Appliance Energy Efficiency Regulations Roadmap, 2020-2030 A PSMA Power Technology Roadmap Presentation May 2<sup>nd</sup>, 2023

Appliance Energy Efficiency Regulations Webinar Series Sponsored by: PSMA's Energy Management Committee

Presenter: Dinesh Kithany, Founder and Chief Analyst Wired and Wireless Technologies (WAWT)

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A PSMA Power Technology Roadmap Presentation

Our power sources industry ecosystem for the benefit of stakeholders

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Compliance







Packaging & Manufacturing



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Transportation

**PowerElectronics** 



Reliability

Energy

Management

#### Manufacturers

#### **Developers**

**Suppliers** Educators

#### Integrators

Users **Funders** 

Regulators





## Our power sources industry ecosystem for the benefit of stakeholders



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PTRs, special studies (1<sup>st</sup> copy) and webinar material free to all members



# **Energy Management Committee**



#### Background

Energy is one of the most critical aspects of global progress and societal development. Concerns about carbon emissions, scarce resources, and economical, efficient use of energy drive the need to increase sustainability. Despite impressive energy savings over the last few decades, we still have a long way to go, and efficient energy management plays a key part.

#### Mission

The mission of the Energy Management Technical Committee is to serve the needs of manufacturers, government policymakers, and industry standards organizations to provide education, support, and recommendations in matters regarding the energy efficiency of power supplies and system power architectures (no-load, standby, and active-on) with, as a primary goal, the establishment of a consistent global standard for energy efficiency.

Additional information on this Committee is available at <u>https://www.psma.com/technical-forums/energy-management</u>

Please contact the Association Office (<u>power@psma.com</u>) to get added to the meeting invitation list. We look forward to your participation!



#### Dinesh Kithany, Founder & Chief Analyst, WAWT



- Dinesh Kithany, a well-established industry expert, is now the Founder and Chief Analyst at Wired & Wireless Technologies (WAWT), a strategic technology analyst and consultancy firm, specializing in wireless power and power supplies industry.
- Prior to founding WAWT, Dinesh was a lead industry analyst with Informa/IHS Markit working across technology sectors, including wireless power and power supplies.
  - He is one of the most sought-after analysts in the industry today in related field.
- Dinesh has 27+ years of experience, of which past 12 years have been in technology sectors. It's safe to say, he is passionate about research, delivering insights and developing strategies.
- Dinesh has helped businesses grow at an extraordinary pace with his expertise and strategic advice. He is widely recognized as a key industry thought-leader.
- He is a regular invitee a speaker at key industry conferences, trade shows and events worldwide, including CES, IFA, CABA, ITRI, PCIM, Electronica, APEC and at industry conferences held by Wireless Power Consortium (WPC), NFC Forum, Wireless Communications Alliance (WCA) and AirFuel Alliance (AFA).
- email: <u>dinesh.kithany@wawt.tech;</u> LinkedIn/Twitter: <u>dineshkithany</u>



#### **Why Appliances and Equipment**

- Most power supplies are located in appliances, and we find more than 15 appliances in any house
- Efforts to improve appliance efficiency started in 1974 with focus on the refrigerator
- Refrigerators built in the **1970s used 5x more** electricity than ones today.
- However, major focus on the whole range of appliances commenced in 2002 with the external power supply that powered everything from toothbrushes to hair clippers, from washing machines, to dryers, to dishwashers, to airconditioners and many others.

#### What uses the most electricity at home?



\*Reference: https://www.regulations.gov/document/EERE-2013-BT-NOC-0005-0106



# **Starting to Bend Energy Consumption Curve**

- Enough progress was made by 2016 that government agencies decided to set the energy consumption baseline for all appliances
- By 2020, Europe already achieved over 50% of the energy reduction needed by 2030.
- Progress due to ...
  - New policies
  - Better technologies
  - COVID-19



#### A PSMA Power Technology Roadmap Presentation

# Focusing on major home appliances (MHA) market

An overview



#### - An overview

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• Global MHA market is expected to ship more than **900 million units** in **2025**, growing at a five-year CAGR of ~5% from 2021, led by:

