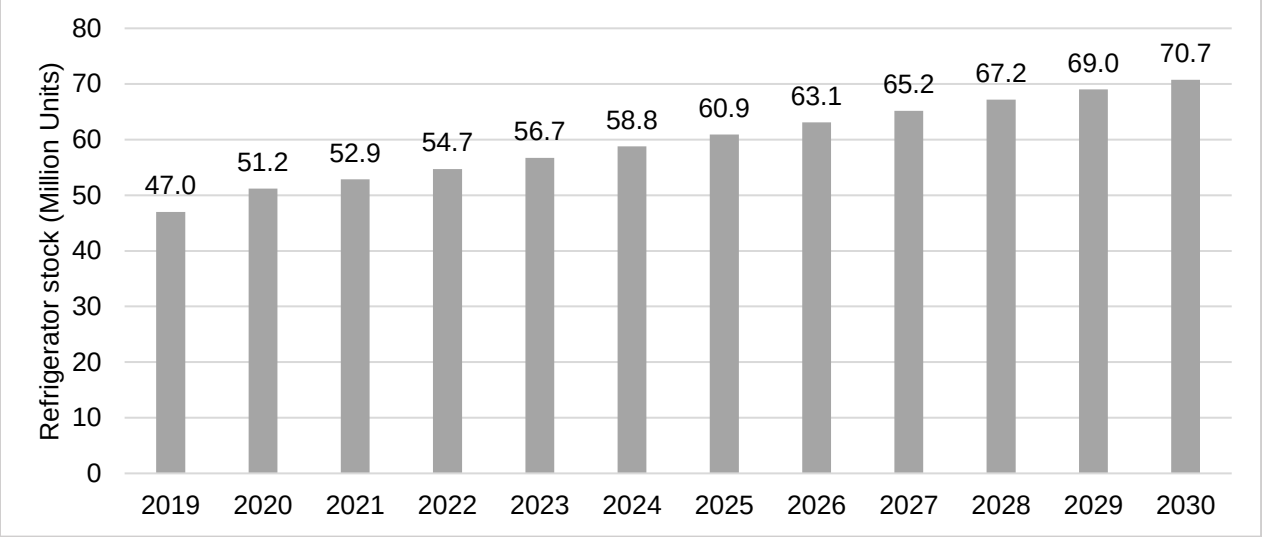

Figure 20: Refrigerator stock forecast, taking into account new sales and retirements

4.3 Market Trends by Type

4.3.1 Door-type

The sales of single-door and double-door top-freezer refrigerators have decreased at a CAGR of -9.54% and -0.64% respectively over the period from 2014 to 2018. Meanwhile, French-door and side-by-side door refrigerator sale have increased at a CAGR of 6.2% and 10.7% respectively over that same period, though from a miniscule base. Figure 21 and Figure 22 depict the unit sales of different types of refrigerators in Indonesia for the past five years.

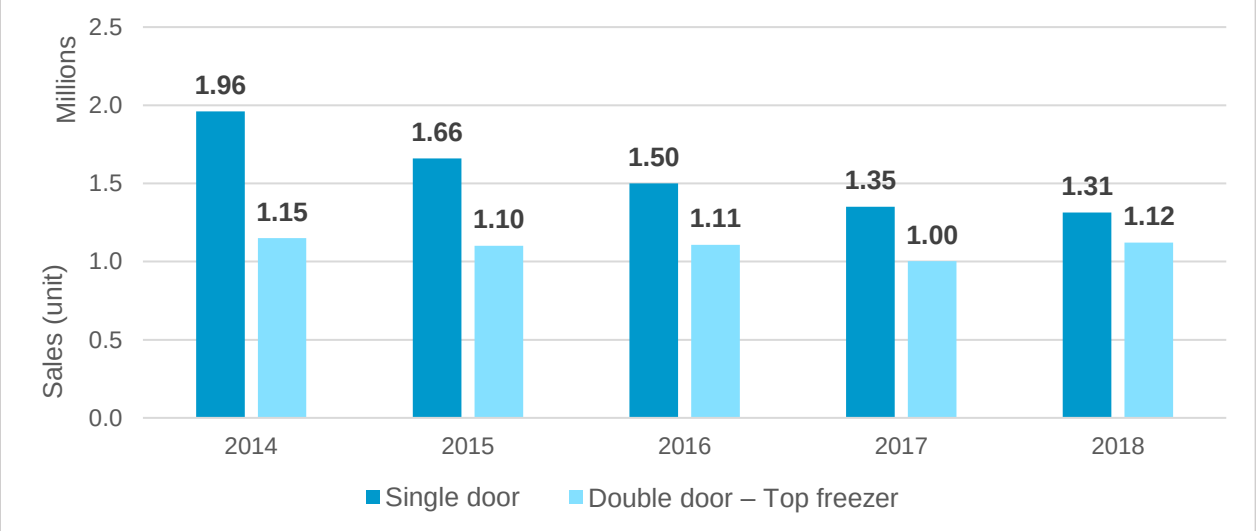

Figure 21: Sale of Single and double-door with top-freezer refrigerator

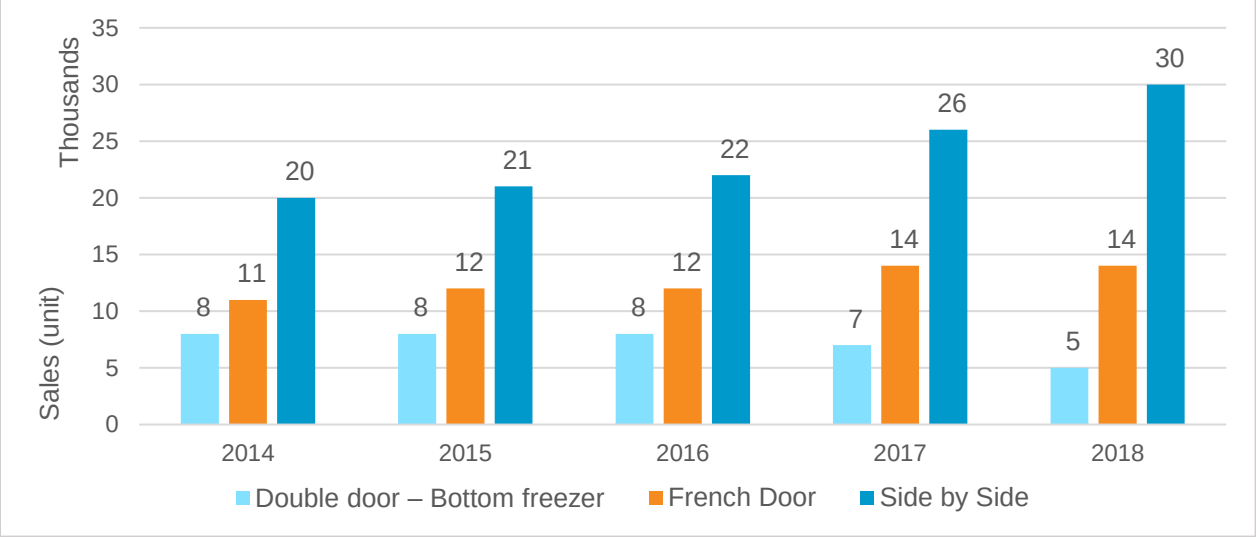

Figure 22: Sale of French-door, side-by-side-door and double-door bottom-freezer refrigerators

Out of overall annual sales within the period of 2014 to 2018, the single-door and double-door top-freezer refrigerators account for 57.7% and 40.7% of the total sales volume, respectively. Meanwhile, French-door, side-by-side-door, and double-door with bottom freezer account for 1.6% of the total sales. The annual shares of single-door sales have been observed to decrease from 2014 to 2018, namely from 62% to 52%, while increase in annual shares is recognized for double-door top freezer units, from 37% in 2014 and 45% in 2018. Figure 23 presents the share of different types of refrigerator in total sales volume.

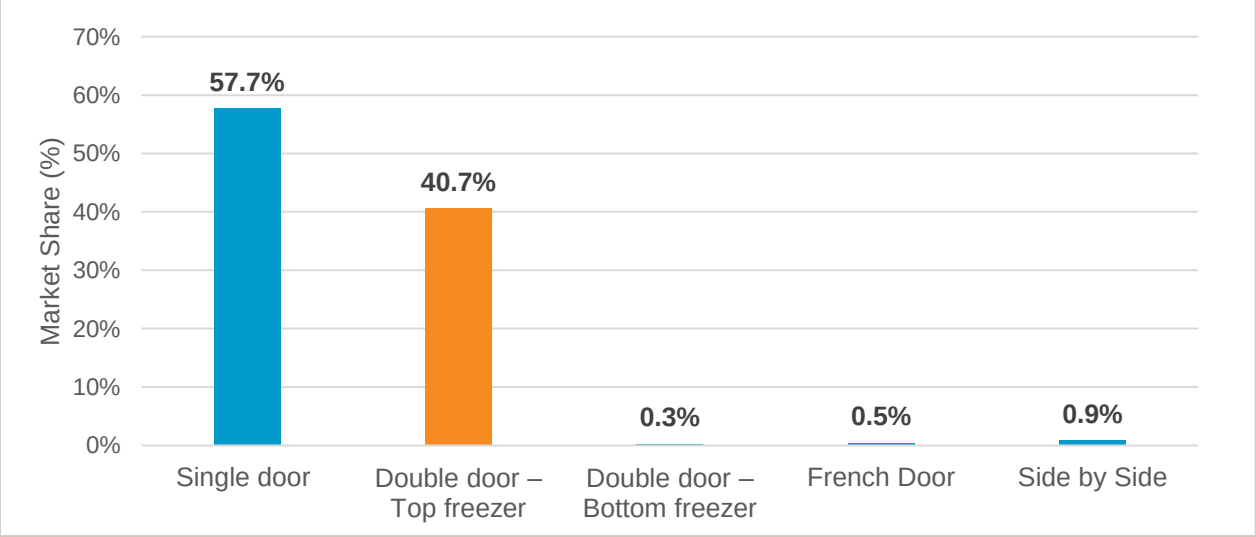

Figure 23: Percentage share of sales of different door types

4.3.2 Capacity

Figure 24 shows the distribution of shipments by capacity (gross volume of both the refrigerator and freezer compartment), based on data provided by a leading manufacturer. Almost 70% of the market corresponds to refrigerators less than 200 L, followed by 22% between 200 L and 300 L, and merely 8% larger than 300 L. This differs from the distribution of models in retail stores, shown in Figure 25, where a higher proportion of models are found at the higher capacities.

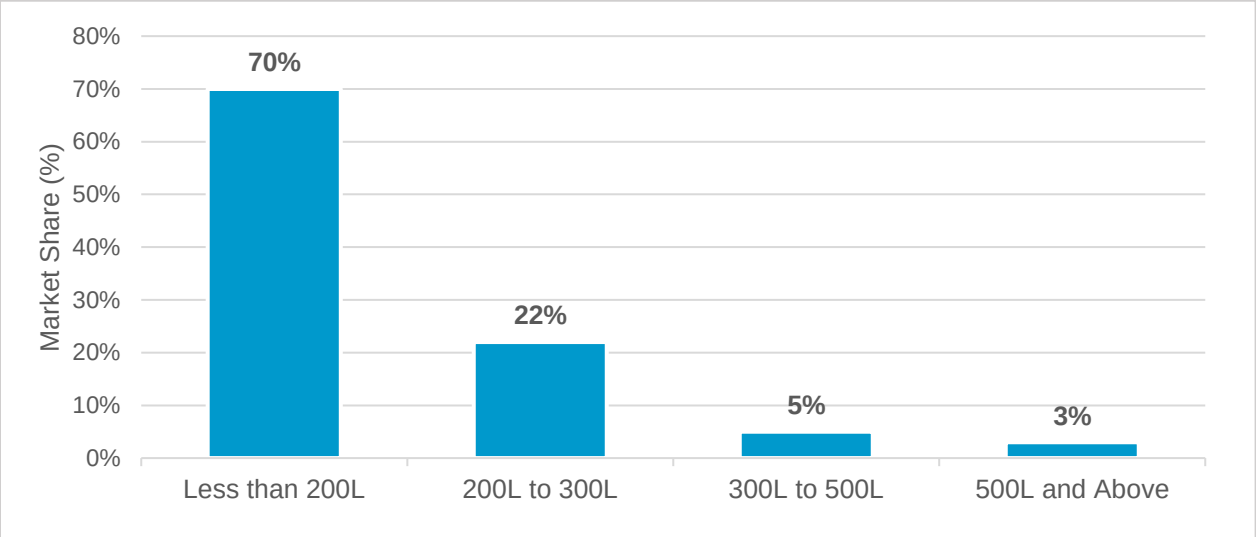

Figure 24: Distribution of refrigerator sales by capacity (gross volume)

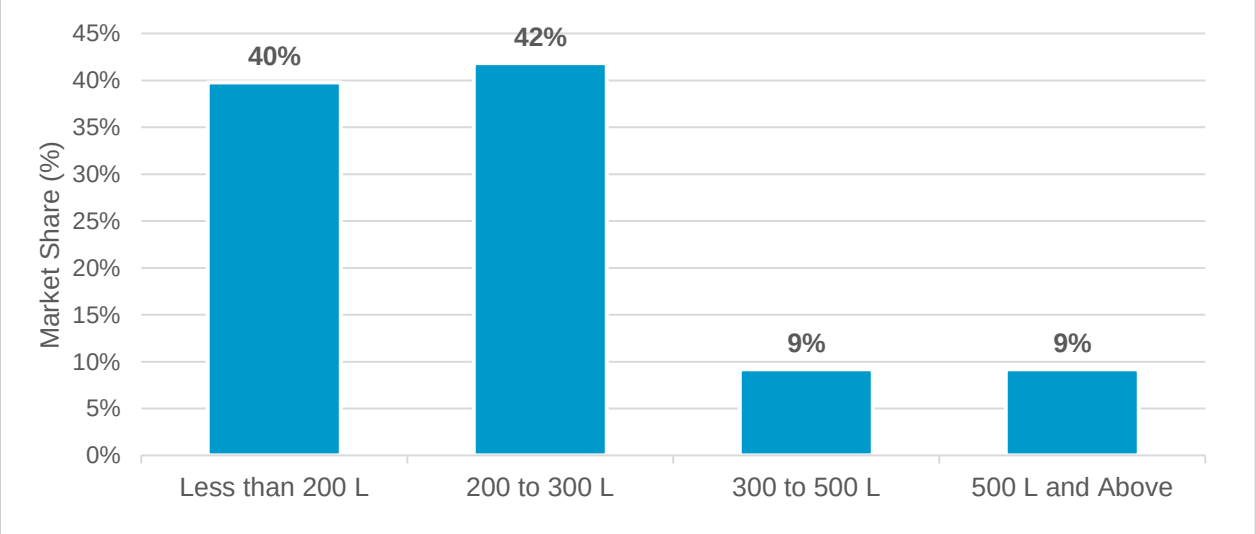

Figure 25: Distribution of refrigerator models in retail by capacity (gross volume)

4.3.3 Refrigerants

Refrigerants in Indonesia are regulated by the Ministry of Environment and Forestry. Indonesia's Hydrofluorocarbons Phase-Out Management Plan (HPMP) Stage 1 which covered the manufacturers in Indonesia is already complete. Manufacturers and assemblers use mostly hydrocarbons. In addition to this, it should be noted that Indonesia has announced its intention to ratify the Kigali amendment to the Montreal protocol in about two years.[60] As "Group 1" country, Indonesia's phase-down schedule will be based on its 2020-2022 average consumption.

