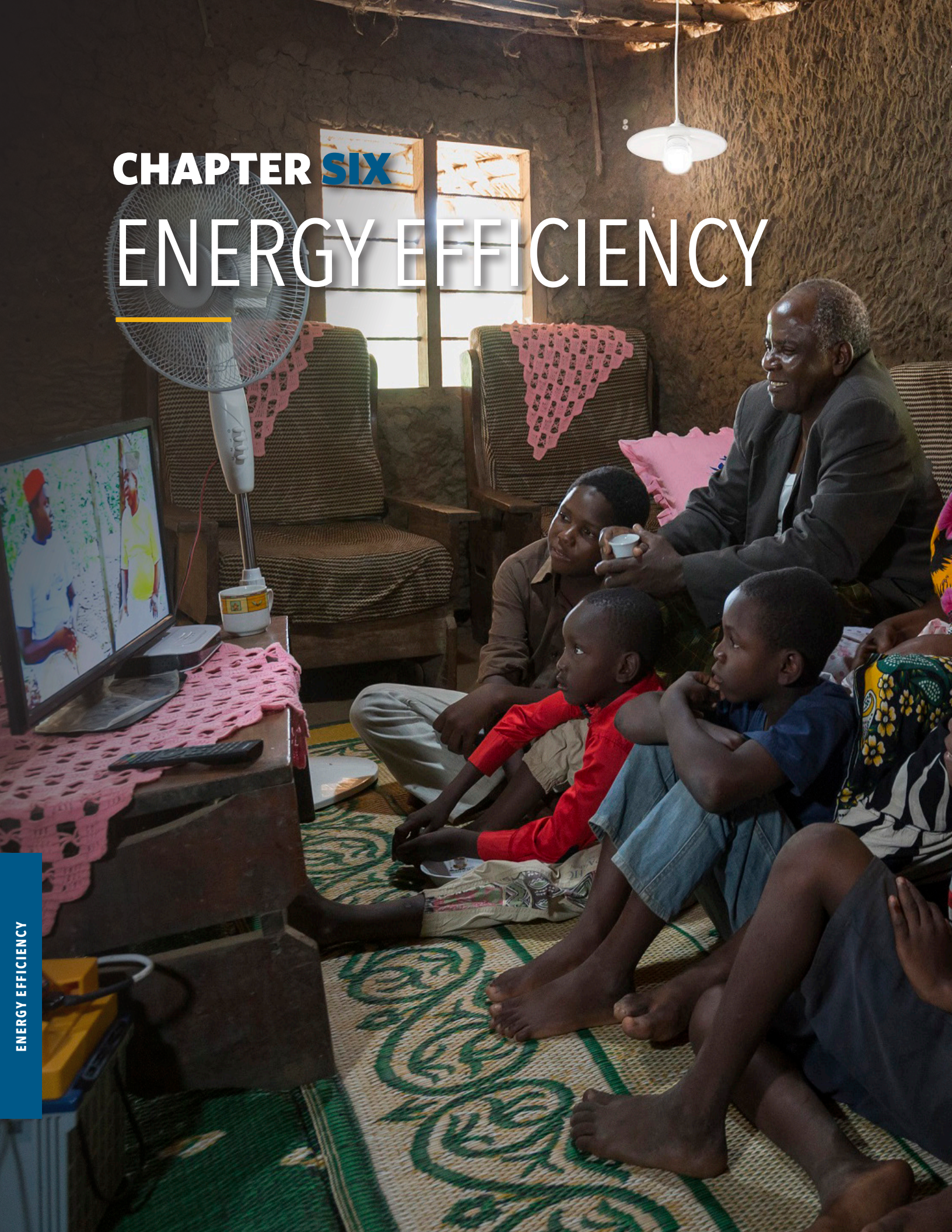


CHAPTER SIX

ENERGY EFFICIENCY



6. ENERGY EFFICIENCY

KEY MESSAGES

- Global progress on energy efficiency policy has been achieved across all indicators, but growth has been slower on critical sector-specific energy efficiency regulations. Important energy efficiency measures such as minimum energy performance standards compliance, building energy codes, and regulations for utilities and the transport sector remain overlooked or underfunded.
- Energy efficiency measures are more readily adopted in the industrial sector than in other sectors in most countries. But while industrial efficiency mandates are common globally, monitoring and verification of mandates needs to improve.
- Heating and cooling are crucial issues in the residential building sector, especially in the developing world. There is a clear gap between residential building codes and compliance systems that policymakers need to address.

POLICY DIMENSIONS FOR ENERGY EFFICIENCY

The energy efficiency pillar in the RISE 2018 report, includes 13 indicators and 31 sub-indicators, with additional indicators spanning heating and transport. The update aims to enhance the clarity and granularity of the questions and collect more accurate data. These thirteen indicators include: 1. National energy efficiency planning; 2. Energy efficiency entities; 3. Information provided to consumers about electricity usage; 4. Energy efficiency incentives from electricity rate structures; 5. Incentives and mandates: Industrial and commercial end users; 6. Incentives and mandates - public sector; 7. Incentives and mandates - utilities; 8. Financing mechanisms for energy efficiency; 9. Minimum energy efficiency performance standards; 10. Energy labeling systems; 11. Building energy codes; 12. Transport sector energy efficiency; and 13. Carbon pricing and monitoring.

The main sources that guided the selection of indicators for the energy efficiency pillar are experts from international organizations, the World Bank's internal sector specialists, academia and private sector stakeholders. Every country follows a different trajectory in developing an enabling framework for energy efficiency. For example, countries that develop their energy efficiency legislation, see their scores for indicators 1 and 2 generally improve. However, even countries that score in the top range of RISE energy efficiency scores and have the proper plans and targets in place, sometimes lack certain sector specific efficiency measures. So, an area of opportunity for the users of RISE data would be to assess what combination of policies and measures appear to be essential for energy efficiency and what is needed to make continued progress.

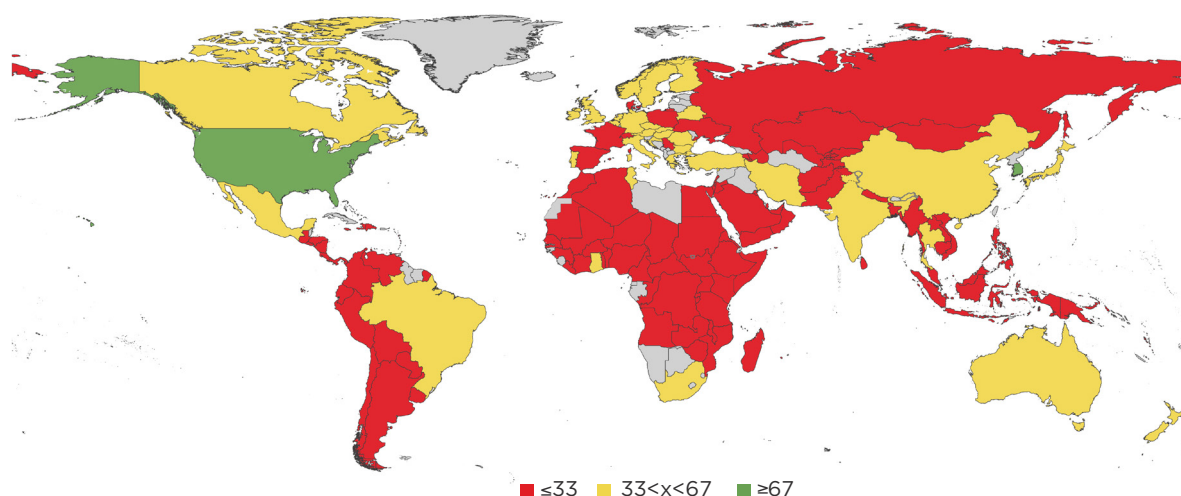
GLOBAL OVERVIEW OF ENERGY EFFICIENCY POLICY FRAMEWORK

In the period 2010–2017, there has been a significant increase in global RISE scores for energy efficiency, as one quarter of the surveyed countries have adopted good practices for policies and regulations (Figure 6.1).