- Appliances: Room air-conditioners, refrigerators and washing machines
- Markets: China, India and US
- Region: Asia to retain around 50% share of volumes
- We expect **4.2 billion units of MHA** to be sold from 2021 to 2025
- Use of electronic displays, touch controls, BLDC motors, smart connected technology and voice controls will continue to grow and boost the use of semiconductor content.
- 'Smart connectivity' will become a standard feature
  - It will be easier to sell **smart and intelligent appliances that are not connected**.
  - But it will not be easy to sell connected appliances that are not smart, intelligent, efficient, integrated, secured, and safe.
- Global small appliance market is expected to ship 2 billion units in 2025.
- Companies are going through 'much-needed' transformation –
   'Think & act like a technology company, not as a manufacturer'





Source: Wired & Wireless Technologies (WAWT) – Home Appliance Research

- Technology segments
- Growth in MHA market is expected to continue drive the growth in the use of electronic displays, touch controls, and inverterized (VSD-variable speed drive/BLDC) motors





#### - Technology segments

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- Around **2.3 billion units** of **'smart connected' MHAs** are expected to be shipped from 2021 to 2025
  - Smart 'connected' appliances can be controlled, monitored and diagnosed (even remotely), via a home automation system and other connected devices





Source: Wired & Wireless Technologies (WAWT) – Home Appliance Research

#### - Technology segments

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  - Smart 'connected' appliances can be controlled, monitored and diagnosed (even remotely), via a home automation system and other connected devices
- The adoption of VSD (variable speed drive motors BLDC inverter technology) in MHA market is expected to grow from 62% in 2020 to around 92% in 2025
  - The TAM for inverterised MHA (using VSD motors) is projected to be **2.4 billion units** from 2021 to 2025
  - Room air-conditioners, washing machines and refrigerators are expected to drive use of <u>inverterised</u> <u>technology (BLDC motors).</u>





**Source:** Wired & Wireless Technologies (WAWT) – Home Appliance Research

# **Inverter-based Variable Speed Motor Control**

- Background to Variable Frequency Motor Control
- Motor control theory is a complex subject with many different motor types and a multitude of variations on control topologies
- The <u>main motor types</u> currently used in MHAs are **Brushed motors; Universal motors; Induction** motors; Brushless DC (BLDC) motors and Switched reluctance motors. Ones used the most to enhance energy-efficiency in MHAs are:
  - Induction Motors which are AC powered (single- or three-phase), brushless motors that offer improved efficiency, longer life, lower running noise and higher safety levels compared to brushed motors and are increasingly used in MHAs such as washing machines. The speed of the motor is dependent upon the stator voltage, motor characteristics and load torque. The voltage is often controlled by using SCR/triac-based controllers or inverters
  - Brushless DC (BLDC) Motors which are also called Permanent Magnet Synchronous (PMSM Motors) combine the high torque and variable speed performance of the universal motor with the brushless operation of the induction motor. They are increasingly being used in MHAs such as dishwashers to drive the pump.



# **Inverter-based Variable Speed Motor Control**

- Background to Variable Frequency Motor Control
- (Contd.)
- There are number of **broad types of motor control** used in MHAs, such as:
  - Basic On-Off Control is the simplest and cheapest form of motor control. The motor simply has two states on and off. The motor is turned on simply by applying the required voltage/current via a simple switch such as a relay or a PTC. In its simplest form, this type of solution requires no semiconductor-control, and it is typically found in dryers, fridges, freezers and microwave ovens
    - E.G., in a fridge, the compressor would simply be turned on when the temperature rises above a certain level, and switched off when it drops
  - Multiple fixed speed control type of solution is used where the motor is required to operate at two or more different motor speeds. The motor might be controlled via a "program" selected by the consumer. Once the program is selected, the motor will operate at two or more different speeds at a timed intervals according to the precise program code. These are open loop solutions (i.e., there is no feedback involved). This approach is often used in washing machines, dishwashers, room air conditioners, fridges and freezers
  - Variable Frequency Control also called "inverter-based" variable speed control, is the most sophisticated (and expensive) solution. Inverter-based control can be either closed loop or open loop. In an open loop system, the inverter-based solution acts in a similar fashion to the "multiple fixed speed control" described above. However, the great advantage of inverter-based solutions is that they can be used in closed loop systems i.e., the system makes use of feedback from the load to determine changes to the movement and speed of the motor. Inverter control is already very widely used in industrial automation applications, but its widespread use in MHAs (white goods) has been held back by its relative higher cost