The project team found that Indonesian refrigerators use both R134a and R600a refrigerants. Both refrigerants have zero Ozone Depletion Potential (ODP). The global warming potential (GWP) for R134a and R600a is 1300 and 3, respectively.[61,62] R134a is used in 89% of the refrigerator models shipped, as can be seen in Figure 26. The models analyzed include all types of refrigerators across a wide range of volumes. However, there are certain brands that sell refrigerators only with R600a in Indonesia. R600a is presently considered one of the best alternative climate-friendly refrigerants.[63]

This finding was corroborated by model-specific data provided by manufacturers. These data indicated that 45 out of 61 models (74%) use R134a refrigerant, as can be seen in Figure 27.

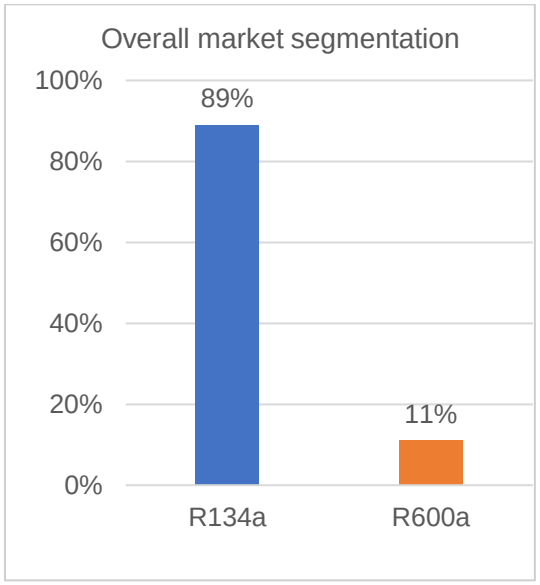

Figure 26: Market share of refrigerants used

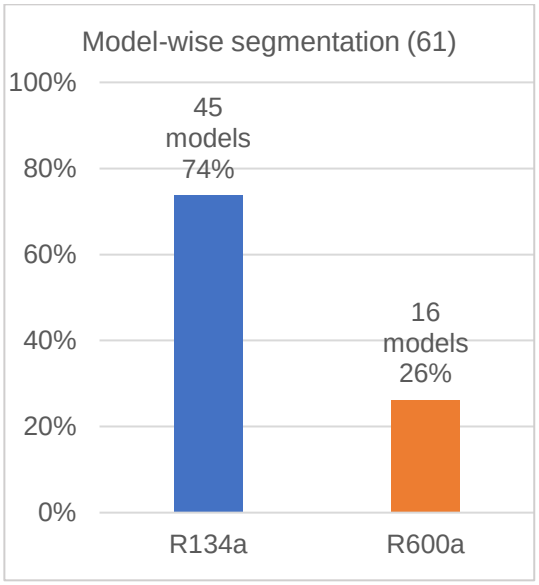

Figure 27: Share of refrigerants in the models surveyed

[60] ANTARA News. https://en.antaranews.com/news/122490/indonesia-aims-to-ratify-kigali-amendment-in-three-years
[61] IPCC AR5 report
[62] Linde. https://www.linde-gas.com/en/products_and_supply/refrigerants/natural_refrigerants/r600a_isobutane/index.html
[63] There is no regulation in place in Indonesia for promoting R600a.

4.4 Price Analysis

The team collected price and volume information for 98 refrigerator models at 13 retailers. The price data was then analyzed to determine a price range by door type and volume/capacity class. This information is shown in Figure 28 and Table 6 below.

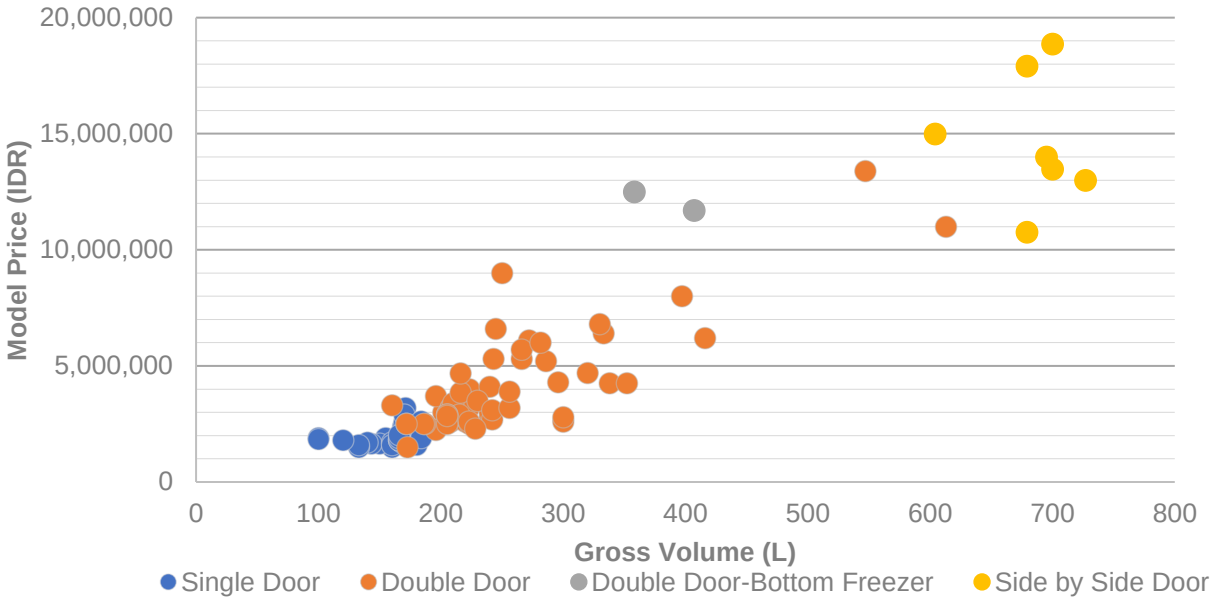

Figure 28: Price of refrigerators

Table 6. Price range of refrigerators

Size (L)	Single-door (million IDR)		Double-door (million IDR)		Double-door bottom freezer (million IDR)		Side-by-side-door (million IDR)	
	Min	Max	Min	Max	Min	Max	Min	Max
100-200	1.50	3.20	1.50	3.70	-	-	-	
200-300	-	-	2.30	9.00	-	-	-	
300-400	-	-	2.60	8.00	11.70	12.50	-	
>500	-	-	11.00	13.40	-	-	10.76	18.87

Key observations related to prices in Indonesian refrigerator market:

- The price of single-door refrigerators ranges from 1.5 to 3.2 million IDR and these are available in the range of 100L to 200L capacity. Whereas, double-door refrigerators price ranges from 1.5 to 13.4 million IDR.
- The price of refrigerators (all categories considered) is proportional to the gross volume.
- In the case of double-door refrigerators, the price range is very wide because these refrigerators are available across the varied capacity range.

- The double-door bottom-freezer refrigerators are more expensive when compared to double-door top-freezer refrigerators.
- Side-by-side-door refrigerators are usually available in bigger capacity ranges i.e., beyond 500L. Also, side-by-side-door refrigerators are premium appliances, and their cost ranges from 10.8 million IDR to 18.9 million IDR.

4.5 Consumer Preferences

During the survey of 13 retail stores, the team questioned store representatives about factors that drive purchasers' selection of refrigerator and their awareness about saving money through energy efficient products. In the questionnaire, retailers were asked to list parameters taken into consideration by the consumers in purchasing refrigerators. Although there were variations found across all retailers' respondents lists, these five parameters were commonly quoted by most retailers;

- Operational cost
- Price
- Energy efficiency
- Aesthetics
- Reliability and durability[64]

In addition to these outcomes obtained from retailer questionnaires, the Residential End Use Survey conducted by CLASP in 2019 also provides some insights on factors considered by the consumers before purchasing a new unit. Table 7 lists the factors that purchasers consider, listed in the order of importance.

Table 7. Factors considered when purchasing a new refrigerator, from CLASP 2019 Residential End-Use Survey

Weighted Responses in Percentages	Factor
26%	Energy saving
24%	Brand
21%	Affordable price
13%	Refrigerator capacity (small/ big capacity)
10%	Technology (inverter, anti-smell, no frosting, etc.)
6%	Local product, made in Indonesia

Although consumers are interested in efficiency, there is no way for them to reliably identify more efficient refrigerators. Efficiency labeling would be very helpful to consumers.

[64] The reliability and durability refer to average lifetime of domestic refrigerator. The consumers consider this as an important criterion for purchase.

4.6 Lifetime

During the stakeholder interviews, four manufacturers of refrigerator reported the lifetime of refrigerators as 5 to 10 years; however, one manufacturer reported 15 years. CLASP's residential end-use survey found that the average age of refrigerator in households was 5.7 years, indicating a lifetime of approximately twice that or 11.4 years, though first-time purchases will tend to decrease the average age such that the lifetime could be higher. The distribution obtained from the survey is illustrated in Figure 29.

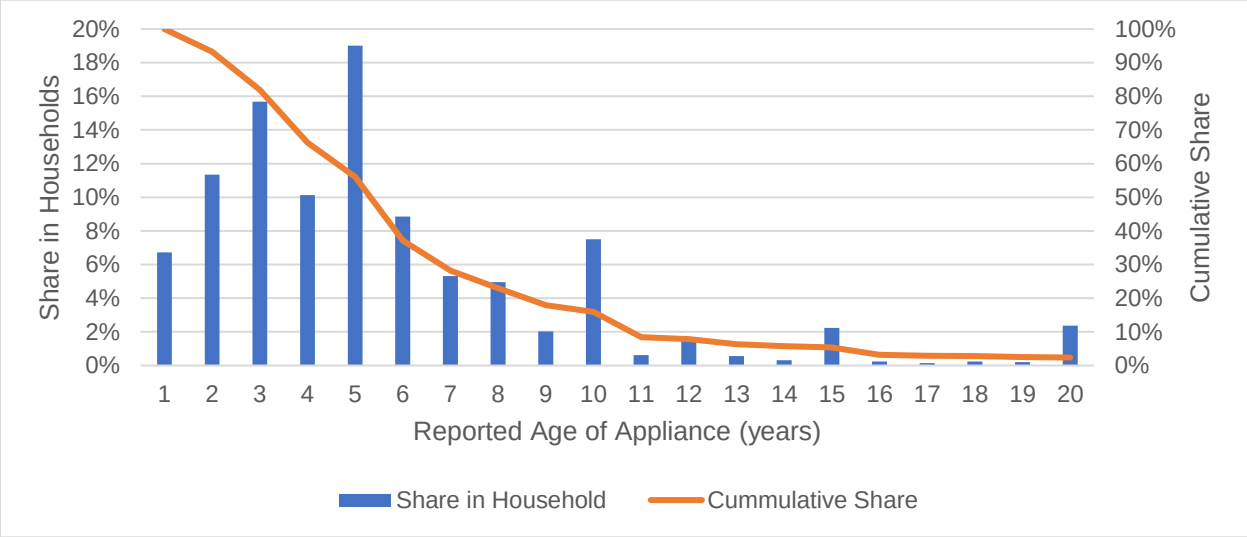

Figure 29: Distribution of refrigerators by age[65]

4.7 Disposal and Resale of Used Refrigerators

Retailers and most manufacturers reported that refrigerators are scrapped at end-of-life with no mechanism in place for recovery of the refrigerant. They also reported that the secondhand refrigerator market is almost nonexistent. However, one out of five manufacturers interviewed claimed that they accept trade-ins of used refrigerators.

[65] CLASP Indonesia 5,000-Household Residential End Use Survey. Conducted in 2019.

Policy Options and Impacts Assessment

5 Review of Draft Regulation

5.1 Draft Regulation for Refrigerators[66]

EBTKE had drafted an energy efficiency regulation, setting minimum energy performance standards (MEPS) and labeling criteria for electric refrigerators. The regulation references the ISO 15502:2008 test standard, which has been adopted as Indonesian National Standard SNI ISO 15502:2008.