Energy efficiency incentives from electricity rate structures and energy efficiency entities have gained the most traction, followed by

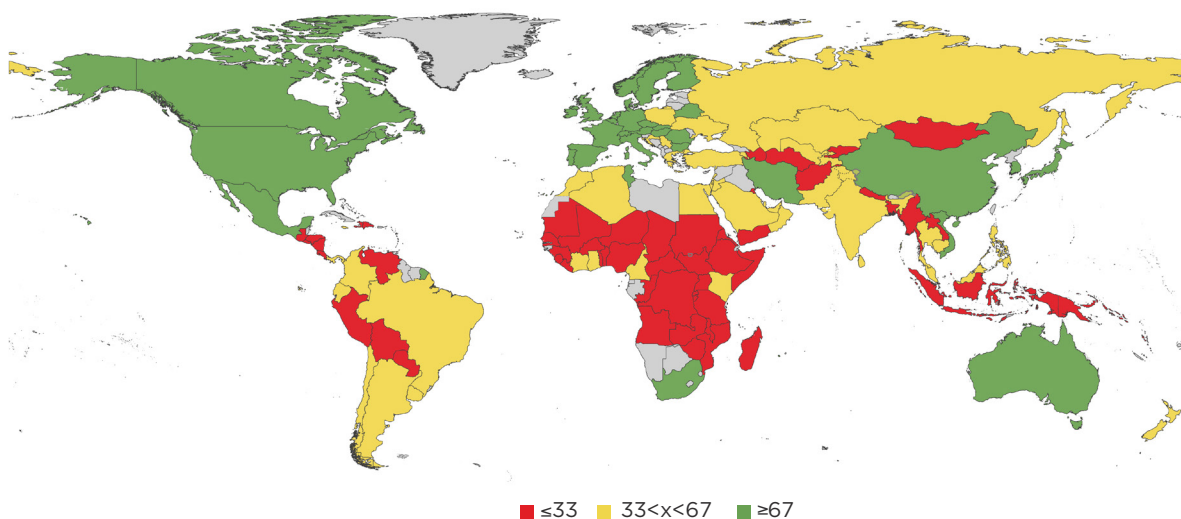
national energy efficiency action plans, which have been the most widely adopted. However, while there is progress overall, other important energy efficiency measures are lagging behind, such as minimum energy performance standards and labels, building codes, and regulations for utilities, and the transport sector. The transport sector should not be overlooked, as it is typically the most energy intensive in terms of fossil fuels in most regions. This edition of RISE has added a new indicator focused exclusively on transport energy efficiency.

FIGURE 6.1 MAP: RISE ENERGY EFFICIENCY SCORES, 2010



Source: World Bank RISE 2018

FIGURE 6.2 MAP: RISE ENERGY EFFICIENCY SCORES, 2017



Source: World Bank RISE 2018

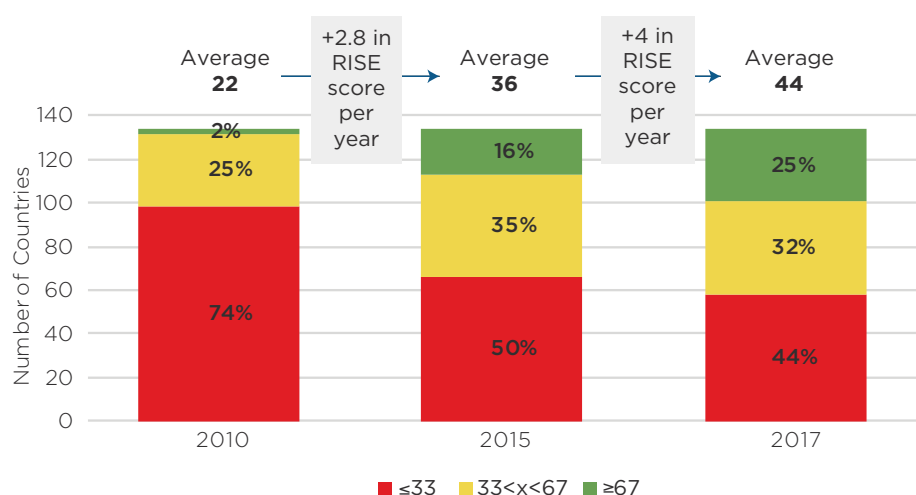
The percentage of countries achieving a RISE score in the green zone has increased more than 10-fold, from 2 percent in 2010 to 25 percent in 2017. Within seven years, the percentage of countries with few or no meaningful energy efficiency policies in place has declined by almost half, from 74 percent to 44 percent. The global average, however, remains low (*Figure 6.3*).

Almost 60 percent of the RISE countries have legislation in place to support energy efficiency, but adoption of specific energy

efficiency measures is lagging. As shown in *Figure 6.4*, national energy efficiency planning has improved the most since 2010, followed by energy efficiency entities and financing mechanisms for energy efficiency. Meanwhile, transport sector energy efficiency has shown the least improvement.

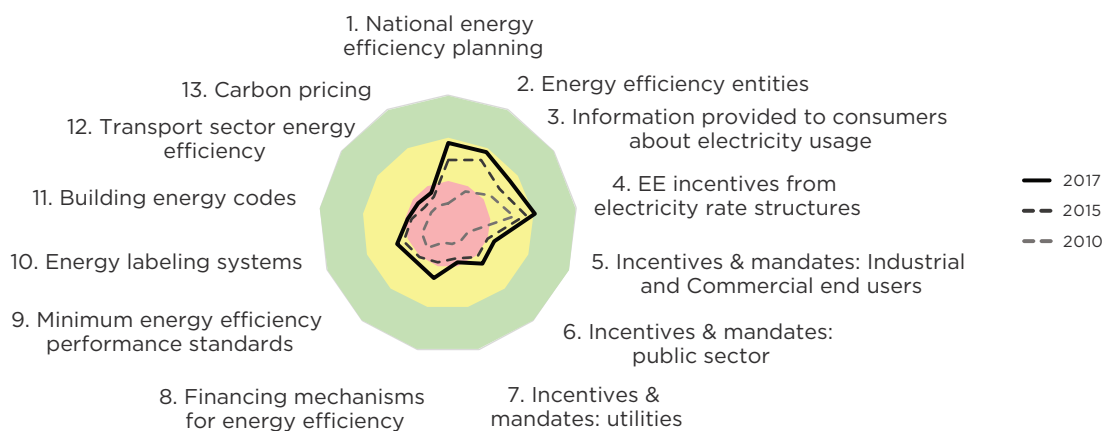
Since 2010, the fastest improving scores in adopted policies have been for energy efficiency legislation/action plans and national energy efficiency targets. National legislation or action plans focused on energy efficien-

FIGURE 6.3 DISTRIBUTION OF RISE ENERGY EFFICIENCY SCORES, 2010, 2015, AND 2017



Source: World Bank RISE 2018

FIGURE 6.4 GLOBAL PROGRESS BY ENERGY EFFICIENCY INDICATOR, 2010, 2015 AND 2017



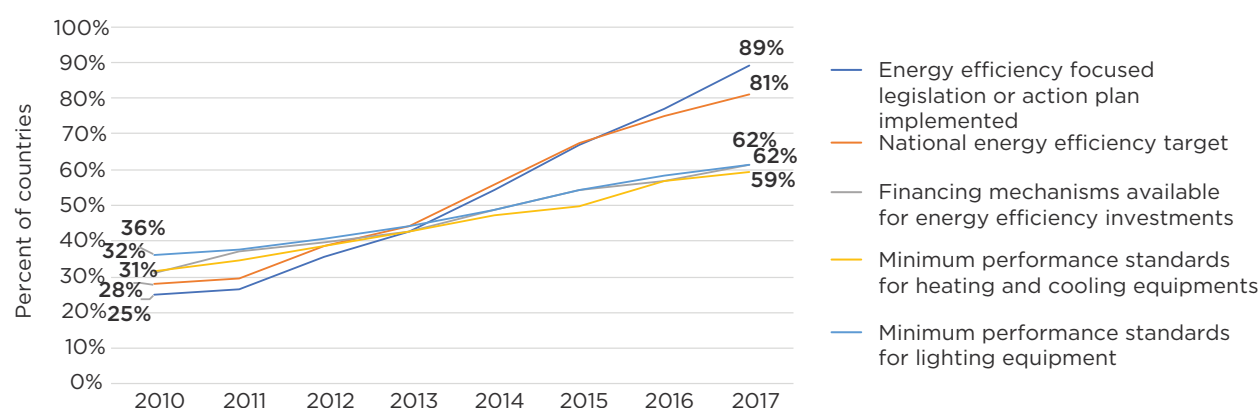
Source: World Bank RISE 2018

cy represented the fastest improving policy area, showing an increase from just a quarter of countries in 2010 to nearly 90 percent of countries in 2017. The second fastest improving energy efficiency measure was national level targets for energy efficiency, increasing from 28 percent of countries in 2010 to over 80 percent in 2017. Financing mechanisms for energy efficiency and minimum energy performance standards for lighting equipment and heating, ventilation, and air conditioning (HVAC) have also shown a fast improvement in scores from 2010 to 2017, although less so than energy efficiency legislation and targets (Figure 6.5).