# **Energy Efficiency of Major Home Appliances**

#### - Background

- From **technology perspective**, we see greater use of inverterised (e.g., VSD-variable drive motors) and induction technology (for cooker-tops), which is driven by demand for energy efficient appliances, with a pull from consumers and a push from the government and regulatory bodies
- To combat 'Vampire Power' government across regions are pressurising appliance makers by setting more (and higher) stringent regulations focussing on increasing the current energy efficiency standards, product labelling, communications, reduce noise output, data security/privacy protocols, increase reliability, creating a continuous need and thirst to innovative
  - Several countries need government support to introduce incentive plans, tax concessions to help trigger demand
  - China government's 'Leader' program triggered & boosted demand for energy-efficient 'inverterised' appliances
- New energy efficiency programs are being implemented across regions. Established efficiency programs continue to revise minimum requirements for efficiency standards. The increased focus on efficiency is driving greater use of electronics in the appliances
- Becoming more energy conscious, consumers are choosing to invest in ENERGY STAR<sup>®</sup> labeled appliances and other energy-efficient devices to cut costs (energy bills) as well as help the environment
- Around two-thirds of all household electricity is consumed by kitchen appliances, lighting, and by heating, ventilation and air-conditioning (HVAC) systems. Thus, not only do home appliances need to be greener and smarter, but lighting and HVAC systems as well



# **Energy Efficiency of Major Home Appliances**

- Three basic approaches adopted by regulators to promote energy efficiency
- Minimum Energy Performance Standards (MEPS)
  - These are usually mandatory minimum standards which all appliances must comply. MEPS are typically set at a
    relatively low-levels and ensure that the worst-performing appliances are removed from the market. They typically
    have little effect on the rest of the market, although the qualifying level can, of course, be raised over time. MEPS
    vary by country and by region
- Comparative Labeling Schemes
  - These mandatory or voluntary labeling system helps to identify the energy efficiency level of appliances in the market. Typically, they provide for 5 or 6 'bands' covering the entire performance range from the MEPS lower limit up to the best performing appliances in the market. The bands are usually a simple 1 through 5, or A through E. The only slight complicating factor is that sometimes "1" can mean the best performing appliances on the market, or sometimes the worst performing, depending upon the country
  - Mandatory comparative labeling schemes have proven to be highly effective in improving the overall energy efficiency of appliances in the market. They are highly visible symbols for consumers, and most appliance makers do not like to offer appliances in the lower bands

#### • Endorsement Labels

 These mandatory or voluntary schemes take the form of a label which can be applied to appliances that meet certain (high) efficiency standards. These labeling schemes can be effective in encouraging manufacturers to develop higher efficiency appliances, provided being promoted effectively. However, they typically have a larger impact near the high-end of the market and lesser impact at the low-end of the market



# **Energy Efficiency of Major Home Appliances**

- Other terms adopted by regulators to promote energy efficiency
- Phantom Power Always-on and Always Costly
  - Many home appliances, including refrigerators, microwaves and TVs, spend most time in **standby mode**. Even when they are plugged in (but turned off) they still use electricity. In fact, some studies have found that appliances in standby mode (aka phantom mode) can consume up to 13% of the total household energy
    - In order to reduce this needless power consumption, new voluntary certification programs, including the ENERGY STAR program, are being put in place to encourage manufacturers to make more energy-efficient products
    - The goal is to have new products meet the one-watt standard, meaning that products could be ENERGY STAR qualified if they consume less than 1 watt in phantom mode. Another example is the EU ErP Directive on standby/off mode

#### • Certification Laboratories

- Cash-conscious **consumers are increasingly concerned** about what they are buying, how much electricity it will consume, whether it is connected, and how long will it last
- As consumers become environmentally aware, manufacturers feel the pressure to earn energy-efficiency certification for their appliances and other consumer electronic devices. Partnering with a testing and certification laboratory allows appliance makers to not only fulfill government requirements, but also to gain insights into regulations that shape the industry. This partnership helps manufacturers to simplify their energy verification process, while producing products with a competitive edge