5.1.1 Draft MEPS & Comparative Labeling Overview

Program scope & technical specifications	(1) MEPS and Labeling Signs for refrigerating appliances intended for household and similar use, being manufactured, imported, traded in the territory of the Republic of Indonesia. (2) Has a maximum gross volume capacity of 300 liters with the following code: a) HS 8418.10.11 b) Ex HS 8418.10.19 c) HS 8418.21.10 d) Ex HS 8418.21.90 e) HS 8418.29.00 f) Ex HS 8418.30.10 g) Ex HS 8418.30.90 h) HS 8418.40.10 i) Ex HS 8418.40.90 (3) Refrigerator designed for climate class T with a range of ambient temperature (+ 16°C to + 43°C) in accordance with ISO 15502: 2008 or the amendments, has a frozen food storage compartment with a capacity of freezing or without freezing capacity.
Existing status	Draft MEPS submitted to the Government and is pending for approval
Reference with Government regulation	Under provisions of Article 15 (2) and Article 16 (3) of Government Regulation No. 70 of 2009 on Energy Conservation Regulation of Minister of Energy and Mineral Resources
Implementing body	MEMR of the Republic of Indonesia
Referred test standard	SNI ISO 15502:2008
Parameters graded	Annual Energy Consumption (kWh/year)
Key definitions	**Energy saving certificate:** A written guarantee given by IPC to declare that a refrigerator has met the specific energy consumption level **Product certification body (LSPro):** It is the IPC, an institution conducting certification activities for the energy-saving refrigerators (energy efficiency tool based)

[66] Information from draft MEPS, received from MEMR, Indonesia

<table>
<tr><td>Calculation for efficiency limits for MEPS</td><td>a) The highest values of energy consumption ≤ formula [465 + (1.378 x V adj)] x 1.15 for Refrigerator type that does not have the capacity of freezing;
b) The highest values of energy consumption ≤ formula [465 + (1.378 x V adj)] x 1.55 for Refrigerator type which has a freezing capacity;</td></tr>
<tr><td>Label band</td><td>Star 1 (least efficient) to Star 4 (most efficient)</td></tr>
<tr><td>Criteria for receiving the label</td><td>1. Does not have the capacity of freezing
<table><tr><th>Formula / Rating Bintang</th><th>Konsumsi energi/tahun (kWh/tahun)</th></tr><tr><td>1-Bintang(☆)</td><td>≤ [465 + (1,378 x V_{adj})] x 1,15</td></tr><tr><td>2-Bintang(☆☆)</td><td>≤ 1-Bintang x 0,77</td></tr><tr><td>3-Bintang(☆☆☆)</td><td>≤ 2-Bintang x 0,77</td></tr><tr><td>4-Bintang(☆☆☆☆)</td><td>≤ 3-Bintang x 0,77</td></tr></table>2. Has a freezing capacity
<table><tr><th>Formula / Rating Bintang</th><th>Konsumsi energi/tahun (kWh/tahun)</th></tr><tr><td>1-Bintang (☆)</td><td>≤ [465 + (1,378 x V_{adj})] x 1,55</td></tr><tr><td>2-Bintang (☆☆)</td><td>≤ 1-Bintang x 0,77</td></tr><tr><td>3-Bintang (☆☆☆)</td><td>≤ 2-Bintang x 0,77</td></tr><tr><td>4-Bintang (☆☆☆☆)</td><td>≤ 3-Bintang x 0,77</td></tr></table></td></tr>
<tr><td>Key stakeholders that have been part of developing the draft MEPS</td><td>SNI, Test Laboratories, Manufacturing association</td></tr>
</table>

5.1.2 Labeling Application Review

The summary of application process and its review defined under the draft regulation is provided in **Appendix E**.

5.2 Energy Assessment

Technical specification of 61 refrigerator models across 6 major brands was provided by the manufacturers. Annual energy consumption data was provided for 34 out of 61 models. The four manufacturers/brands which provided information on energy consumption on these 34 refrigerator models are prominent players in the country. These four brands constitute approximately 47% of the market sales by volume in 2018.

Out of these 34 refrigerator models, 10 are single-door, 23 are double-door, 1 is side-by-side door. Among these 34 refrigerator models, 8 models have volume more than 300L. To understand the popularity of these models the project team reviewed the information collected from retailers. Twelve models were available in retail stores (spread across seven stores) and can be considered currently marketed models.

Further, the energy performance of 21 models (from two brands) was tested per IEC 62552:2007, while that for 7 models (from one brand) was tested per SNI ISO 15502:2008. For the remaining 6 models, the manufacturer estimated the performance based on the design, assuming the model were tested according to SNI ISO 15502:2008. The reference standard for SNI ISO 15502:2008 is ISO 15502:2005 “Household Refrigerating Appliances – Characteristics and Test Methods”. ISO 15502:2005 and its corrigendum were then superseded by IEC 62552:2007 (ed.1). These are mostly identical, and the results can be considered equivalent. Therefore, all performance values in the dataset are directly comparable to each other.

Current draft levels differentiate between products with and without freezing capacity, which has been interpreted as having a freezer compartment that can maintain a temperature of -18 C. Figure 30 shows the performance of refrigerator-freezer models (with freezing capacity), while Figure 31 shows the performance of refrigerator models. All models would qualify for the 4-star (highest) levels.

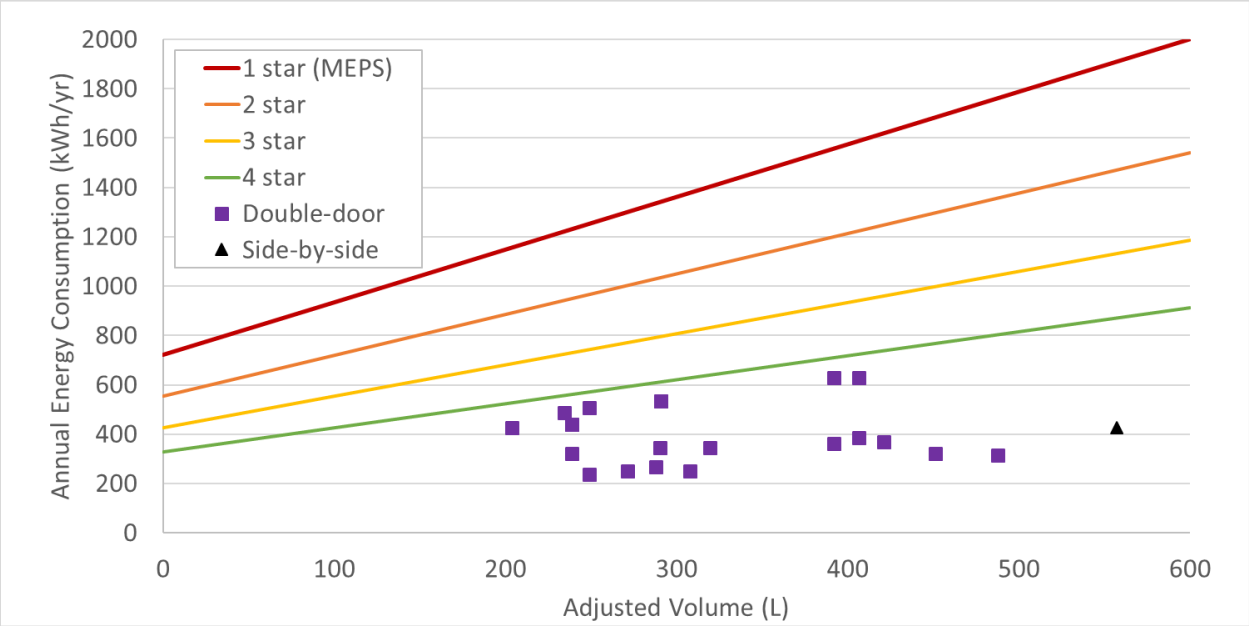

Figure 30: Energy performance and draft Indonesia MEPS for refrigerator-freezers ("has freezing capacity", interpreted to include products ≤-18 °C; volume adjusted to 5 °C reference temperature)

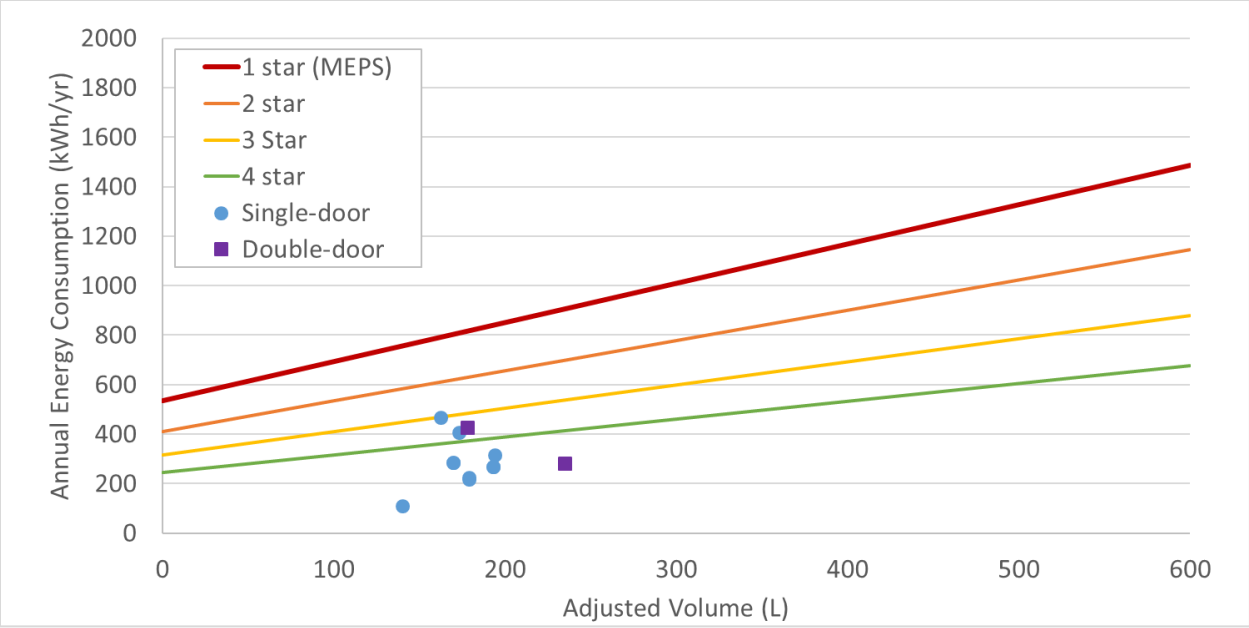

Figure 31: Energy performance and draft Indonesia MEPS for refrigerators ("does not have freezing capacity", interpreted to include products > -18 °C; volume adjusted to 5 °C reference temperature)

However, as discussed in the next chapter, IEC 62552 was significantly revised in 2015 and BSN has adopted an Indonesia National Standard based on it in 2019. CLASP recommends referencing this new standard in the final regulation.

Despite differences between the old and new standards, the impact on the performance data is expected to be small. While the refrigerator compartment is expected consume more energy, the freezer compartment should consume less.[67] The two effects are small (less than 2%) and cancel each other out for refrigerator-freezers.

Moreover, while the standards referenced by manufacturers when reporting the energy consumption of models in the dataset have a 5 °C reference temperature for the fresh-food compartment, many of the models were operating at lower temperatures (4 or even 3 °C). Therefore, there should be no impact to the performance of these models due to the 4 °C reference temperature in IEC 62552:2015. Across all models in the dataset, the energy consumption is expected to decrease by 0.1%, with the maximum difference equal to 2%.

The impact on adjusted volume is expected to decrease by approximately 4%.[68] These two effects are illustrated in Figure 32. Since neither is expected to significantly affect performance or ability to meet the proposed MEPS, the remaining analysis has been performed using the original performance data per ISO 15502.

[67] "At equal ambient temperatures, fridges will consume more as the reference temperature has dropped from 5 to 4°C. Freezers will consume less as the -18°C average temperature inside the compartment is easier to achieve than the -18°C in the warmest package in the current standard." Martien Janssen, "Impact of the new IEC 62552-1,2,3:2015 global standard to cold appliance energy consumption rating", Report number 14127CE40/V2, 29 May 2015, p. 4.

[68] VHK and ARMINES, "Preparatory/review study: Commission Regulation (EC) No. 643/2009 with regard to eco-design requirements for household refrigeration appliances and Commission Delegated Regulation (EU) No. 1060/2010 with regard to energy labelling of household refrigeration appliances", Final Report, 4 March 2016, p. 35.

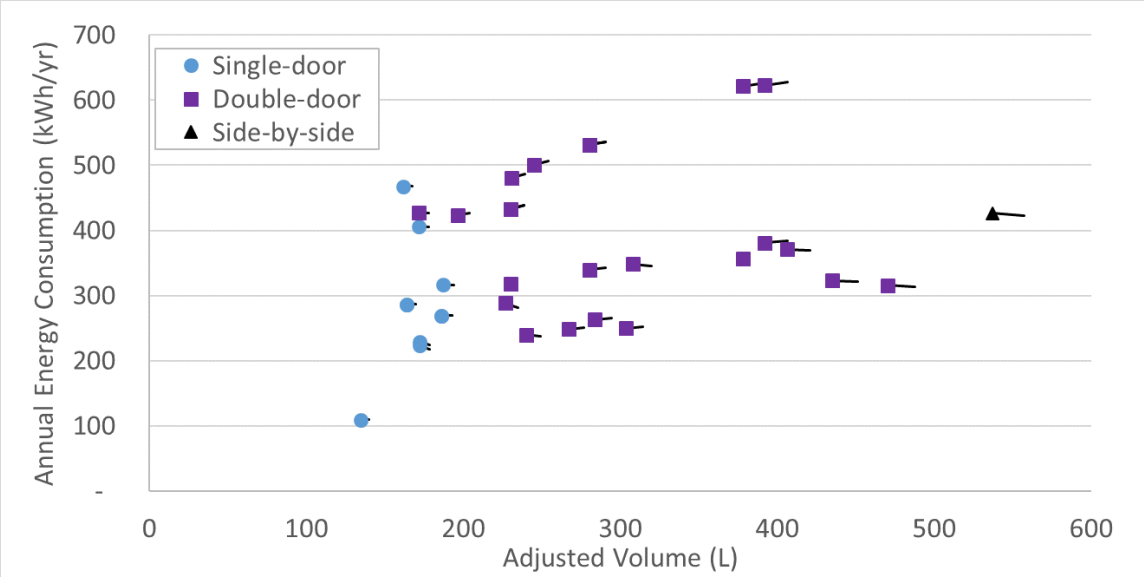

Figure 32: Energy performance and volume of models in the market, adjusted to the reference temperature conditions in IEC 62552:2015 where line indicates performance equivalent to ISO 15502:2005

In addition to the differences in performance due to different reference temperatures, the shift to IEC 62552:2015 would require a different measurement of defrost energy for refrigerators with automatic defrost. These differences are summarized in Table 8, below.