REGIONAL AND COUNTRY OVERVIEW OF ENERGY EFFICIENCY POLICY FRAMEWORK

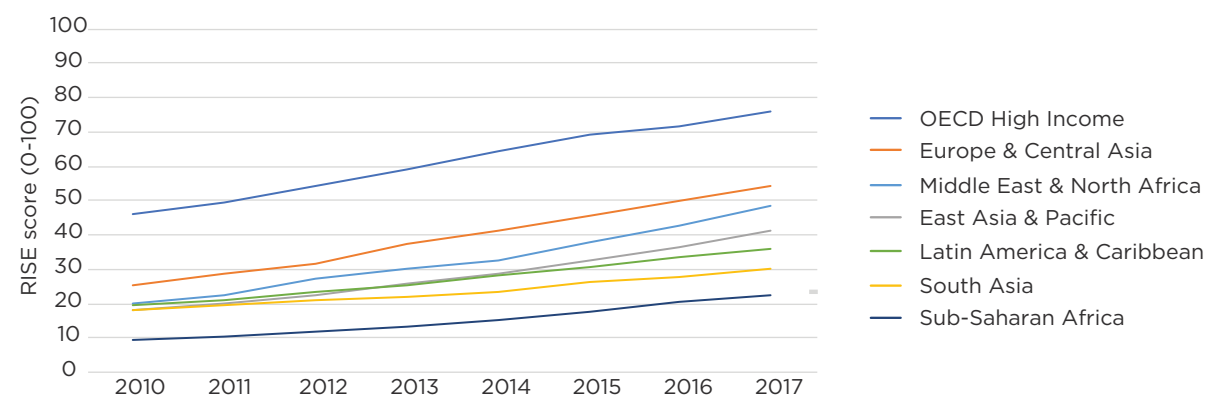
OECD countries are ahead on energy efficiency policy and regulations, but other regions are catching up. Progress on energy efficiency is uneven across regions (Figure 6.6). The Europe & Central Asia region has adopted the most regulations for utilities. South Asia is among the top scorers on energy efficiency incentives from electricity rate structures. Meanwhile, Sub-Saharan Africa, which has been the lowest scoring region over time, is also catching up. South Africa is an outlier

FIGURE 6.5 FASTEST IMPROVING SCORES (PERCENTAGE OF COUNTRIES) IN ADOPTION OF ENERGY EFFICIENCY POLICIES, BY POLICY AREA, 2010-2017



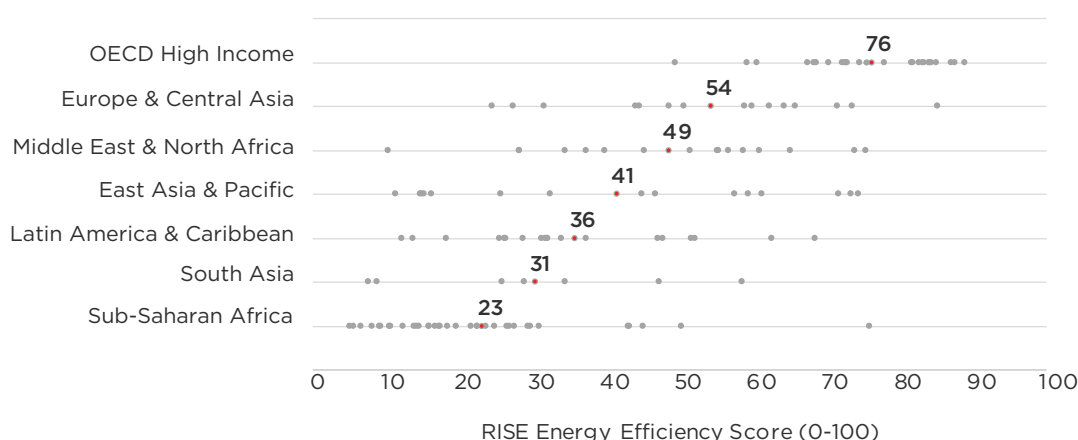
Source: World Bank RISE 2018

FIGURE 6.6 EVOLUTION OF ENERGY EFFICIENCY PILLAR SCORES BY REGION



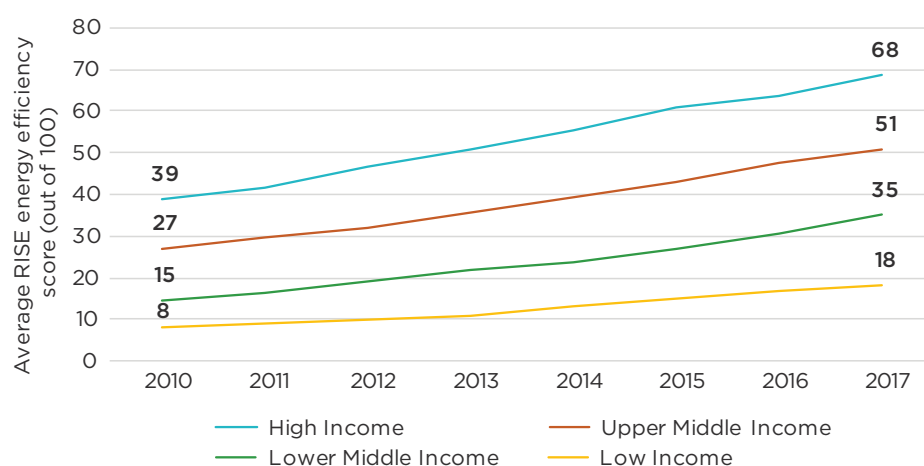
Source: World Bank RISE 2018

FIGURE 6.7 ENERGY EFFICIENCY COUNTRY SCORES BY REGION, 2017



Source: World Bank RISE 2018

FIGURE 6.8 AVERAGE RISE ENERGY EFFICIENCY SCORE BY COUNTRY INCOME GROUP, 2010 - 2017



Source: World Bank RISE 2018

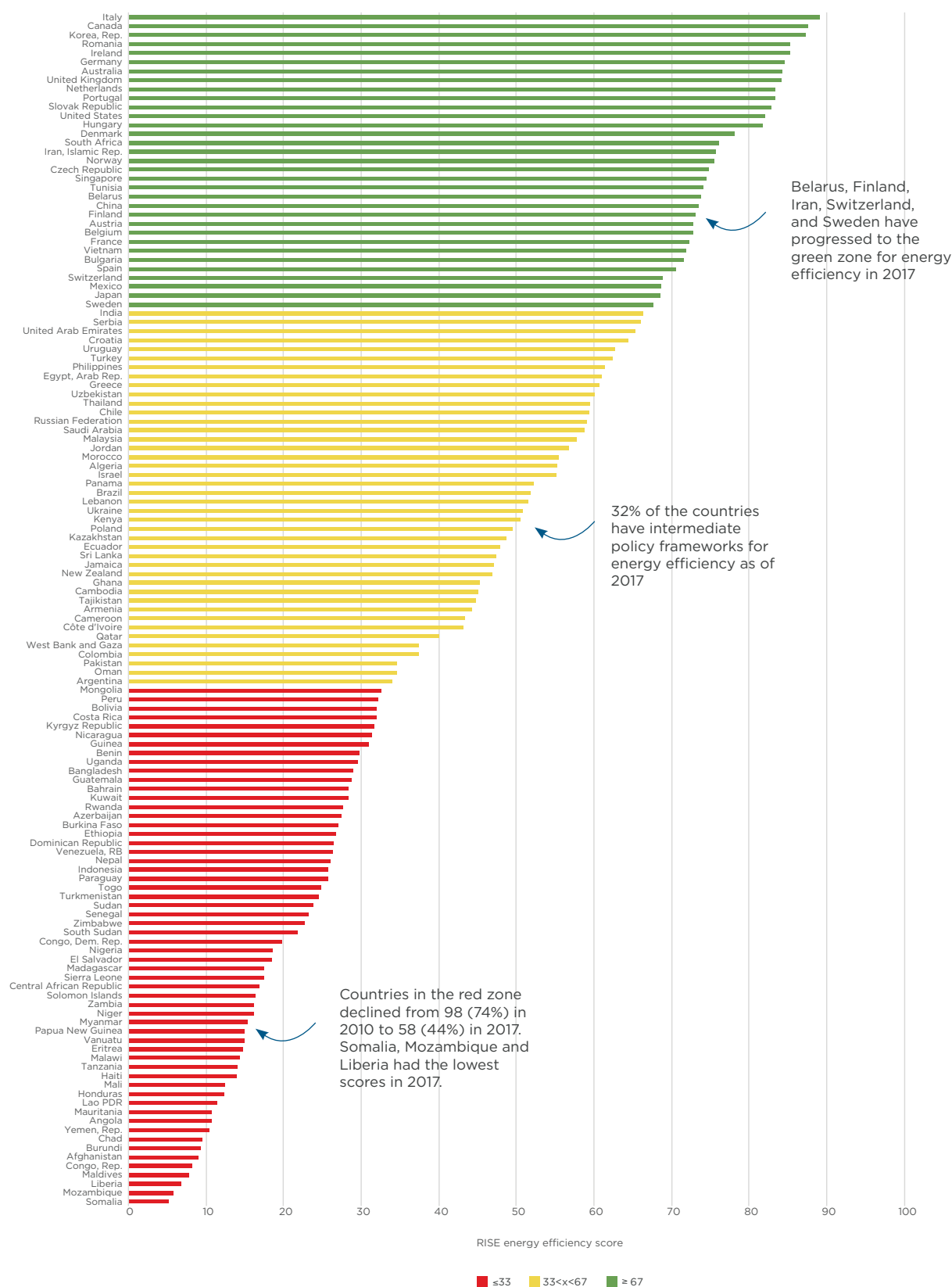
with a high score in Sub-Saharan Africa with regard to energy efficiency policy and regulation, along with Mexico in Latin America & the Caribbean (*Figure 6.7*).