# **About ENERGY STAR® and EnergyGuide**

- ENERGY STAR<sup>®</sup> is a US Environmental Protection Agency (EPA) voluntary program for energy efficiency. EPA and DOE have <u>announced enhancements to the Energy Star<sup>®</sup> Program</u> for product qualification and verification.
  - Since 2011, all Energy Star<sup>®</sup> partners are required to have 3<sup>rd</sup> party Energy Star<sup>®</sup> certification of product performance prior to labeling. Partners must also submit products for on-going verification testing, administered by the appropriate EPA Recognized Certification Body (CB), to ensure labeled products continue to meet Energy Star<sup>®</sup> requirements.
  - EPA ENERGY STAR Emerging Technology Award 2012 was created to recognize innovative products that face initial entry barriers to U.S., including high costs & low consumer awareness. These products may not be immediately eligible for ENERGY STAR labeling program, but still have the potential to considerably reduce greenhouse gas emissions
  - In 2011, ENERGY STAR launched the 'Most Efficient' pilot program, which seeks to identify those appliances that 'demonstrate efficiency performance that is truly exceptional, inspirational, or leading edge – consistent with the interests of environmentally-motivated consumers and early adopters'. 'Most Efficient' recognition is available for clothes washers and refrigerator/freezers
  - US refrigerator standard (1993) represented ~30% increase in energy efficiency, eliminating 99% models from market
- EnergyGuide: The US DOE's Appliances and Commercial Equipment Standards Program develops EnergyGuide test procedures and sets minimum efficiency standards for appliances used for residential and commercial purposes. The appliance manufacturers must submit energy use data to the DOE and FTC, stating that it complies with the regulations, before the products are sold, and need to report when models are introduced and discontinued. MHAs which require EnergyGuide testing include washing machines, refrigerators, dishwashers and room air-conditioners.



# **Other regulatory standards and bodies**

- California Energy Commission (CEC): The Appliance Efficiency Regulations were first adopted by the CEC in 2007, which was then amended and replaced all earlier ones with updated regulation of 2012. These mandatory regulations include standards for 23 categories covering both federally-regulated appliances and non-federally-regulated appliances (including MHA), specifically sold or offered for sale in California, except those sold wholesale for final retail sale outside the state, and those designed and sold exclusively for use in recreational vehicles and other mobile equipment
- AHAM Testing: The Association of Home Appliance Manufacturers maintains its status as an ANSI (American National Standard Institute) accredited Standards Developing Organization. AHAM submits many of its standards for major and portable home to ANSI for approval as American National Standards. Each standard that gains ANSI recognition bears the ANSI/AHAM designation in the title of the standard. AHAM's procedures for developing consensus for the approval, reaffirmation, revision and withdrawal of its standards are documented in 'AHAM Procedures for Approval of AHAM standards as American National Standards'
- AHRI Testing: The Air-Conditioning, Heating and Refrigeration Institute (AHRI) is a trade association of manufacturers which maintains and publishes over 80 standards, mainly related to equipment performance, many are accepted as ANSI standards. AHRI's rating standards, when teamed with ASHRAE's (American Society of Heating, Refrigeration and Air-Conditioning Engineers) methods of tests, provide a method to test and rate heating, air-conditioning, ventilation, commercial refrigeration, water heating, boiler, and radiant panel equipment
- Natural Resources Canada (NRCan) Testing: Canada's <u>EnergyGuide labeling</u> requirements are coordinated with the US <u>Energy Star</u> and EnergyGuide labeling program. Canadian customs will not allow products without such labeling to enter their country
- Consortium for Energy Efficiency (CEE): Energy efficiency program administrators from the US and Canada formed the CEE to achieve lasting and verifiable energy efficiency. The <u>CEE role is not to</u> develop or implement the programs delivered at the local level, but to influence manufacturers, stakeholders & government agencies in order to maximize the impact of efficiency programs



# A 'Call to action' on efficient and smart appliances

While COP26 was approaching, IEA spearheaded international initiative to double the efficiency of key appliances sold globally

- New global evidence shows appliance efficiency policies have helped to halve the energy consumption of MHAs such as REFs, RACs, lighting, TVs, WMs and cooking appliances, without meaning to make them more expensive to purchase. These huge efficiency gains have been achieved even as the price of the appliances fell by an average of 2-3% per year
- Policy makers must now broaden the scale and scope of appliance policy and increase its level of ambition. That is why the IEA, with the UK government, is co-leading the Product Efficiency Call to Action to double the efficiency of key appliances sold globally in the run-up to the United Nations Climate Change Conference 2021 (or COP26).
- Appliance energy efficiency is key to reaching net zero emissions in the electricity sector.
  - IEA has modelled a pathway for the world to reach **Net Zero Emissions by 2050**. Despite an overall decrease in global energy demand, the Net Zero Emissions by 2050 scenario expects its demand to be more than 2x between now and 2050
- Long-running appliance energy efficiency policies are saving up to 15% of total national electricity consumption
  - Energy efficiency policies can successfully move appliances away from less efficient to more efficient ones. **Minimum energy performance standards**, for example, set a threshold for energy efficiency for specific products sold in a market. **Energy labels**, help consumers to choose well
  - Because these products account for a significant proportion of total electricity use, making them more efficient can have a strong impact on total electricity demand. Countries with the longest history of applying minimum energy performance standards have achieved electricity savings of around 15% of total electricity consumption per year. Savings increase each year as older, less-efficient stock is replaced highly efficient ones
  - In countries with advanced programs, such standards have reduced national energy-related CO<sub>2</sub> emissions by 7%-10%