Table 8. Key differences between ISO 15502:2005 and IEC 62552-3:2015[69]

Aspect	EN 62552:2013 [Based on ISO 15502:2005]	IEC 62552-3:2015
Energy consumption	A test period must include at least one defrost and recovery period (which is called an operating cycle) and be longer than 24 h.	The test is split in two parts: a) a steady state part in which no defrost occurs, b) a defrost and recovery part (including period prior to defrost). The two parts must be added together taking the defrost interval time into account.
Temperatures during defrost	During the test period it is allowed that temperatures increase above the compartment temperature for a limited duration (4 hours or 20 % of operating cycle) and for a maximum value of 3 K	Incremental temperatures during defrost must be calculated and are added to the temperatures during the steady state part (in a similar way as incremental energy is added).
Defrost interval time	For full frost-free (having air exchange between fresh food and frozen food) the maximum operating cycle length is 48 hours.	Three possibilities: a) fixed time interval (as defined by the product hardware) b) fixed compressor run time (as defined by the product hardware) c) variable defrost.

[69] Martien Janssen, "Impact of the new IEC 62552-1,2,3:2015 global standard to cold appliance energy consumption rating", Report number 14127CE40/V2, 29 May 2015, p. 27.

Aspect	EN 62552:2013 [Based on ISO 15502:2005]	IEC 62552-3:2015
	For other frost-free appliances, the maximum length is 72 hours. The longer the defrost interval the smaller the impact of defrost energy.	For variable defrost the length of the defrost interval is not measured but calculated based on two parameters which must be declared by the manufacturer (and which can be checked). These are the maximum and minimum defrost interval length at 32°C ambient. Next, a formula is used which gives a defrost interval time of 40 hour in the best case and 6 hours in the worst case. To obtain the 40 hours, the maximum defrost interval must be declared as 96 hours which may be difficult to achieve with full frost-free products. The defrost interval time at 16°C is taken as the double value of the 32°C case.

It is unclear how different defrost timing in the test will impact efficiency. The presence of automatic defrost (common in among the double-door units), does not appear to have an impact on unit energy consumption of models in the dataset. During the development of the EU standard for refrigerators in 2016, the analysis team noted that automatic defrost is provided an adder of 36.5 kWh/year for freezers tested at 32 °C in Australia; however, no data were available at the time on the actual impact of the feature.[70]

Finally, the new standard also adds a measurement of load processing energy. This measurement is intended to capture the energy required to bring down the temperature of food from ambient and has been used historically in other Asian countries and Australia.[71] Since load processing was not included in the test method in the draft regulation, it has not been included in this analysis either.

[70] VHK and ARMINES, "Preparatory/review study: Commission Regulation (EC) No. 643/2009 with regard to eco-design requirements for household refrigeration appliances and Commission Delegated Regulation (EU) No. 1060/2010 with regard to energy labelling of household refrigeration appliances", Final Report, 4 March 2016, p. 110.

[71] VHK and ARMINES, p. 32,

6 Test Procedure and Testing Capability

6.1 Test Procedure in Draft Regulation

The Directorate General of New Renewable Energy and Conservation, MEMR in 2017, have defined the performance test procedure and requirements for Refrigerator based on SNI ISO 15502:2008. This was done through Draft Decree of Minister of Energy and Mineral Resources No.07 - 2015 concerning implementation of Minimum Energy Performance Standard and Inclusion Label of Energy Saving for Refrigerator Devices.[72]

The test procedure is a part of draft energy efficiency regulation (MEPS) and provides detailed description on method of conducting tests as well as key requirements for the tests in terms of equipment required and standard conditions to be maintained. The scope of test procedure includes;[73]

a) Determination of linear dimensions, volume and area;
b) Energy consumption with load and no load;
c) Tests carried out in accordance freezing capacity as per standard; and
d) Single-phase working voltage up to a voltage of 240 V alternating current 50 Hz.

The terms and procedures of energy consumption performance test is applicable to a refrigerator with a tropical climate class (T) according to Standard SNI 04-6710-2002. The requirements of the energy consumption performance test are to determine the level of energy efficiency of the refrigerator in accordance with the specified test conditions, in order to assess the compliance with MEPS and affixing Energy Saving Label Signs, SNI 04-6958-2003.

6.2 Existing Test Procedure for Refrigerators

The draft regulation references SNI ISO 15502: 2008. The ISO 15502:2005 “Household Refrigerating Appliances – Characteristics and Test Methods” is the reference International Standard.

ISO 15502:2005 and its corrigendum were then superseded by IEC 62552:2007 (ed.1), which was mostly identical. Both ISO 15502:2005 and its superseded standard IEC 62552:2007 have become obsolete and have been withdrawn by ISO and IEC. The latest and globally accepted test standard for refrigerator is IEC 62552:2015. Majority of the countries have moved to IEC 62552:2015 or have adopted the components of IEC 62552:2015 to match the global standards. Adherence to SNI IEC 62552 is voluntary.

A national standard harmonized with IEC 62552:2015 has also been adopted in Indonesia.[74] The standards can be accessed from the following website: http://akses-sni.bsn.go.id. All the three parts on the standard are adopted in entirety as given below:

1. IEC 62552-1:2015 was adopted identically as SNI 8557-1:2018 IEC 62552-1:2015
2. IEC 62552-2:2015 was adopted identically as SNI IEC 62552-2:2016
3. IEC 62552-3:2015 was adopted identically as SNI 8557-3:2018 IEC 62552-3:2015

[72] EU Commission, Database. https://ec.europa.eu/growth/tools-databases/tbt/en/search/?tbtaction=search.detail&Country_id=IDN&num=115&dspLang=EN&basdatedeb=&basdatefin=&baspays=HUN&basnotifnum=30&basnotifnum2=&bastypepays=&baskeywords=&CFID=41511&CFTOKEN=6da15e44af5fd56e-E0EA60F5-BDF0-C012-00D223C204443AF0

[73] Information on draft test procedure received from EBTKE.

[74] The IEC 62552:2015 has been approved and implemented in Indonesia. However, section 4.1.1 lists referred standard as SNI ISO 15502:2008. This is because the draft MEPS refers to ISO standard and there is a need for revision in the draft decree for MEPS.

6.3 IEC 62552:2015

An overview of the IEC standard is provided in **Appendix F**.

6.4 Existing Test Facilities and Capabilities

It should be noted that the facilities available within few of the manufacturer's premise is considered in this assessment as of now. Some of these facilities are also accredited by KAN for testing as per IEC 62552:2015. The manufacturers having accredited test facilities also adds-up to the overall testing capacity in the country. Combining the capacity from these facilities, it can be considered that the country has enough testing capacity for domestic refrigerators.

The respondents from PT. Sucofindo have shared that their existing facility is highly under-utilized because the regulation for refrigerator hasn't been implemented yet. The officials shared that as per them once the MEMR implements energy efficiency regulation then depending upon the demand from stakeholder PT. Sucofindo will be able to further expand their infrastructure and cater to the need of stakeholders. They also conveyed that as of now the testing facilities are good enough for the regulation to be initiated.

The list of test facilities along with preliminary information on the respective testing capacity for refrigerator is shared below.[75] Laboratories have the capacity to test the performance of 78 models per month or 936 models per year. Accredited laboratories have the capacity to test 14 models per month or 168 per year, which should be sufficient to test all the models in the market within one year (the team fond 98 models in retail and obtained specifications for 61 models from manufacturers).

An additional note regarding laboratory capacity is that European industry found that "for most products the duration of the tests under the new IEC standard [62552:2015] can be almost half with respect to the current test standard" based on ISO 15502:2005.[76] In Europe, testing to IEC 62552:2015 requires two tests, one at 16 °C and another at 32 °C. Since in Indonesia, only one test at 32 °C would be required, the test time would be further reduced.

Table 9. Testing infrastructure for domestic refrigerator in Indonesia

Test Facilities		SAFETY testing (nos.) (SNI IEC 60335-2-24:2009)		PERFORMANCE testing (nos.) SNI ISO 15502:2008 /IEC 62552:2015	
		Monthly indicative testing capacity (nos.)	Accreditation from KAN	Monthly indicative testing capacity (nos.)	Accreditation from KAN
1.	P2SMTP	2	No	0	-
2.	PT. Sucofindo	40	Yes	10	Yes
3.	PT. Qualis	48	Yes	12	-
4.	PT. Polytron	20	Yes	4	Yes
5.	PT. Panasonic	100	Yes	20	No
6.	PT. LG Electronics	144	No	24	No

[75] Information received from EBTKE

[76] VHK and ARMINES, "Preparatory/review study: Commission Regulation (EC) No. 643/2009 with regard to ecodesign requirements for household refrigeration appliances and Commission Delegated Regulation (EU) No. 1060/2010 with regard to energy labelling of household refrigeration appliances", Final Report, 4 March 2016, p. 32.

Test Facilities		SAFETY testing (nos.) (SNI IEC 60335-2-24:2009)		PERFORMANCE testing (nos.) SNI ISO 15502:2008 /IEC 62552:2015	
		Monthly indicative testing capacity (nos.)	Accreditation from KAN	Monthly indicative testing capacity (nos.)	Accreditation from KAN
7.	PT. Maspion	12	No	N/A	No
8.	PT. Sharp Electronics	30	No	20	No
9.	Balai Riset dan Standarisasi Industri Surabaya (Baristand Industri)	N/A	Yes	0	-
10.	Balai Besar Bahan dan Barang Teknik (B4T)	N/A	Yes	0	-
	Total	**396**		**90**	

Among the list of test facilities with infrastructure to conduct refrigerator testing (safety and energy performance testing), P2SMTP and PT. Sucofindo are the government facilities. P2SMTP is a research type facility and is generally not involved in providing certificates for registration purposes. Also, P2SMTP has provided confirmation that their facility has not received accreditation for refrigerator testing. The government owns almost 95% of stake in PT. Sucofindo. Remaining all facilities are private setups. Amongst the remaining setups, PT Qualis is third-party test facility and remaining are facilities of manufacturers. Detailed questionnaire-based assessment was carried out for PT. Sucofindo (LS Pro) and PT. Qualis.

6.4.1 Sucofindo

PT Sucofindo is a joint venture of government of Indonesia and Societe Generale de Surveillance Holding SA (SGS), Switzerland. The facility adheres to ISO/IEC 17025 for quality systems. PT Sucofindo's lab personnel are trained three times in a year for enhancing the competence levels, and the staff are required to clear the yearly competence test.

The labs in Sucofindo can perform tests 24×7. The lab is completely supported by power backup facility and seamless tests can be conducted. MEMR has invested for the new testing chamber to test refrigerator, washing machines, fan, and luminaire. The lab has facilities for testing the appliances for safety, as well as energy performance regulations. The lab has facility for testing the refrigerator and other appliances for safety requirements as per IEC 60335. Besides, the lab has both the resources and understanding of SNI ISO15502:2008, IEC 62552:2015 and Saudi Arabic Standards Organization (SASO) for testing the energy performance of refrigerators. During the survey, respondent from the lab confirmed that the facility has an approved accreditation for SNI ISO 15502:2008 from KAN.[77] The accreditation is valid until September 2024.

Regarding capability of test facility to test the refrigerators based on IEC 62552:2015, it was shared that PT. Sucofindo has the infrastructure and technical capability to conduct performance testing as per IEC

[77] Relevant supporting document i.e. accreditation certificate is awaited from the facility.

62552:2015. However, the facility has not initiated the request for obtaining accreditation for testing as per IEC 62552:2015 primarily because the draft regulation has not mentioned IEC 62552:2015 as referred standard so far. It was further shared that the test facility will be able to submit the request for obtaining accreditation for IEC 62552:2015 as soon as the MEMR makes revision in the draft regulation.

The testing capacity within independent facilities i.e. PT. Sucofindo (as per IEC 62552) is about 10 per month for complete energy performance testing. Therefore, considering testing of 10 product models per month, the annual testing capacity of PT. Sucofindo for refrigerators as per IEC 62552:2015 is estimated as 120.

6.4.2 Qualis

This is also a third-party testing facility located in Tangerang, Banten. They have suitably qualified personnel who have extensive experience in consumer electronics manufacturing industry. Also, they provide training to their staff every year to hone the skillsets, and the training is given by the resource person from the consumer electronic manufacturing industry. To-date, PT Qualis has accreditation for safety test for consumer electronics goods like air conditioners, washing machines, fans, water pumps, water heaters, battery chargers etc. In addition, the lab has energy performance testing accreditation for Air Conditioners and is in the process of obtaining accreditation for other appliances.