Income levels are generally correlated with a country's overall energy efficiency score, although there are encouraging outliers in each income group. Apart from high-income countries, no other income group has an average score in the green zone for energy efficiency in 2017, while low-income countries

were the only ones to score consistently in the red zone. Middle-income countries are narrowing the gap with high-income countries, with Belarus, Mexico and Romania having achieved energy efficiency scores in the green zone in 2017.

About one-quarter of the countries scored in the green zone. These countries have successfully established good practices in institutions, policies, and mechanisms to promote energy efficiency (*Figure 6.9*).

FIGURE 6.9 RISE 2017 ENERGY EFFICIENCY PILLAR SCORES FOR ALL 133 COUNTRIES



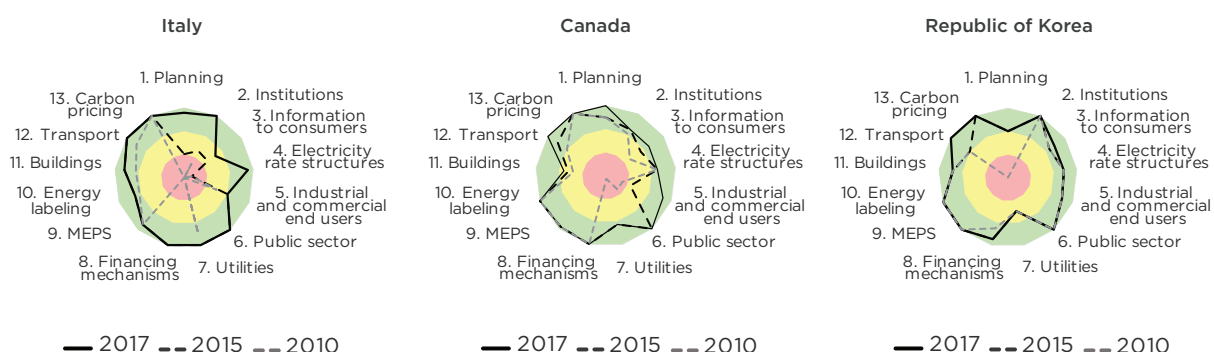
Source: World Bank RISE 2018

The top three performers on energy efficiency in 2017 were Canada, Italy, and Korea (Figure 6.10). All three countries scored full points for incentives and mandates in the public sector, transport sector energy efficiency, and carbon pricing. They also scored very high on financing mechanisms for energy efficiency, minimum energy performance standards, and energy labeling systems. From 2010 to 2017, Canada saw the most improvement in incentives and mandates for the public sector, while Italy improved its score on both incentives for the public sector and financing mechanisms. In the case of Korea, the most improvement in its score came from national energy efficiency planning and carbon pricing, because the

Korea Emission Trading Scheme was launched in 2015.

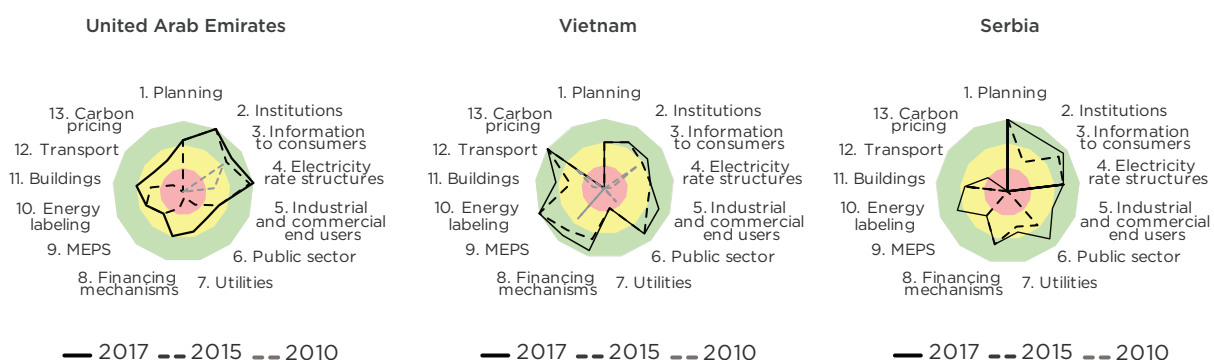
Serbia, the United Arab Emirates (UAE), and Vietnam were the fastest improvers from 2010 to 2017 (Figure 6.11).¹⁷ Establishing dedicated energy efficiency entities was the most evident area of progress for Serbia and the UAE. Vietnam improved its score the most on incentives and mandates for industrial and commercial end users. Both Vietnam and Serbia have also improved their scores on energy labeling schemes, while the UAE was a middle-tier performer in this regard. The UAE was the only country in this group that scored in the green zone for building energy codes.

FIGURE 6.10 TOP THREE PERFORMERS IN THE ENERGY EFFICIENCY PILLAR, 2017



Source: World Bank RISE 2018

FIGURE 6.11 TOP THREE FASTEST MOVERS IN THE ENERGY EFFICIENCY PILLAR, 2010-2017



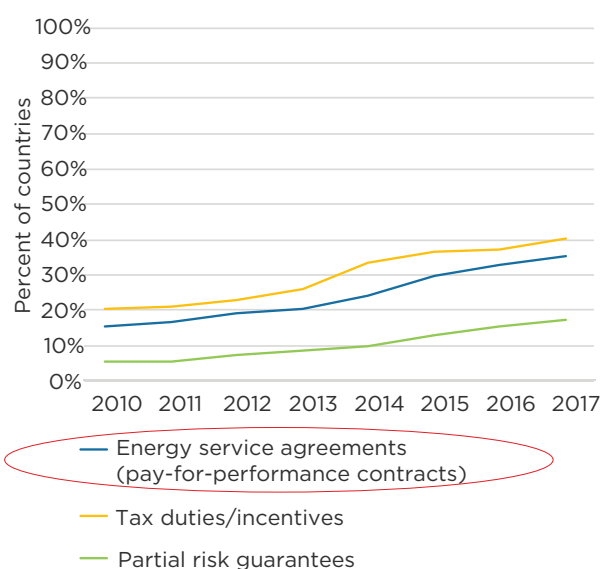
Source: World Bank RISE 2018

ADOPTING FINANCING MECHANISMS FOR ENERGY EFFICIENCY

Obtaining financing for energy efficiency investments is a crucial barrier to address, especially in the private sector. Financing initial investment costs presents a challenging hurdle, because payback periods and returns on investment are typically analyzed based on financial savings as opposed to income streams. Therefore, public sector support and/or clearly defined regulatory incentives are critical. Typically, public sector support is most effective at the early stages of market development and is then phased out as markets mature. OECD countries are top scorers for financing mechanisms for energy efficiency, while most of Sub-Saharan Africa scores the lowest. In Sub-Saharan Africa, only six countries offer financing mechanisms for energy efficiency: Benin, Ethiopia, Malawi, Rwanda, Sierra Leone, and Uganda, and five of them offer government tax incentives across sectors.

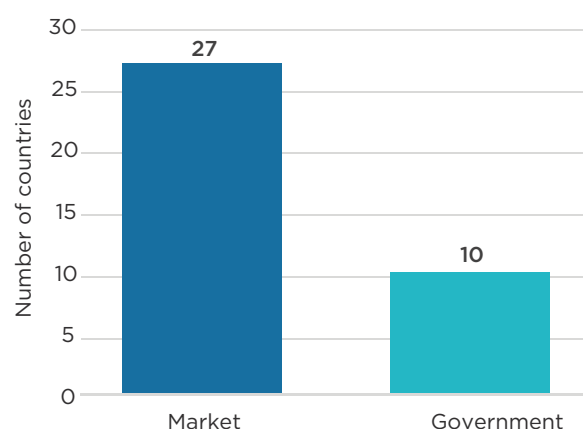
Energy service agreements have become nearly as prevalent a financing option as government tax incentives (Figure 6.12). Markets for energy service companies—private and/or semi-private companies that design, install, and can finance energy efficiency projects through energy service agreements—have grown significantly. Of the 133 countries surveyed worldwide, the percentage of countries with energy service companies for energy efficiency financing has more than doubled, rising from 16 percent in 2010 to over 36 percent as of 2017. In dollar terms, the global market for these companies grew to US\$28.6 billion as of 2017, of which about one-quarter of the market share is in the United States and 10 percent is in the EU.¹⁸ Among middle-income countries, India, Mexico, South Africa, and Thailand have developed profitable energy service company markets focused on industrial and public infrastructure energy efficiency. Among all the surveyed countries where energy service agreements are available, more than two-thirds are in private sector markets without any government-owned energy service companies (Figure 6.13).