Source: https://www.iea.org/articles/a-call-to-action-on-efficient-and-smart-appliances



# A call to action on efficient and smart appliances (contd.)

#### • Additional policies and measures are needed to maintain the momentum

- Standards and labelling programs have been the backbone of the most successful appliance efficiency policies, but they can have
  highest impact as part of a more comprehensive policy package. For example, a high-efficiency performance standard can define a
  threshold above which a product is identified as highly efficient (often by carrying an endorsement label, such as ENERGY STAR in US)
- The sale of highly efficient products and equipment can then be promoted via policies or other initiatives:
  - Financial incentives for consumers, such as subsidies or rebates, reduce the costs of highly efficient products
  - On-bill or on-wage financing make it easier for consumers to buy highly efficient products by spreading the purchase cost over many energy bills or salary deductions. The <u>ECOFRIDGES programme</u> in Ghana is an example of on-wage financing
  - Technology product lists provide consumers with information to help them make decisions about highly efficient products
  - **Procurement schemes** allow governments to create markets for highly efficient products or encourage private sector investment in efficient products. Initiatives such as **EP100 group** demonstrate private sector commitments to purchasing highly efficient products
  - Technology awards, such as the Global Cooling Prize, reward leading-edge innovation efforts to increase efficiency & reduce costs
- The IEA has developed a simple tool, the energy performance ladder, for developing and implementing these different policies under a single consistent set of performance thresholds. For a given product, ladder steps equate to the efficiency levels defined using a standard test procedure. Governments can then set policy thresholds (such as minimum energy performance standards, labels & highefficiency performance standards) at different steps on the same ladder & set years in which the thresholds will move up the ladder.

#### The next generation of appliances and equipment is broadening the scope of appliance efficiency policy

• In addition to policy packages that focus on improving appliance performance, the rapid growth of internet-connected digital devices is opening a new frontier for efficiency policy as the scale and scope of what is achievable is redefined and a new market rapidly emerges.

Source: https://www.iea.org/articles/a-call-to-action-on-efficient-and-smart-appliances



# The recent: The COP26 Product Efficiency Call to Action

- The **objectives** of the **COP26 Call to Action** are to:
  - 1. Set countries on a trajectory to **double the efficiency of key products sold globally by 2030** industrial motors systems, general lighting service lamps, residential air conditioners and residential refrigerator/freezers
  - 2. Support the delivery of national climate change targets
  - 3. Provide consumers and businesses with more efficient products that are affordable and cost-effective to own and operate
  - 4. Stimulate innovation and provide businesses with export opportunities
  - 5. Promote a **dual course of action** making products both **energy efficient and climate friendly** by reducing the use of refrigerants in cooling appliances
- UK government and IEA to spearhead the largest ever global initiative to make products more energy efficient
  - Australia, Indonesia, Japan and Nigeria are latest countries to join COP26 Product Efficiency Call to Action to save energy and cut emissions, bringing total number to 14 and still counting
- Jointly led by the UK government and the IEA, the <u>COP26 Product Efficiency Call to Action</u> is an ambitious initiative to double the efficiency of key internationally traded products by 2030 in order to help drive reductions in global greenhouse gas emissions and consumers' energy bills
- The Call to Action encourages governments to deploy a range of policies such as product standards, labels and incentives to raise the efficiency of high-energy consuming products
- Focuses particularly on four key products lighting, refrigerators, air-conditioners & industrial motor systems which together account for over 40% of global electricity demand and over 5 billion tonnes of global CO2 emissions per year

Source: <u>https://www.iea.org/articles/a-call-to-action-on-efficient-and-smart-appliances</u>



#### **Energy Efficiency 2021 Report** Key findings

- <u>Global energy efficiency progress is recovering but not quickly enough to meet international climate goals</u> (click link for details)
- Efficiency improvements are returning to pre-pandemic levels however remain well below the pace needed in a net zero pathway

Section 2.2 Appliances : Standards have helped halve the energy consumption of key appliances in the longest-running programs