The lab fully depends on the state electricity supply company for power requirements, and the lab does not have a provision for power backup. However, the lab is planning to have power backup infrastructure in place in coming years. The lab has energy performance testing facility in place for refrigerators but, they follow SNI ISO15502:2008. Even though the lab has the energy performance testing facility, it does not have accreditation. Their understanding is limited to SNI ISO 15502:2008 at present.

PT. Qualis is in the process of getting accreditation for energy performance testing. Going forward, it is expected that the facility from PT. Qualis will soon be augmented to cater the testing as per IEC 62552:2015. Thus, the facility from PT. Qualis is expected to add the overall testing capacity for domestic refrigerator in the country in near future.

7 Policy Analysis Methodology

To support EBTKE's effort in formulating effective energy conservation regulations, CLASP used the findings from this market study to evaluate the drafted MEPS and labeling policies and develop policy scenarios. CLASP used the Policy Analysis Modeling System (PAMS), which was developed with Lawrence Berkeley National Laboratory to generate assessments that can be used by key stakeholders in the policymaking process.

PAMS is a tool that helps policymakers assess the benefits of energy efficiency policies and identify the most attractive targets for MEPS levels. It is an Excel workbook designed to give first-order policy impacts projections with a minimal preparatory research on the part of local policymakers. The model can be also used to perform robust technical analysis to support the development of MEPS, by customizing the tool with any available country-specific data.

PAMS can estimate savings potential from implementing policies that improve the energy efficiency of products in any economy. The impacts are examined from two perspectives – the consumer and national perspective:

- At the consumer level, savings are estimated using life-cycle cost (LCC) metric - the total costs of owning the appliance, including the purchase price and the electricity cost throughout its life between business as usual and the improved policy scenario.
- At the national level, energy savings are expressed in terms of the reduction in national energy consumption due to more efficient appliances as well as in terms of avoided CO2 emissions resulting from reduced electricity consumption.

In this analysis, CLASP evaluated the impacts to consumer as well as impacts at the national level for selected policy scenarios. Additionally, CLASP estimated the impacts to the manufacturers by calculating the number of models eliminated from the market under more stringent MEPS.

7.1. Baseline Analysis

To estimate the impact of potential MEPS, CLASP first evaluated the cost-efficiency relationship of models in the dataset. As can be seen in Figure 33, CLASP found a strong correlation between price and energy consumption after normalizing for adjusted volume, removing single-door and side-by-side models, and excluding an outliers with a price above 15,000,000 IDR.

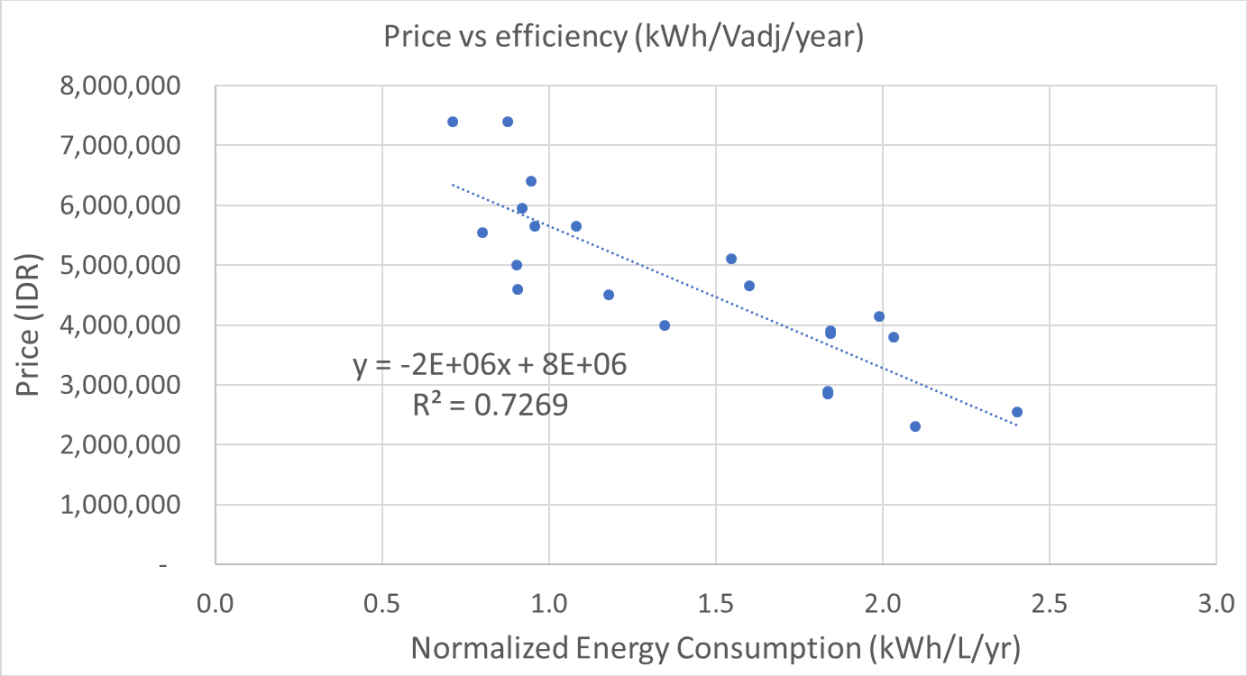

Figure 33: Cost-efficiency relationship for double-door refrigerators

By performing a multivariate regression with energy consumption and adjusted volume as the independent variables, the coefficient of determination (R^2) was increased to 0.86. The regression results are summarized in Table 10. These regression results were then used to determine the price of the representative model in the baseline (no MEPS) and MEPS scenarios.

Table 10. Multivariate regression results for double-door refrigerators; price as a function of adjusted volume and annual energy consumption. R^2 = 0.86

Parameter	Coefficient	*p*-value
Intercept	1,488,981	0.03
Adjusted Volume (L)	16,852	2E-09
Tested Annual Electricity Consumption - (kWh/year)	-4,884	2E-04

The earlier review of retail models found that double-door models with a gross volume of 205 L are the most popular. There were two double-door models with a gross volume of 205 L in the dataset. Both of these had an adjusted volume of 239 L; therefore, this was the representative adjusted volume chosen for the analysis. The energy consumption of the other models in the dataset was scaled to the representative unit by multiplying by the ratio of the representative adjusted volume and the adjusted volume of each unit, resulting in a baseline unit energy consumption of 329 kWh/yr. Using the regression in Table 10, the price for this baseline unit was estimated at 3,879,465 IDR.

No cost-efficiency relationship was found for single-door models, as can be seen in Figure 34. However, to calculate the energy savings, a representative unit with an adjusted volume of 195 L was used in the analysis. This corresponded to a gross volume of 185 L, the most popular among single-door models. As before, the performance of the other models in the dataset was scaled by the ratio of the representative adjusted volume and the model volume, to arrive at a market average unit energy consumption of 314 kWh/yr.

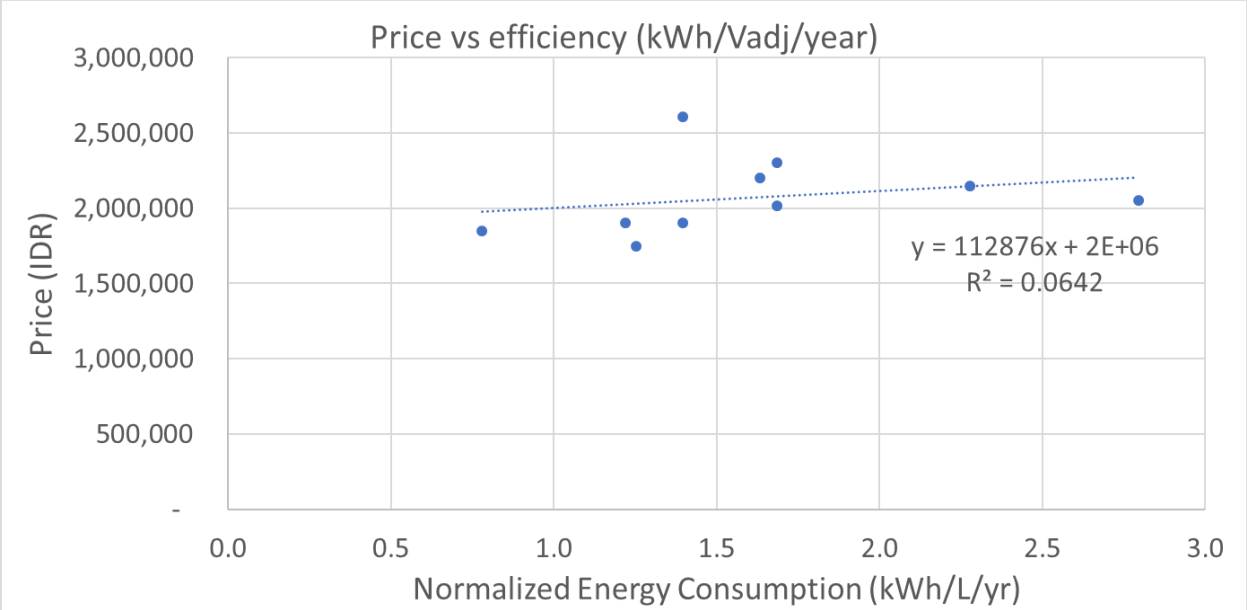

Figure 34: Cost-efficiency relationship for single-door refrigerators, no correlation

7.2 Model Inputs and Assumptions

PAMS estimates the impacts of implementing policies that improve energy efficiency of new equipment by calculating the difference between a business-as-usual scenario (i.e., no policies implemented) and a policy scenario (i.e., higher MEPS or Best Available Technology). The model uses a bottom-up approach, based on a stock model and sales forecasts considering first purchase (increase in number of households and ownership levels) and replacement of retired appliances.

In the model, total energy consumption is estimated per year for the stock in use under each policy scenario. Emissions are estimated using an electricity CO2-intensity emissions factor, CO2/kWh. Costs consider appliance prices (defined for each scenario using a cost-efficiency curve reflective of the market) and local electricity prices to estimate total life cycle cost (purchase price and cost of electricity bill over appliance lifetime).

CLASP used the following data inputs and assumptions to estimate the impacts under different scenarios:

- Electricity price of 1,467.28 IDR/kWh, equivalent to 0.10 USD/kWh was applied, based on the most recent price for non-subsidized tariff for the R-1 residential class, published by PLN for the year of 2019.
- Transmission and distribution (T&D) losses at 9.51%, as published in PLN's annual statistics report for the year of 2018.
- CO_2 emissions factor of 0.807 kg/kWh was applied, as listed in PLN's statement release.[78]
- The standard year or year when policy is implemented is set at 2020.
- Consumer discount rate of 6.1%, national discount rate of 6.5% and real income growth rate of 4.0% from World Bank for 2018.
- Population and urbanization data from United Nations, namely from the 2017 revisions of the World Population Prospects dataset from the Department of Economic and Social Affairs, Population Division.
- Unit energy consumption was calculated based on the baseline values discussed in the previous section.
- The exchange rate used for conversion to and from IDR and USD was 14,124.50 IDR/USD.

[78] PLN Bantah PLTU Jadi Penyebab Polusi Jakarta. (2019, August 3). Retrieved from https://nasional.republika.co.id/berita/pvnraa377/pln-bantah-pltu-jadi-penyebab-polusi-jakarta

Further, specific model assumptions to refrigerators are shown below. Additional shipments scenarios were developed using 3.5% and 5% growth rates:

		Single-door Refrigerator 185 L Gross Volume	Double-door Refrigerator-freezer 205 L Gross Volume	Notes
Product Lifetime (years)		10	10	Confirmed by CLASP Indonesia residential end-use survey
Stock in 2018 (millions of units)		36.3	9.15	Confirmed by CLASP Indonesia residential end-use survey
Historical Shipments (millions of units)	**2016**	1.50	1.11	
	2017	1.35	1.00	
	2018	1.31	1.12	
Forecast Shipments (millions of units)	**2019**	1.45	1.02	Ipsos calculation based on historical shipment and growth trend input from macroeconomy condition, household and population growth, as well as input from manufacturers
	2020	1.47	1.03	
	2021	1.48	1.05	
	2022	1.50	1.06	
	2023	1.52	1.07	
	2024	1.54	1.08	
	2025	1.56	1.10	
	2026	1.57	1.11	
	2027	1.59	1.12	
	2028	1.61	1.14	
	2029	1.63	1.15	
	2030	1.65	1.16	
Energy Consumption (kWh/yr)	**Base case (no MEPS)**	314	335	UECs are averages across all models of the particular subtype in the dataset adjusted scaled to the representative volume under different standard scenarios, and also include models unaffected by MEPS.
	CLASP Recommended MEPS	292	303	
Price (IDR)	**Base case (no MEPS)**	2,303,789	3,879,465	Calculated based on adjusted volume and energy consumption using regression
	CLASP Recommended MEPS	2,303,789	4,038,213	

8 Policy Options and Results

EBTKE Draft Regulation

The MEPS level in the draft EBTKE regulations are reproduced below in Table 11, covering refrigerator products with maximum gross volume capacity of 300 L. As mentioned previously, all models in the dataset can meet the regulations such that they would have no effect on the market if adopted.

Table 11. MEPS in the draft EBTKE regulation (MEPS is at 1 star)

1. Does not have the capacity of freezing

Formula / Rating Bintang	Konsumsi energi/tahun (kWh/tahun)
1-Bintang(☆)	≤ [465 + (1,378 x V_{adj})] x 1,15
2-Bintang(☆☆)	≤ 1-Bintang x 0,77
3-Bintang(☆☆☆)	≤ 2-Bintang x 0,77
4-Bintang(☆☆☆☆)	≤ 3-Bintang x 0,77

2. Has a freezing capacity

Formula / Rating Bintang	Konsumsi energi/tahun (kWh/tahun)
1-Bintang (☆)	≤ [465 + (1,378 x V_{adj})] x 1,55
2-Bintang (☆☆)	≤ 1-Bintang x 0,77
3-Bintang (☆☆☆)	≤ 2-Bintang x 0,77
4-Bintang (☆☆☆☆)	≤ 3-Bintang x 0,77

CLASP Recommendation

In contrast, CLASP has developed a set of MEPS and labelling tiers that will eliminate the least efficient models, while recognizing higher efficiency, without negatively impacting local manufacturers. The proposed performance levels are listed in Table 12 and shown in Figure 35 with the pass rates for each category.