FIGURE 6.12 EVOLUTION OF COUNTRY PROGRESS IN ENERGY EFFICIENCY FINANCING MECHANISMS, 2010-2017



Source: World Bank RISE 2018

FIGURE 6.13 ENERGY SERVICE AGREEMENTS: NUMBER OF COUNTRIES WITH PRIVATE MARKET OPERATED VS. GOVERNMENT-OWNED AGREEMENTS, 2017



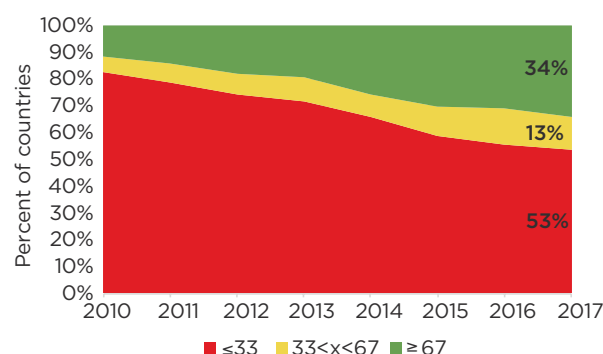
Source: World Bank RISE 2018

ENERGY EFFICIENCY POLICY, BY END-USES

In most countries, energy efficiency measures have been more readily adopted in the industrial sector than in other sectors. The *Tracking SDG7* report indicates that industrial energy efficiency was the fastest improving sector globally in terms of energy intensity. The four most energy-intensive areas of most economies are buildings, transport, industry, and utilities. When comparing energy efficiency mandates and incentives across these four areas with respect to global energy consumption, industry stands out as the most advanced thus far.

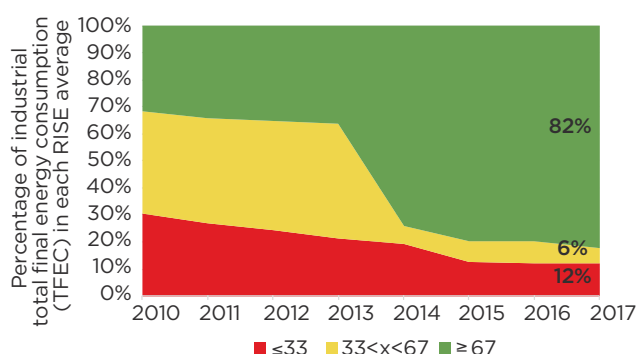
While all regions have countries that score green for industrial energy efficiency, adoption of regulations and enforcement systems is far from universal. Still, uptake of efficiency measures more than doubled in the industrial sector between 2010 and 2017, increasing from 26 percent to 60 percent (*Figure 6.22*). Encouragingly, small and medium-size enterprises (SMEs) are not being overlooked with respect to industrial energy efficiency programs. SMEs have seen an increase in uptake of energy efficiency measures since 2010, in conjunction with industrial incentives, improving from 17 percent to 41 percent (*Figure 6.23*).

FIGURE 6.14 SCORES FOR INDUSTRIAL MANDATES (ALL COUNTRIES EQUAL), 2010-2017



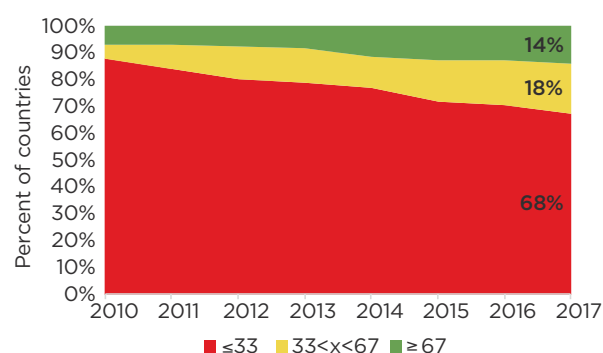
Source: World Bank RISE 2018

FIGURE 6.15 SCORES FOR INDUSTRIAL MANDATES WEIGHTED BY INDUSTRIAL TFEC, 2010-2017



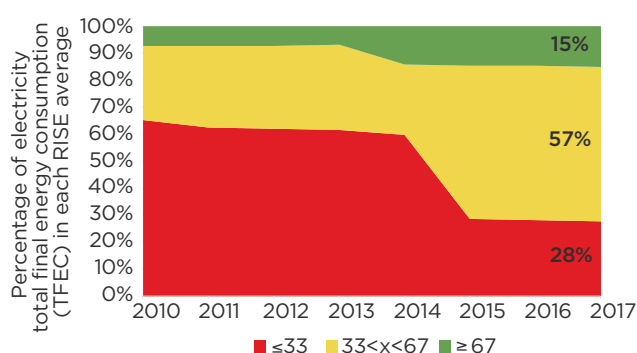
Source: World Bank RISE 2018

FIGURE 6.16 SCORES FOR UTILITIES MANDATES (ALL COUNTRIES EQUAL), 2010-2017



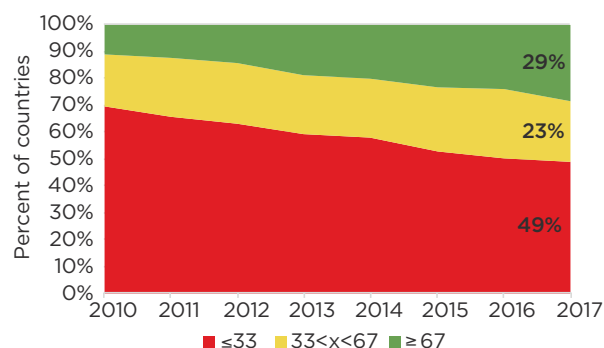
Source: World Bank RISE 2018

FIGURE 6.17 SCORES FOR UTILITIES MANDATES WEIGHTED BY ELECTRICITY TFEC, 2010-2017



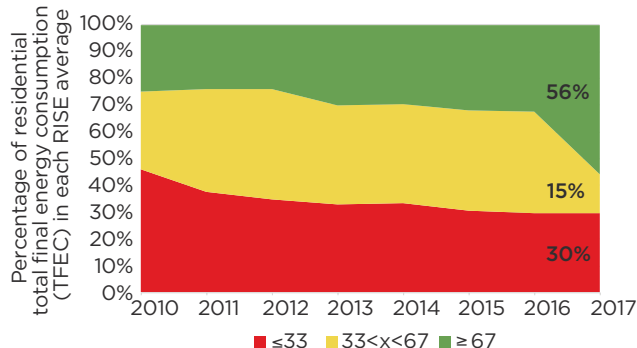
Source: World Bank RISE 2018

FIGURE 6.18 SCORES FOR RESIDENTIAL BUILDINGS (ALL COUNTRIES EQUAL), 2010-2017



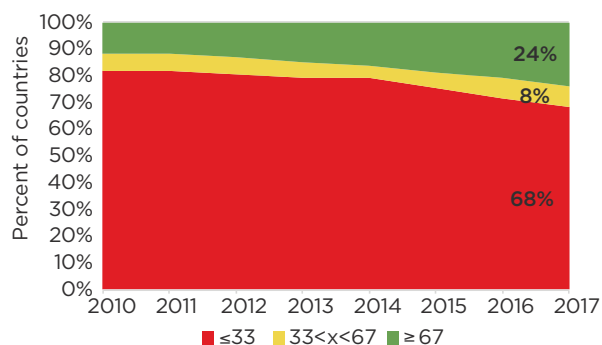
Source: World Bank RISE 2018

FIGURE 6.19 SCORES FOR RESIDENTIAL BUILDINGS WEIGHTED BY RESIDENTIAL TFEC, 2010-2017



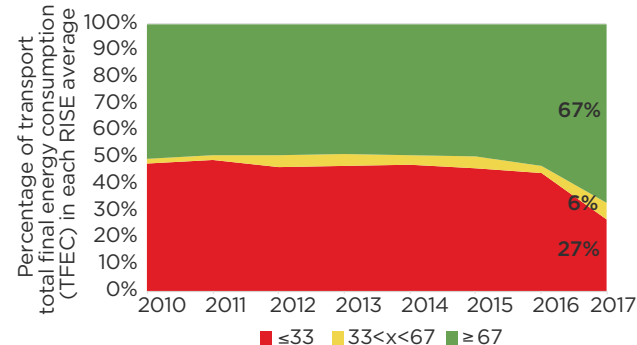
Source: World Bank RISE 2018

FIGURE 6.20 SCORES FOR TRANSPORT (ALL COUNTRIES EQUAL), 2010-2017



Source: World Bank RISE 2018

FIGURE 6.21 SCORES FOR TRANSPORT WEIGHTED BY TRANSPORT TFEC, 2010-2017

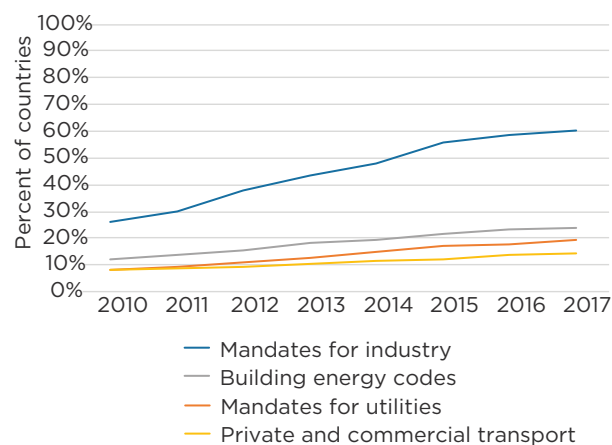


Source: World Bank RISE 2018

Mandates for industrial consumers and minimum energy performance standards for industrial equipment are generally adopted globally, but significant improvements are needed in monitoring and verification. Monitoring and verification measures to support mandates are less common than the mandates themselves. Only 26 percent of the countries have penalties in place for noncompliance, while even fewer (22 percent) have measurement and verification programs in place for the data reported by large consumers (*Figure 6.24*). Some countries have penalties on the books for noncompliance but have no monitoring and verification system. In Ethiopia, for example, large consumers are required to self-report their energy consumption improvements. It is best practice to have a third-party verification system for energy consumption targets, especially for industrial consumers.