- Over 120 countries have implemented or are developing mandatory standards and labels for key appliances, incl. MHAs, lighting & TVs.
- These huge gains have been achieved even as the **purchase price of such appliances fell by an average of 2-3% per year**. Thus, consumers have benefited from both, lower appliance purchase costs and lower operating costs.
- Appliance standards and labelling is highly effective at reducing energy use, based on a new joint study finds (click link for details)
- Standards and policy programs save consumers billions of dollars and avoid hundreds of millions of tonnes of CO2 emissions each year
- Electricity generation is currently the largest source of energy-related CO2 emissions, accounting for 41% of the 34 Gt CO2 emitted globally in 2020
- More than 40% of this electricity energy consumption is for just four end uses industrial electric motor systems, RACs, REFs and lighting. These four uses also contribute over 5 Gt of CO2 emissions a year – roughly equal to the United States' current total CO2 emissions. This underscores just how important energy efficiency standards and labels can be to slow electricity demand growth and allow renewable energy to replace fossil fuels, rather than just going towards meeting the need for higher electricity demand
- Efficiency programs have avoided consumption equal to total wind and solar power generation
  - When designed and implemented well, standards and labelling programs increase efficiency in highly cost-effective ways. A 2018 study by the IEA and 4E Technology Collaboration Programme showed that in 9 countries/regions where there was data, incl. China, the EU & US, standards & labelling saved ~1500 TWh of electricity use, equivalent to year's total generation from wind & solar in those countries.
  - In the countries with the longest-running programs the effect is so large that around 15% of total electricity generation is being saved through appliance programs. If a similar 15% improvement had been achieved by all countries, electricity consumption could have been reduced by 3500 TWh - roughly equivalent to cutting China's current electricity consumption in half

Source: https://iea.blob.core.windows.net/assets/9c30109f-38a7-4a0b-b159-47f00d65e5be/EnergyEfficiency2021.pdf



#### **Energy Efficiency 2021 Report** Key findings (contd.)

- A new level of energy efficiency is being enabled through rapid digital technology deployment
  - In 2021, the stock of 'smart' connected appliances, devices and sensors was expected to overtake the number of people on the planet
  - Most of these are measuring devices, such as sensors & smart meters, with other devices achieving market take-off more recently. EG., deployment of smart appliances is expected to double from 2020-2021 and number of smart lighting devices is approaching 1 billion
- Standards and labels are a keystone of energy efficiency policy
  - In recognition of their substantial cost-effective energy savings potential and other benefits, more than 100 countries now use mandatory energy efficiency performance standards and/or energy labels for RACs, REFs, lighting, industrial motors and passenger cars. However, policies are still absent in a range of markets where growth in ownership of appliances is fastest. Additional or expanded standards and labelling schemes are under development in over 20 countries, mainly in Asia and East and Southern Africa
- Enhanced investment in energy efficiency can create nearly 6 million jobs by 2030
  - A major benefit of a more efficient energy system in the IEA Net Zero Emissions by 2050 Scenario is the job creation potential of increased spending on more efficient appliances, vehicles, building retrofits and new construction
- Countries are coming together to deliver higher ambition
  - The Super-Efficient Equipment and Appliance Deployment (SEAD) Initiative is a collaboration between 20+ governments, the IEA and other partners to accelerate and strengthen the design and implementation of energy efficiency policies for appliances and equipment – particularly lighting, industrial motor systems, air conditioning and refrigeration
  - In November 2021, the IEA and the COP26 presidency launched the COP26 Product Efficiency Call to Action to double the efficiency of key appliances and help countries raise ambition more quickly, easily and at lower cost. G7 leaders had previously welcomed the Call to Action at the 2021 G7 Summit in Cornwall, having a set objectives (mentioned in previous COP26 Product Efficiency Call to Action slide)

Source: https://iea.blob.core.windows.net/assets/9c30109f-38a7-4a0b-b159-47f00d65e5be/EnergyEfficiency2021.pdf



#### To summarise,

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This graph illustrates the current energy consumption balance

#### Energy Use Per Person in Africa vs. a Typical American Refrigerator

Annual kilowatt-hours of electricity consumed per capita, 2017



SOURCE: INTERNATIONAL ENERGY AGENCY AND ENERGY FOR GROWTH HUB

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**Thank you** Question please

Presenter: Dinesh Kithany, Founder and Chief Analyst Wired and Wireless Technologies (WAWT)

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