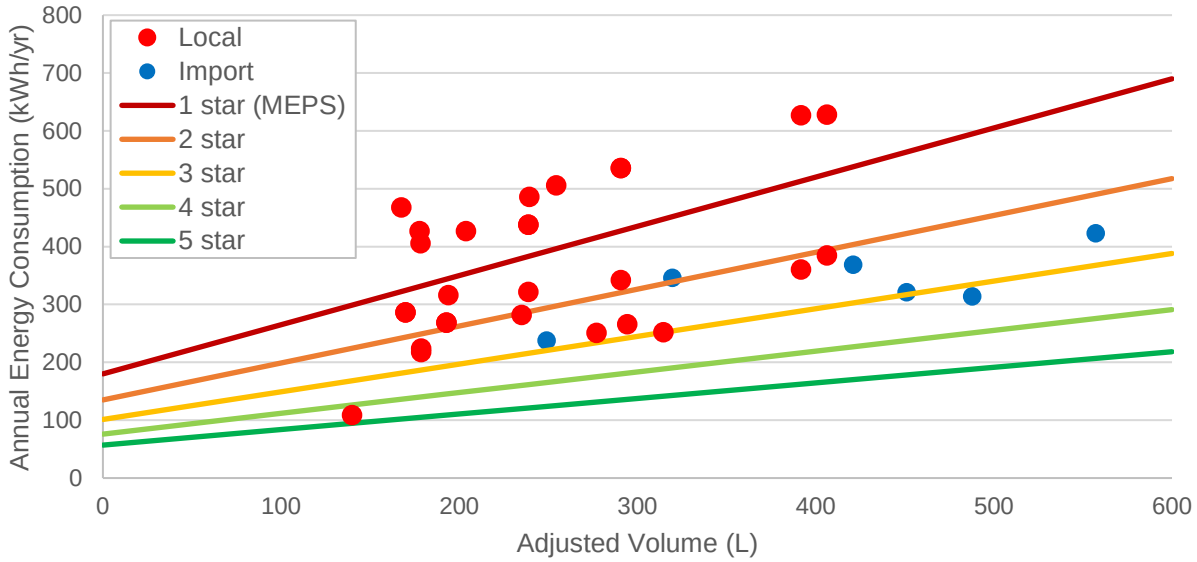

Figure 35: CLASP recommended performance requirements compared to the tested models.

Table 12. CLASP recommended labeling tiers and compliance rates (MEPS is at 1 star).

Adjusted Volume (L)	Energy Consumption (kWh/yr) Level				
	1 Star/MEPS	*2 Star*	*3 Star*	*4 Star*	*5 Star*
	$(0.85 \times V_{ADJ}) + 180$	*0.75 × 1 Star*	*0.75 × 2 Star*	*0.75 × 3 Star*	*0.75 × 4 Star*
0	180	135	101	76	57
100	265	199	149	112	84
200	350	263	197	148	111
300	435	326	245	184	138
400	520	390	293	219	165
500	605	454	340	255	191
600	690	518	388	291	218

9 Impacts Assessment

9.1 Impacts to Consumers

The impacts to consumers from the CLASP-recommended MEPS are shown in *Table 13*. The results show a minimal price increase of approximately 5,000 IDR and an energy reduction of as products are redesigned to meet the CLASP-recommended MEPS, but an annual electricity bill savings of approximately 11,000 IDR, which results in a lifecycle cost savings of 32,000 IDR.[79] The cost would be paid back within 0.5 years of the product's 4-year average life.

Table 13. Consumer impacts of different MEPS options

Policy Option	Product Subtype	Price Increase (1000 IDR)	Lifecycle Cost Savings (1000 IDR)	Payback Period (years)	Product Life (years)
EBTKE MEPS in Draft Regulation	Single-door Refrigerator	0	0	N/A	10
	Double-door Refrigerator	0	0	N/A	10
CLASP Recommended MEPS	Single-door Refrigerator	0	239	0	10
	Double-door Refrigerator	344	191	3.3	10

9.2 Impacts to Manufacturers

Based on the performance of models in the dataset, CLASP estimates that 65% of models would be able to meet the requirements, including 47% of local models. Each of the four brands that provided data would continue to have models that meet the MEPS, with continuing availability of both single- and double-door models.

Table 14. CLASP recommended labeling tiers and compliance rates for locally manufactured models (MEPS is at 1 star)

Performance Data	Non-compliant	Energy Efficiency Ratio (Watt hour/liter), Where: *V* is the measured (80% water) volume in liters.				
		1 Star/MEPS	*2 Star*	*3 Star*	*4 Star*	*5 Star*
		(0.85 × V_{ADJ}) + 180	*0.75 × 1 Star*	*0.75 × 2 Star*	*0.75 × 3 Star*	*0.75 × 4 Star*
Test Result – Local (n=28)	53%	21%	24%	0%	3%	0%

[79] This is the average impact across all models in the dataset. For the 30% of non-compliant models, the price increase necessary to just meet the CLASP MEPS level would be approximately 12,000 IDR while decreasing annual energy consumption by 28 kWh .

9.3 Impacts at the National Level

While consumer impacts of the regulation are small, the large number of refrigerators in Indonesia results in significant energy and CO_2 benefits to the nation. Table 15 shows the savings over the decade (2020-2030) and annually (in 2030).

Table 15. Indonesian national impacts of different MEPS options

Policy Option	Product Subtype	Final Energy Savings (TWh)		CO2 Mitigation (Mt)	
		2020-2030	2030	2020-2030	2030
EBTKE MEPS in Draft Regulation	Single-door Refrigerator	0	0	0	0
	Double-door Refrigerator	0	0	0	0
	Total	**0**	**0**	**0**	**0**
CLASP Recommended MEPS with 1.2% Growth	Single-door Refrigerator	1.7	0.3	1.5	0.3
	Double-door Refrigerator	1.8	0.3	1.6	0.3
	Total	**3.5**	**0.6**	**3.1**	**0.6**
CLASP Recommended MEPS with 3.5% Growth	Single-door Refrigerator	2.0	0.4	1.8	0.3
	Double-door Refrigerator	2.0	0.4	1.8	0.3
	Total	**4.0**	**0.8**	**3.6**	**0.6**
CLASP Recommended MEPS with 5% Growth	Single-door Refrigerator	2.2	0.4	1.9	0.4
	Double-door Refrigerator	2.2	0.4	2.0	0.4
	Total	**4.4**	**0.8**	**3.9**	**0.7**

10 Conclusion and Recommendations

This *Indonesia Refrigerator Market Study and Policy Analysis* provides the technical evidence to support a revision of MEPS. Government agencies can use this information to define their efficiency baseline for refrigerators, quantify potential energy and GHG emissions reductions in support of national energy efficiency targets or NDC commitments, and estimate other potential benefits from revising the drafted energy efficiency policy requirements.

The analysis presented in this report was based on product data for almost 100 models found in retail and 61 models provided by manufacturers, including 34 with performance data. Manufacturers provided sales data. Stock was based on CLASP's 2019 5000-household Indonesia end-use survey.

Refrigerators are an important household appliance in Indonesia, contributing significantly to the nation's electricity use due to their high unit energy consumption and high penetration (71% nationally).

Currently EBTKE is developing MEPS and labeling criteria for refrigerators. **Refrigerators found on the market would easily exceed the current draft MEPS,** based on either the test method referenced in the draft regulations or the latest International Standard, IEC 62552:2015, which was adopted as an Indonesian National Standard in 2019. **CLASP recommends referencing this new test standard** as it should also reduce testing time.

While the new and old standards are significantly different, the impact on measured energy consumption is expected to be low. CLASP has proposed new requirements that recognize more efficient products in the market and result in significant energy savings. Furthermore, the products can be met by all manufacturers that provided data and would not result in significant price impacts on consumers. CLASP estimated the energy and emissions savings and LCC savings for consumer, which were significant and positive. Based on this analysis, CLASP recommends adopting more ambitious performance levels to eliminate the least efficient models from the market.

In preparation to the upcoming revision to the existing draft regulation, a Focus Group Discussion (FGD) was held by EBTKE in Jakarta on January 29th, 2020. Key market study findings and CLASP's recommendations were presented to a smaller group of key stakeholders, namely major manufacturers, approved testing facilities, governmental research laboratories, and technical experts. This FGD serves as a forum for these key industrial representatives to voice their opinions, provide inputs, and state possible concerns for the proposed requirements.

Through this meeting, EBTKE had successfully established a collective agreement between the key stakeholders for the recommended reference standard, the MEPS requirements, and the comparative labeling criteria. Recommended use of the SNI-adopted IEC 62552:2015 as the reference standard for the refrigerator policy was accepted by the industrial representatives. The IEC 62552:2015 standard has been established as the globally recognized standard for refrigerators and is expected to gradually replace the older version of IEC 62552:2007 and its withdrawn equivalent standard of ISO 15502:2005 in countries where refrigerator policies are enforced.

As for the set of requirements proposed by CLASP, the levels were claimed to be too stringent by a number of major manufacturers. While several of these manufacturers did not provide performance data for the purpose of the policy analysis, higher energy consumption limits were considered during the meeting. The MEPS requirements were then revised to be 90 kWh/yr higher, and accordingly adjusted for the comparative labeling criteria proportional to the CLASP recommended levels.

This less stringent alternative policy option was agreed to by the key stakeholders. Shown in Figure 36 and Figure 37 are the distribution of the available performance data against the CLASP recommended policy and the alternative agreed-upon levels, respectively. Tabulated values of the original CLASP recommended policy and the alternative levels are provided in the subsequent tables, Table 16 and Table 17, respectively.

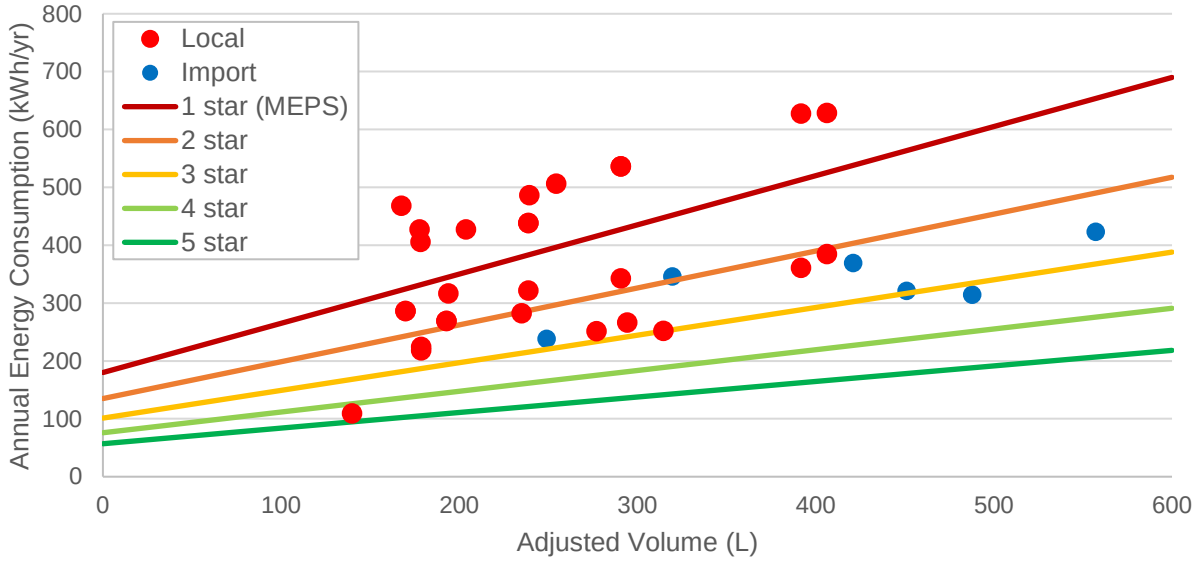

Figure 36: CLASP recommended MEPS and labeling requirements for refrigerators with and without freezing capacity

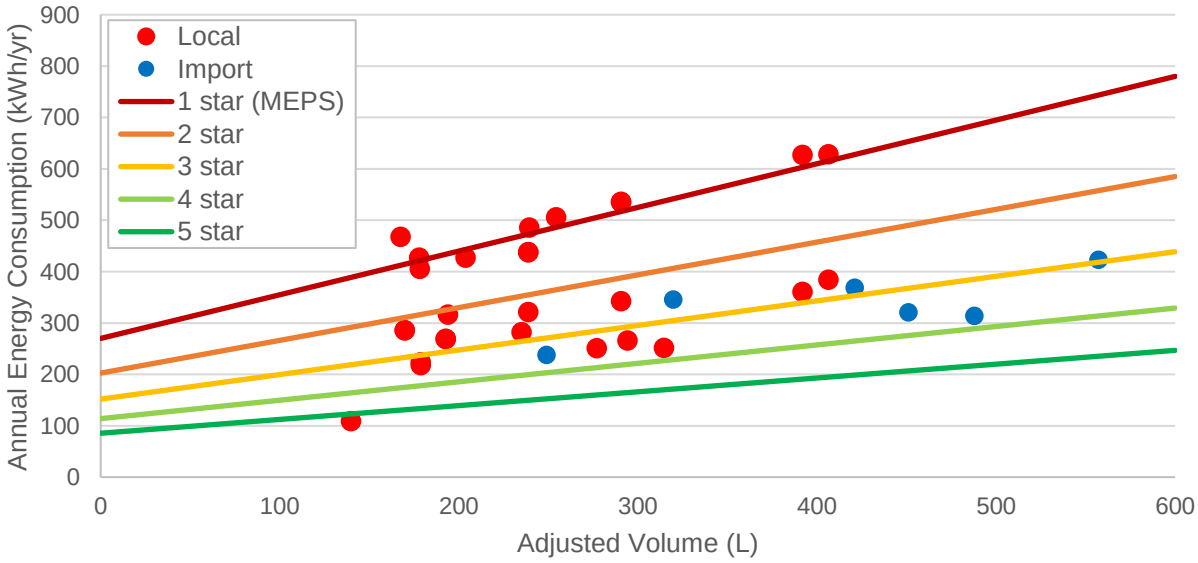

Figure 37: MEPS and labeling requirements agreed on during the January 29th, 2020 FGD