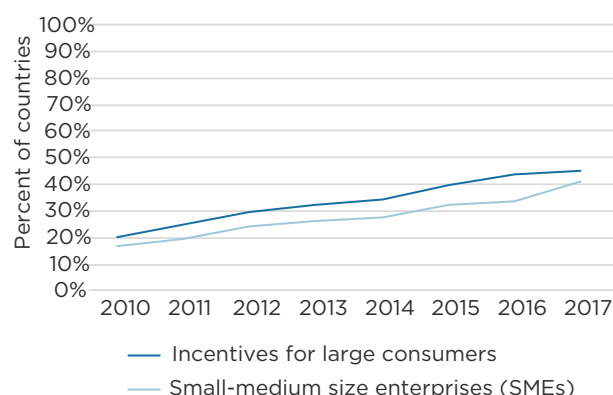
Minimum energy performance standards for industrial equipment cover a significant portion of global industrial energy consumption, while verification of standards compliance leaves ample room for improvement. While more than three quarters of the world's industrial energy consumption is covered by standards for industrial equipment, only about half of that energy consumption covered by standards is actually supported with a robust compliance system of monitoring and enforcement. Periodic updates of standards to match appropriate global thresholds, objective verification processes, and penalties for noncompliance with standards are all crucial building blocks to make industrial energy efficiency standards effective (*Figure 6.25*).

FIGURE 6.22 PERCENTAGE OF COUNTRIES WITH ENERGY EFFICIENCY MEASURES FOR INDUSTRY, BUILDINGS, UTILITIES, AND TRANSPORT, 2010-2017



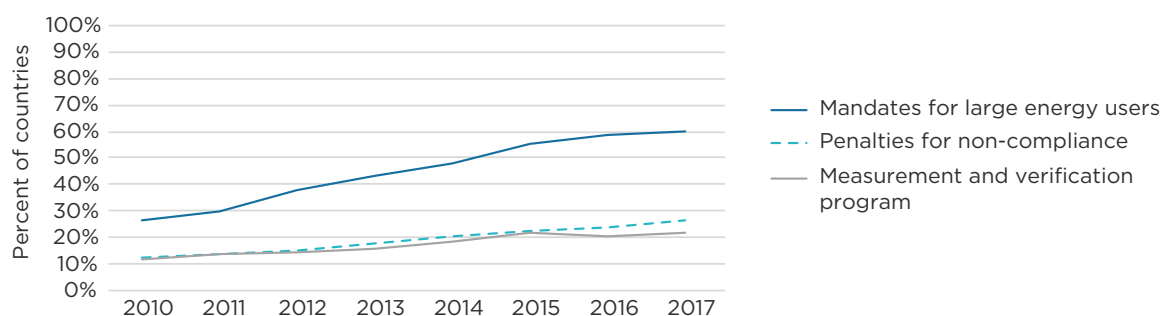
Source: World Bank RISE 2018

FIGURE 6.23 PERCENTAGE OF COUNTRIES WITH ENERGY-EFFICIENCY INCENTIVES FOR INDUSTRIAL AND SMALL-MEDIUM SIZE ENTERPRISE CONSUMERS, 2010-2017



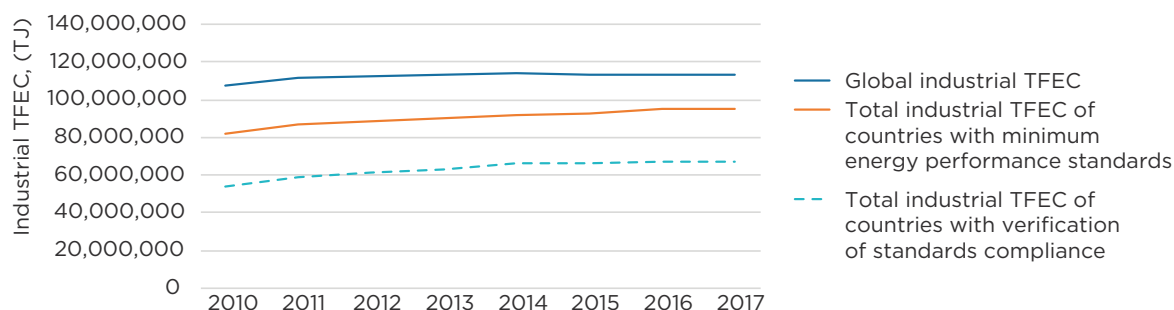
Source: World Bank RISE 2018

FIGURE 6.24 PERCENTAGE OF COUNTRIES WITH INDUSTRIAL ENERGY EFFICIENCY MANDATES AND ACCOMPANYING COMPLIANCE PROGRAMS, 2010 - 2017



Source: World Bank RISE 2018

FIGURE 6.25 COVERAGE OF MINIMUM ENERGY PERFORMANCE STANDARDS IN GLOBAL INDUSTRIAL ENERGY CONSUMPTION, 2010 - 2017



Note: 2015 consumption data was used for RISE 2015, 2016 and 2017 scores. Source: World Bank RISE 2018.

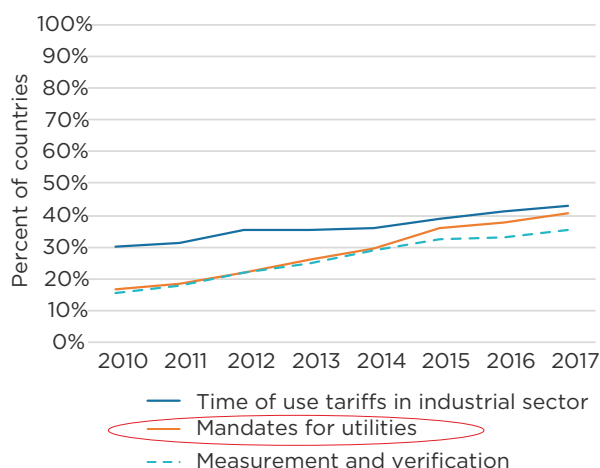
Source: World Bank RISE 2018

Similarly, 41 percent of countries have adopted energy efficiency measures for utilities, while only 35 percent have robust monitoring and verification programs for each type of utility. Though many countries have taken steps to impose energy efficiency mandates on utilities, very few use this approach to its full potential. This indicator has the second lowest average scores in the energy efficiency pillar, with just 23 percent of countries attaining scores in the green zone, while 60 percent of countries receive scores in the red zone, half of which have not adopted any standards at all. Top scorers include countries that were

early movers in this area, including countries in Europe & Central Asia and OECD high-income countries, while the lowest scorers mostly span Sub-Saharan Africa. Income, however, is not a determining factor in this regard. Any country can choose to take advantage of the utility customers to develop energy efficiency programs.

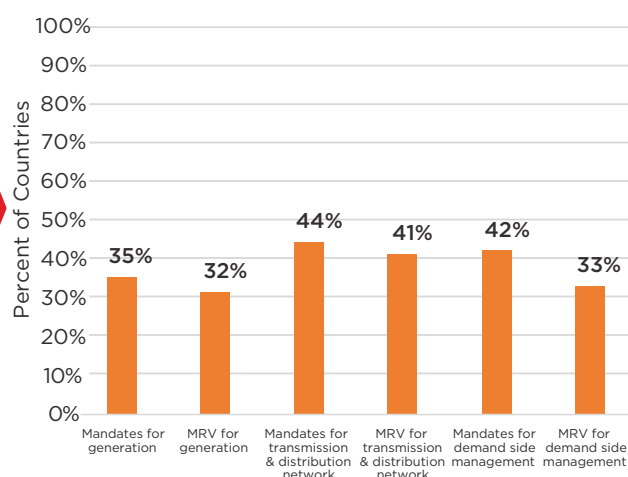
As shown in *Figure 6.26* and *Figure 6.27*, most countries with utility obligations also track performance in meeting energy efficiency requirements. However, this is being adopted much more slowly in all three areas (generation, transmission and distribution, and de-