Table 16. Tabulated values of CLASP's original refrigerator policy recommendation

Adjusted Volume (L)	Energy Consumption (kWh/yr) Level				
	1 Star/MEPS	2 Star	3 Star	4 Star	5 Star
	$(0.85 \times V_{ADJ}) + 180$	0.75 × 1 Star	0.75 × 2 Star	0.75 × 3 Star	0.75 × 4 Star
0	180	135	101	76	57
100	265	199	149	112	84
200	350	263	197	148	111
300	435	326	245	184	138
400	520	390	293	219	165
500	605	454	340	255	191
600	690	518	388	291	218

Table 17. Tabulated values of the agreed alternative levels

Adjusted Volume (L)	Energy Consumption (kWh/yr) Level				
	1 Star/MEPS	2 Star	3 Star	4 Star	5 Star
	$(0.85 \times V_{ADJ}) + 270$	0.75 × 1 Star	0.75 × 2 Star	0.75 × 3 Star	0.75 × 4 Star
0	**270**	**203**	**152**	**114**	**85**
100	**355**	**266**	**200**	**150**	**112**
200	**440**	**330**	**248**	**186**	**139**
300	**525**	**394**	**295**	**221**	**166**
400	**610**	**458**	**343**	**257**	**193**
500	**695**	**521**	**391**	**293**	**220**
600	**780**	**585**	**439**	**329**	**247**

Comparing the alternative levels with different policy requirements in other countries, the alternative policy option would be slightly less stringent than Singapore's policy, comparable to Malaysia's policy, and slightly more stringent than Vietnam's policy for refrigerators with freezing capacity, shown in Figure 38.

Additionally, the agreed MEPS level for would be more stringent compared to Korea's and the Philippines' policy, but less stringent compared to Singapore's, Malaysia's, and Vietnam's policy, as shown in Figure 39. As recommended by CLASP and agreed by the key stakeholders, differentiation based on freezing capacity was not considered necessary, as products both with and without freezing capacity could meet the requirements at similar rates.

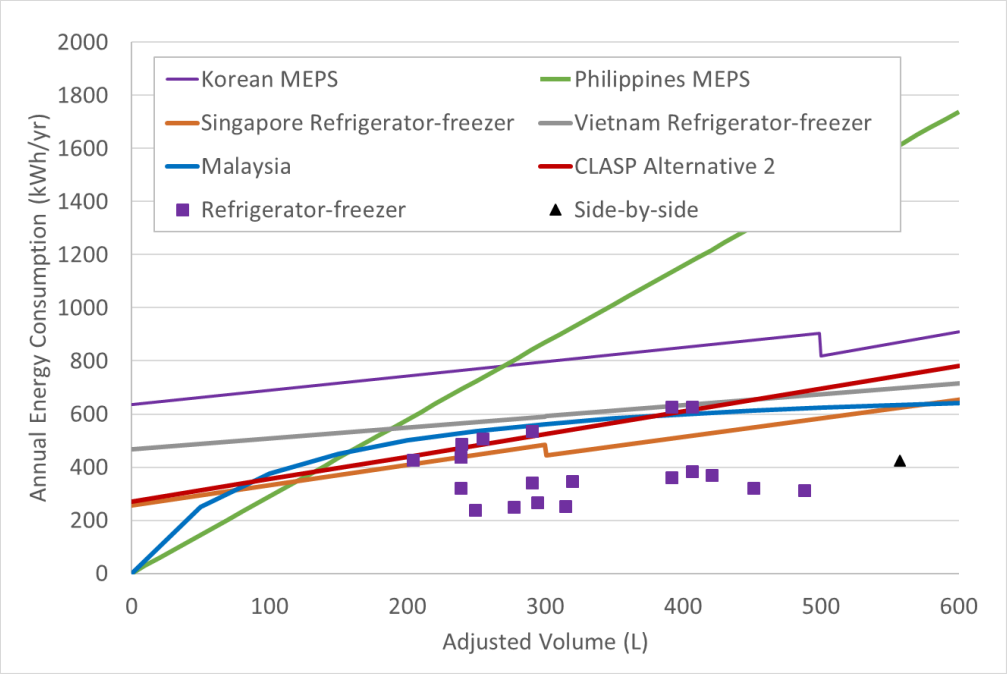

Figure 38: Comparison of other countries' policies for refrigerators with freezing capacity and the MEPS level agreed upon during the January 29 Focus Group Discussion

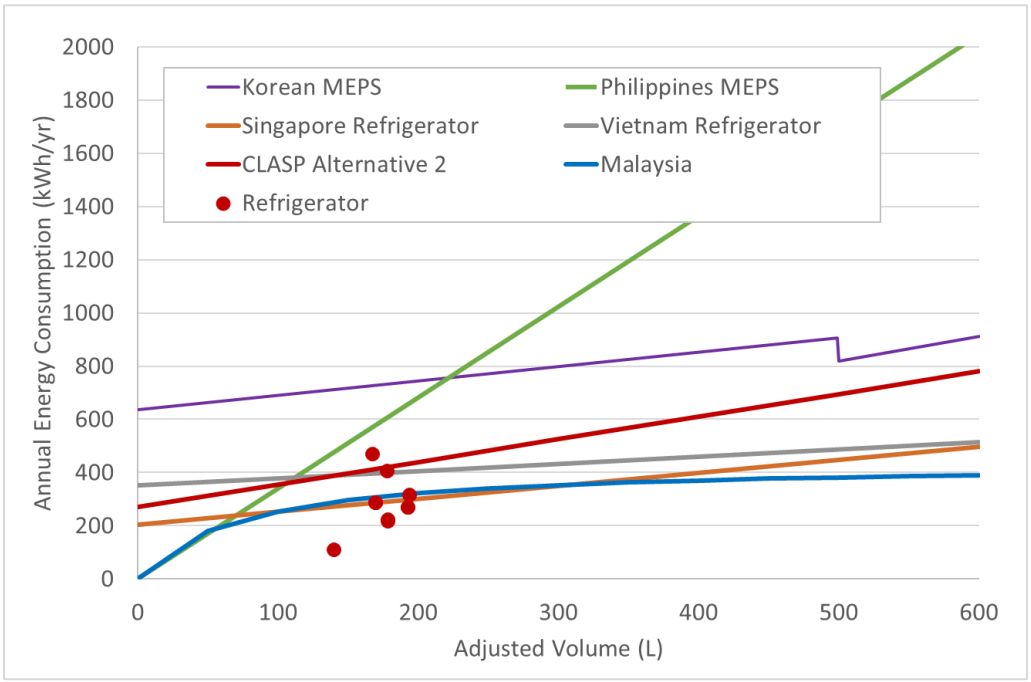

Figure 39: Comparison of other countries' policies for refrigerators without freezing capacity and the MEPS level agreed upon during the January 29 Focus Group Discussion

Following the January FGD, subsequent discussions took place in February 2020. EBTKE decided to proceed with the agreed-upon alternative levels in the revised draft regulation. In addition to this, the new SNI standards based on IEC 62552:2015 will be the referenced test standard, as recommended by CLASP and agreed during the FGD.

Given the resulting higher pass rates for refrigerators with lower efficiency rates, the national level impacts would be much lower. Under CLASP's recommended levels, GHG emissions mitigation of at least 5.3 $MtCO_2$ from 2020 to 2030 and 0.7 $MtCO_2$ in 2030 would be achieved. However, under these agreed levels, the mitigated emissions become 1.1 $MtCO_2$ from 2020 to 2030 and 0.1 $MtCO_2$ in 2030.

Nonetheless, the introduction of refrigerator policy in Indonesia would be beneficial by eliminating the least efficient products from the market and increasing consumers' awareness of energy consumption of refrigerators, an appliance that operate continuously for 24 hours a day. Finally, policy will lead to data collection, which will make it possible to establish more ambitious requirements in a future revision, ensuring energy conservation targets are achieved at the national level while bringing further monetary benefits to households.

Appendix A Refrigerator HS Codes

HS is the abbreviation of Harmonized Systems. It is an internationally accepted commodity description and coding nomenclature for product classification. As defined by the world customs organization (WCO) internationally six-digit HS codes are followed for classifying the products however, the countries are free to further classify the products by adding additional numbers to first six digits.

In Indonesia eight-digit HS codes are followed where the last two digits are specific to Indonesia. In the draft MEPS following codes were mentioned:

Table B1. Eight-digit HS codes mentioned in draft MEPS of Indonesia

Sr. No.	HS codes	Description
1.	HS 8418.10.11	Combined refrigerator and freezer of capacity <=230L fitted with separate external door, household type
2.	Ex HS 8418.10.19	Combined refrigerator and freezer of capacity >230L fitted with separate external door, household type
3.	HS 8418.21.10	Refrigerator of capacity <=230L, household and compression type
4.	Ex HS 8418.21.90	Refrigerator of capacity >230L, household and compression type
5.	HS 8418.29.00	Refrigerator for household but not compression type
6.	Ex HS 8418.30.10	Freezers of capacity <=200L, the chest type
7.	Ex HS 8418.30.90	Freezers of 200L< capacity <=800L the chest type
8.	HS 8418.40.10	Freezers of capacity <=200L, the Upright type
9.	Ex HS 8418.40.90	Freezers of 200L< capacity <=800L the upright type

Here, EX refers to product codes which are excluded and thus not considered for the regulation.

However, for 'Indonesia refrigerator market study' only the HS codes pertaining to refrigerators and combined refrigerator-freezer are considered for extracting the import and export figures. These are tabulated below.

Table B2. Six-digit HS codes considered for extracting import and export data

Sr. No.	HS codes	Description
1.	8418.10	Refrigerators and freezers; combined refrigerator-freezers, fitted with separate external doors, electric or other
2.	8418.21	Refrigerators; for household use, compression-type, electric or other
3.	8418.29	Refrigerators; household, electric or not, other than compression-type
4.	8418.22	Refrigerators; for household use, absorption-type, electrical

The standalone freezers of both chest and upright types (8418.30 & 8418.40) are not covered in the report and export - import data analysis.

Appendix B Key Stakeholders

A summary of stakeholders consulted for collection of relevant data is tabulated below (the list also includes few of those stakeholders where the data collection is in-progress presently)

Table A1. List of stakeholders

Type of stakeholder	Name of stakeholder	Status of discussion /interviews
Ministries and government stakeholders	EBTKE ESDM	Done
	Ministry of Trade	Done
	Ministry of Industry	Done
	Indonesia National Single Window (INSW)	Done
	Badan Standardisasi Nasional (BSN)	Done
	Badan Pusat Statistik (BPS)	Done
	Komite Akreditasi Nasional (KAN)	Done
Certification and testing	LSPro - PT Sucofindo	Done
	PT Qualis	Done
Associations	Gabel	Done
Local and international manufacturers /importers	PT Sanken Argadwija	Done
	PT Mitsubishi Electronic Indonesia	Done
	PT Yasonta / Sharp Electronics	Done
	PT LG Electronic	Done
	PT Hitachi Asia Indonesia	Done
	PT Panasonic	Done
	PT Sanyo /Aqua	No response from the manufacturer
	PT Polytron	Data requirement discussed with manufacturer, but no information received
Retailers	Traditional and Modern stores	Done (13 stores)

The status mentioned in the table above specifies some of the stakeholders where the interview-based data collection has not yet happened, and at present the team is in the process of scheduling it in-consultation with the respective stakeholder.

Appendix C Retail Stores

Assessment of consumer behavior towards purchase of refrigerators in Indonesia has been done through 'Point of Salespersons' (Retailers). The list of key retailers in Indonesia (including both traditional and modern stores) surveyed is shared below:

Table C1: List of retail stores visited in Indonesia

Sr. No.	Shop Name	Area/Market (in Jakarta)	Address
1.	Sinar Teratai Elektronik	Klender	Ruko perumnas klender
2.	Bintang Jaya Elektronik	Klender	Jl. Teratai Putih Raya No. 9
3.	Tri Jaya Elektronik	Klender	Jl. Teratai Putih Raya No. 10B Perumnas Klender jakarta timur
4.	Mega Bintang Electronc	Klender	Teratai putih raya blok 17 no.10 pasar klender jakarta timur
5.	Karuniya Jaya	Kramat Jati	Kramat Jati, numbr 5
6.	Irma Jaya	Kramat Jati	Kramat Jati, numbr 17
7.	Prima Elektronik	Pondok Gede	Jl Pasar Pondok Gede No C1-C2
8.	Sumber Abadi	Pondok Gede	Jl Pasar Pondok Gede No 2-3
9.	Electronic City	Buaran	Jl. Raden inten #1, Jakarta Timur
10.	DJ Electronic	Pasar Minggu	Jalan Pasal Minggu Block F39
11.	Central Electronics	Pasar Minggu	Jalan Jaya Pasal Minggu Block
12.	Electronic City	Toko Mokoen	Jalan Raden Inten A Nio 1 Jakarta timur
13.	Kenanga Jaya Store	TEBET	Jalan Tebet Barat IX No 44

Appendix D Stock Forecast

The forecasting of installed stock by the end of 2030 is done in two parts:

1. **Surviving stock based on future sales from 2019-2030:** Surviving stock of future sales of refrigerators from the year 2019 to 2030, is determined with the help of CLASP's Product Policy Analysis Tool.
2. **Stock based on survival of refrigerators which are already in-use up to 2018:** The surviving stock of presently installed refrigerators in the country, equal to 47 million units, per CLASP's Indonesia residential end-use survey.

Figure below depicts the concept behind the stock projection process followed to estimate the stock by the end of 2030.

Figure D1: Stock projection methodology

CLASP Product Policy Analysis Tool is used for estimating the surviving stock of future sales (2019-2030). The tool uses the estimated future sales and the average life of the appliance as inputs for calculating the surviving stock of future sales (2019-2030). As already depicted in Figure D1, the future sales are estimated by considering a year on year growth of 5% (sale in the year 2018 is used as baseline), and 10 years as the life of refrigerators. The survival stock distribution of future sales is tabulated in Table D1. The percentage values tabulated in are the survival rate of stock.

For example, the surviving stock by the end of 2024 (column-wise), will comprise of 93%, 97%, 98%, 99%, 100% and 100% of refrigerators sold in the years (row-wise) 2019, 2020, 2021, 2022, 2023, and 2024 respectively. Similarly, in further years, some percentage of refrigerators from the previous years will accumulate (survive) and some will retire.

Table D1. Survival stock distribution

Estimated Sales (5% YoY growth) (million)		Years for which the survival stock is forecasted												
		Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2.60	Year of future sales	2019	100%	100%	99%	98%	97%	93%	89%	82%	73%	62%	50%	38%
2.73		2020	0%	100%	100%	99%	98%	97%	93%	89%	82%	73%	62%	50%
2.87		2021	0%	0%	100%	100%	99%	98%	97%	93%	89%	82%	73%	62%
3.01		2022	0%	0%	0%	100%	100%	99%	98%	97%	93%	89%	82%	73%

3.17		**2023**	0%	0%	0%	0%	100%	100%	99%	98%	97%	93%	89%	82%
3.32		**2024**	0%	0%	0%	0%	0%	100%	100%	99%	98%	97%	93%	89%
3.49		**2025**	0%	0%	0%	0%	0%	0%	100%	100%	99%	98%	97%	93%
3.66		**2026**	0%	0%	0%	0%	0%	0%	0%	100%	100%	99%	98%	97%
3.85		**2027**	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	99%	98%
4.04		**2028**	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	99%
4.24		**2029**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%
4.45		**2030**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Surviving stock (millions)			2.60	5.34	8.18	11.14	14.23	17.36	20.55	23.71	26.79	29.75	32.54	35.15

Figure D3 presents the estimated stock of refrigerators from 2019 to 2030. The surviving stock in the year 2030 is estimated to be 26.6 million from units sold from 2019 to 2030, and 35.6 million for the 47 million units currently in stock sold before 2019.

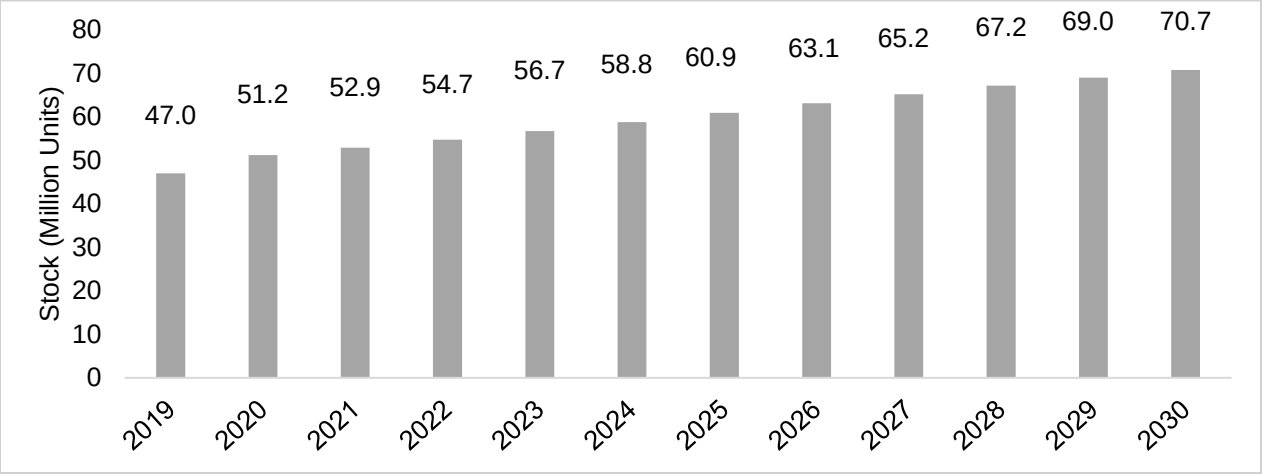

Figure D3: Estimated installed stock for 5% sales growth (2019-2030)

Secondly, it was already explained that ~39 million refrigerators are installed/in-use in the country by the end of 2018. To calculate the survival of in-use refrigerator in each year from 2018 onwards requires information on past sales /market consumption. The composition of past sales is limited owing to the lack of historical sales data. Therefore, the survival stock of past sales cannot be accurately determined. However, **for illustration, it is assumed** that the installed/in-use refrigerators retire at a rate of 2.5% year on year.

Survival stock of refrigerators which are installed/in-use until 2018

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
EXAMPLE: Surviving stock of past sales (until 2018)	47.0	45.8	44.7	43.6	42.5	41.4	40.4	39.4	38.4	37.4	36.5	**35.6**

Finally, the surviving stock by the end of 2030 will be sum of the surviving stock of sales from 2019-2030 and the surviving stock of past sales (i.e., until 2018).

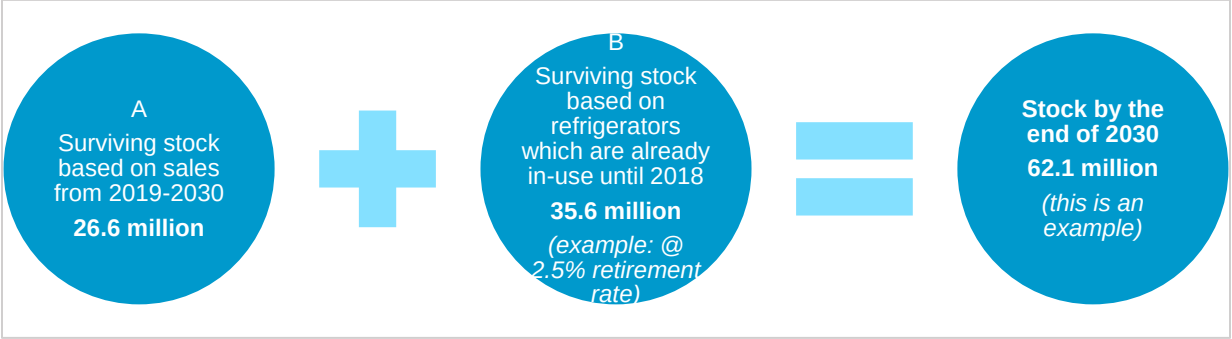

Figure D4: Illustrative representation of stock by the end of 2030

Appendix E Labeling Application Review Process

The summary of application process and its review defined under the draft regulation is provided in this appendix.

Competent authority	Director General, MEMR Manufacturers or Importer, before affixing Energy Saving Label Signs on the Refrigerator, must obtain permission from the Director General
Documents required to be submitted for seeking permission for Labeling	Manufacturers of domestic refrigerator or importers must apply to the Director General by enclosing the following documents: a) Energy Saving Certificates; b) Tax ID number; c) Deed of Incorporation; d) Photocopies of certificates using SNI mark IEC 60335-2-24: 2009 Household Electrical Appliances and Similar Electrical Appliances – Safety or amendments to Tool Refrigerators; e) Photocopy of the certificate of quality management system ISO 9001: 2008 or its amendments, or other quality management system equivalent and must have a scope Appliances Refrigerator; f) Photo or picture Counterfeit products Refrigerators; g) Counterfeit production code readings Refrigerators; h) Planned amount of production or import for one year
Additional documents required to be submitted by the Importers	In addition to the documents mentioned above, the importer must also submit the following: i) Copy of Importer Identification Number (API)-U; and j) ISO 9001: 2008 or its amendments, or quality management system standards equivalent type of producer country of origin of the product in English or translated into Indonesian;
Process	The Director General's office is the verifying authority for the applications of energy labeling submitted by manufacturers and/or importers of Refrigerator. Based on the results of verification of application, the Director General may approve or reject the license for application of Labeling Signs Energy Saving. The process is generally to be done in 7 (seven) working days from the receipt of complete applications. In case the application is approved, the Director General give permission for Signs Energy Efficient Labeling. The information on labeling permission is also provided to customs for keeping a check on products at the time of import. In case of rejection, the Director General shall notify in writing to the applicant accompanied by reasons for refusal.

Labeling period validity	Three years and may be extended
Reporting requirements	Domestic manufacturers which have obtained permission for labeling, shall make a monthly report on the domestic market which is to be delivered in every 3 (three) months. Importers who have obtained permission for Labeling, shall report the brand, type / make, model, volume, and the number of refrigerators during each import consignment

Furthermore, the MEPS regulation provide the following details:

1. Provision for obtaining energy saving certificates
2. Appointment of certification institution (LSPro) and its powers
3. Provisions related with any changes in the product design / performance post award of permission of labeling
4. Labeling instructions
5. Penalty provisions / sanctions

Appendix F Overview of IEC 62552:2015

The IEC standard is segregated into three parts:

- IEC 62552-1: Scope, definitions, instrumentation, test room and set up of refrigerating products;
- IEC 62552-2: General performance requirements for refrigerating appliances and methods for testing them;
- IEC 62552-3: Energy consumption and volume determination

Specifically, for energy consumption testing, the testing methodologies in the standard is specified in such a way that majority of key factors affecting the energy consumption can be quantified and aggregated to reflect the realistic operating conditions. The vital factors impacting the energy consumption are:

- Ambient temperature
- Temperature control setting
- Defrost and recovery characteristics
- Load processing efficiency
- Quality of thermal insulation
- The dimension and size
- User interaction i.e., the normal usage of the refrigerator and
- Other auxiliaries

Moreover, one can customize the energy consumption testing by selecting the most relevant regional/ climate-specific factors. Two different ambient conditions (32℃ and 16℃) are defined in the standard for determining the energy consumption, thus it helps analyzing the effect of temperature on energy use. The standard provides a datum for comparing different refrigerators which subjected to similar conditions and similar loads.

A brief overview of information covered in the part 2 and part 3 of the IEC standard is shared below:

IEC 62552-2

The part 2 of IEC 62552:2015 standards presents the methods /procedure for quantifying performance requirements. The type of tests required to substantiate the performance requirements of refrigerators covered in this part of IEC standard are mentioned below:

1. Storage test: This test quantifies the storage temperature maintaining capabilities of the refrigerator for a given climate class.
2. Cooling capacity test: It is quantified by the time take by refrigerator to bring down the temperature of stipulated mass to a required temperature from ambient temperature.
3. Freezing capacity test: This test acts as a qualification criterion for frozen compartments (Four-star compartment). This quantifies the load processing capability of the compartment.
4. Automatic ice making test: This test is the yardstick of ice making capabilities of the refrigerator.

5. Pull-down test: It is the measure of reserve capacity of a refrigerator, particularly for high ambient temperature environments.
6. Wine storage test: To check the compliance with requirements of this standard at each of the ambient temperatures
7. Temperature rise test: To check the time required to raise the temperature of test packages in those refrigerators which have one or more three star and four-star compartments.
8. Water vapor condensation test: To check the extent of water vapor condensation on external surface of refrigerators.

IEC 62552-3

This part lays down the methods /procedure for determining the energy consumption and volume of household refrigerator. This part of the test standard elaborately covers the test procedures for determining the energy consumption and volume of all varieties of household refrigerator. Also, it talks about different compartment types of a typical household refrigerator and their respective target temperatures. The specified target temperatures are used to determine the energy consumption.

This part includes 11 annexes and the brief description of all the annexes is given below.

1. Annex A details out the requirements of set up for energy testing. It mandates to prepare the refrigerator as per part 1 of IEC 62552:2015. Further, it lists the other set up requirements like ice-making trays, user adjustable controls, ambient temperatures, accessories and shelves, anti-condensation heaters and automatic icemakers.
2. Annex B describes the specifics of determining the steady state power and temperature. Moreover, it explains the process for two specific cases which applies to two kinds of refrigerators as mentioned below:
    a. Refrigerator without a defrost control cycle and the refrigerators with its own defrost control cycle where steady state period of interest is not bound by the defrost recovery period.
    b. Refrigerators with its own defrost control cycle where the steady state test period of interest commences with a valid defrost and recovery period
3. Annex C presents the procedure to be followed determining defrost and recovery energy and change in temperature during defrost and recovery.
4. Annex D describes the method for determining defrost interval
5. Annex E explains methods of interpolating results for determining the energy consumption at target temperatures.
6. Annex F gives details about the test requirements for determining the energy consumption of auxiliaries like anti-condensation heaters and automatic ice makers etc.
7. Annex G states the procedure for determining load processing efficiency. The intent of the test is to quantify the incremental energy impact of user-related aspects of refrigerator's use such as door openings and cooling of warm food and drinks.
8. Annex H explains the procedure for determining the volume of refrigerator.

9. Annex I contain worked examples of energy consumption calculation
10. Annex J presents the purpose behind the development this global IEC standard.
11. Annex K explains the approach to be adopted for the analysis of test data for a refrigerating appliance without steady state conditions between defrosts.