FIGURE 6.26 PERCENTAGE OF COUNTRIES WITH ENERGY EFFICIENCY REGULATIONS FOR UTILITIES, 2010 - 2017



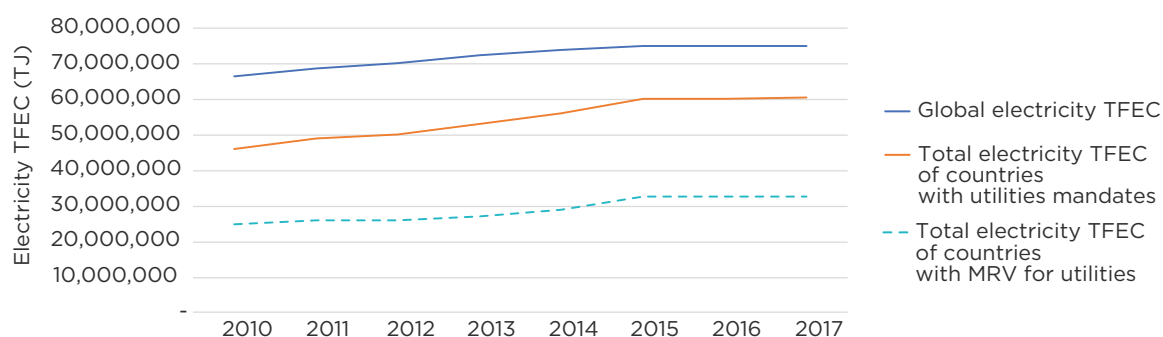
Source: World Bank RISE 2018

FIGURE 6.27 AVERAGE RISE SCORE OF COUNTRIES WITH ENERGY EFFICIENCY REGULATIONS FOR GENERATION, T&D AND DSM, 2017



Source: World Bank RISE 2018

FIGURE 6.28 COVERAGE OF UTILITIES MANDATES AND MRV IN GLOBAL ELECTRICITY CONSUMPTION, 2010 - 2017



Note: 2015 consumption data was used for RISE 2015, 2016 and 2017 scores.

Source: World Bank RISE 2018

mand-side management) than the mandates themselves. Time-of-use tariffs have become a more popular energy-efficiency measure. The most prevalent form of time-of-use tariff is peak-time rebates/time-of-day tariffs, used for the industrial sector in 43 percent of the surveyed countries.

Measures to improve the energy performance of buildings have been mostly adopted by OECD high income countries, while most developing countries have not adopted them.

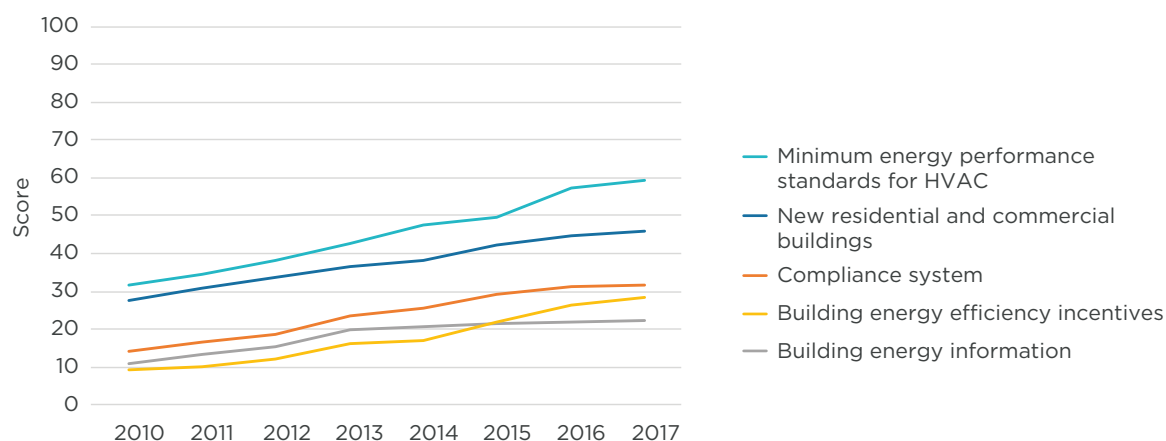
This is important, because countries that will have the bulk of the world's new construction are unprepared to mandate that their buildings will incorporate measures for ensuring good energy performance. Compliance systems and building energy information are also less prevalent in countries with energy codes (Figure 6.29).

For buildings, a major energy efficiency issue is heating and cooling, and only 59 percent of the countries had an energy efficiency plan

for this sector in 2017. Minimum standards for HVAC equipment and building energy codes are two important measures to address this. However, compliance programs and building energy efficiency incentives are lagging. Nearly all OECD high income countries score in the top tier for building energy codes, as do most countries in Europe & Central Asia. Qatar, Tunisia, and UAE are the only three Middle East & North Africa countries that score in the green zone.

Similarly, minimum energy performance standards for HVAC are the most widely adopted standard. These standards are well developed in OECD high income countries, while other regions also have good performers – Brazil, China, India, South Africa, Tunisia, and Vietnam – among many others. This is encouraging, since the demand for these products is growing, especially in developing countries where more and more segments of the population can afford air conditioning and modern heating systems.

FIGURE 6.29 BUILDING ENERGY CODES: SUB-INDICATOR SCORES, GLOBAL AVERAGE, 2010-2017



Source: World Bank RISE 2018

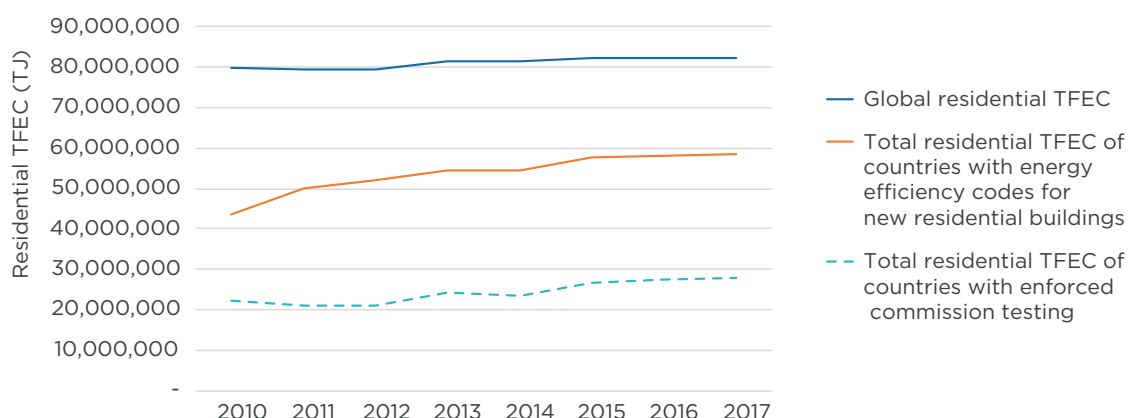
There is a clear gap between residential building codes and compliance systems.

Heating and cooling is a crucial issue in the residential building sector, especially in the developing world, where energy demand for residential space heating and cooling is expected to more than double by 2050 from a 2010 baseline. Effective residential building energy codes are an important policy lever to ensure that demands for heating and cooling are minimized as much as possible (Figure 6.30). Having a building code in place is not sufficient;

the code needs to be supplemented with an effective compliance system that includes commission testing and incentives for energy efficiency investments by building developers. Globally, there is a clear shortcoming when it comes to compliance systems for residential building energy codes. This gap is more pronounced for middle-income countries than for high-income countries (Figure 6.31).

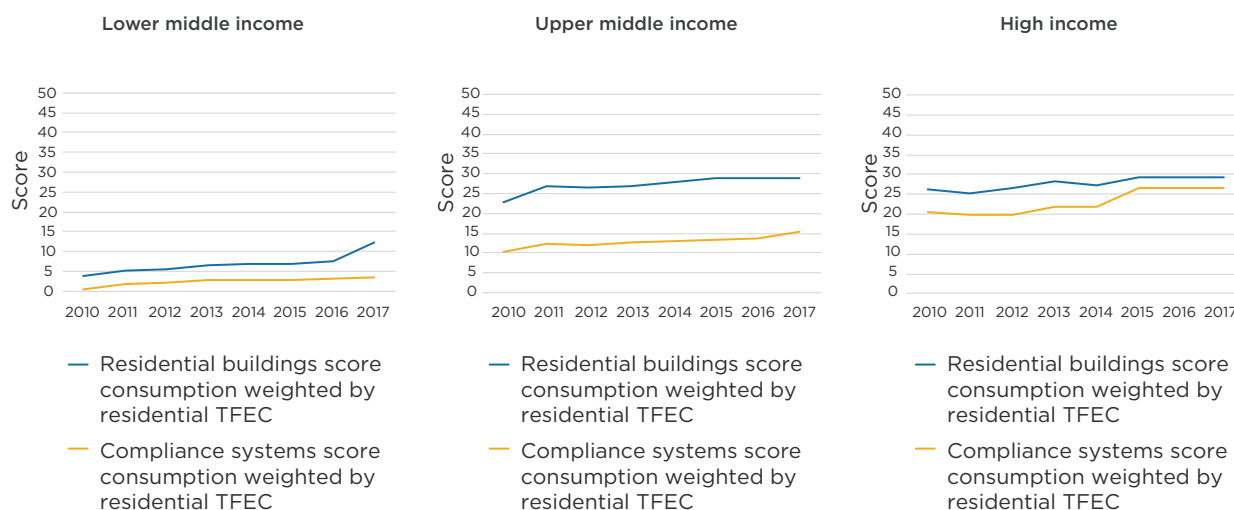
In the transport sector, the adoption of energy efficiency policies in high income countries is far ahead of all other income groups.

FIGURE 6.30 COVERAGE OF RESIDENTIAL BUILDINGS AND COMPLIANCE SYSTEMS IN RESIDENTIAL TFEC, 2010 - 2017



Note: 2015 consumption data was used for RISE 2015, 2016 and 2017 scores
Source: World Bank RISE 2018

FIGURE 6.31 SCORES FOR RESIDENTIAL BUILDING CODES AND COMPLIANCE SYSTEMS, BY COUNTRY INCOME GROUP, 2010 - 2017



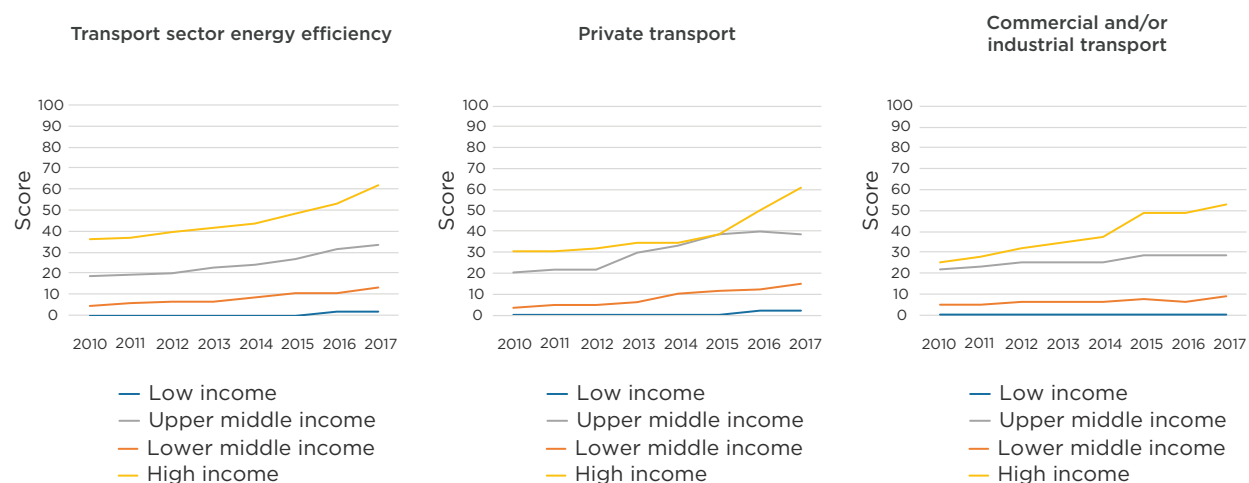
Source: World Bank RISE 2018

OECD high-income countries have made the most progress on transport sector energy efficiency and are top scorers on this indicator (Figure 6.32). However, most other regions score in the red zone, and it is overall the lowest scoring indicator in the energy efficiency pillar. This trend is prevalent for both private and freight transport. Mandates for private transport are becoming increasingly common. For commercial freight transport, 20 percent of the surveyed countries have an efficient fuel switching mandate in place.

In electric vehicle incentives and/or mandates, there has been a clear uptick since

2012–2013, with priority attention going to passenger transportation. As evidenced by the *Tracking SDG 7* report, there is more focus on passenger transport (both public and private) than on freight transport, with electric vehicle programs being a popular policy lever for reducing transport local and global emissions. There has been a clear increase in uptake of electric vehicle incentives and/or mandates since 2012–2013, although not many new countries have adopted light-duty vehicle fuel economy standards since then. For heavy-duty vehicles, there has been a more pronounced uptake of fuel economy standards, with a handful of large economies—such

FIGURE 6.32 AVERAGE SCORES BY COUNTRY INCOME GROUP FOR TRANSPORT ENERGY EFFICIENCY INDICATORS AND SUB-INDICATORS, 2010 – 2017



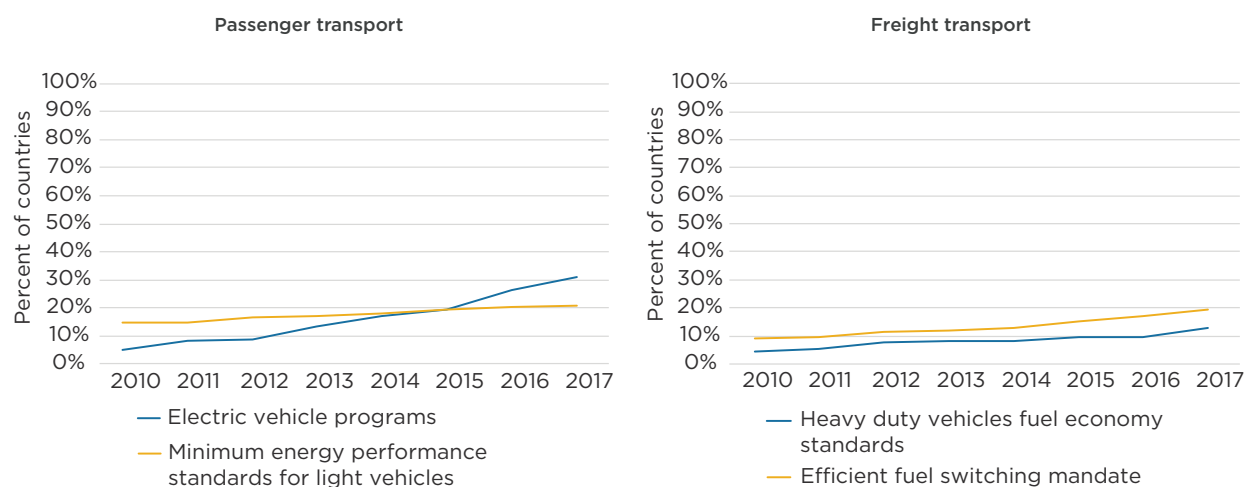
Source: World Bank RISE 2018

as India, Korea, and Mexico—planning to implement them before 2020, as highlighted in the IEA’s *Future of Trucks* publication series¹⁹ (Figure 6.33).

Fuel economy standards now cover more than 70 percent of transport energy consumption worldwide, but verification programs for

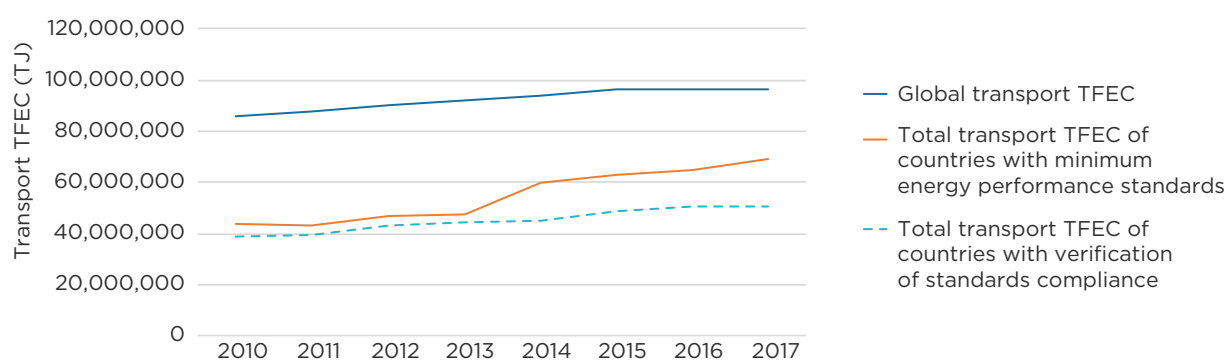
these standards are not widely adopted. With increasing motorization of passengers and freight travel in developing countries, and with most growth in transport demand expected to come from them, fuel economy standards and compliance mechanisms are a clear opportunity for progress against the SDG7 energy efficiency target. (Figure 6.34).

FIGURE 6.33 PERCENTAGE OF COUNTRIES HAVING THE TWO MOST PREVALENT ENERGY-EFFICIENCY MEASURES IN THE PASSENGER AND FREIGHT TRANSPORT SUBSECTORS GLOBALLY, 2010 - 2017



Source: World Bank RISE 2018

FIGURE 6.34 COVERAGE OF FUEL ECONOMY STANDARDS IN GLOBAL TRANSPORT ENERGY CONSUMPTION, 2010 - 2017



Note: 2015 consumption data was used for RISE 2015, 2016 and 2017 scores.

Source: World Bank RISE 2018

ENDNOTES

¹⁷ This group of fast-improving countries for energy efficiency also includes Denmark, Egypt, Malaysia, and Uzbekistan.

¹⁸ IEA, Energy Efficiency Market Report 2018,
https://webstore.iea.org/download/direct/2369?fileName=Market_Report_Series_Energy_Efficiency_2018.pdf

¹⁹ IEA, The Future of Trucks: Implications for Energy and the Environment,
<https://www.iea.org/publications/freepublications/publication/TheFutureofTrucksImplicationsforEnergyandtheEnvironment.pdf>