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Leveraging Financial Mechanisms for Increased Investment in Energy Efficiency

by Gray Bender

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1. INTRODUCTION

The Sustainable Development Goals (SDGs), defined in the United Nations' 2030 Agenda for Sustainable Development, set out an ambitious set of goals and targets across a broad range of development topics, including that of energy. SDG7 entails ensuring access to affordable, reliable, sustainable, and modern energy for all, and includes Target 7.3 of doubling the global rate of improvement in energy efficiency by 2030. Synergies from improving energy efficiency exist also with targets 7.a to enhance international cooperation on clean energy and energy efficiency technology, and 7.b to increase the supply of energy services in developing countries. Looking more broadly as well, improving energy efficiency globally can contribute to a wide number of SDGs through co-benefits and by enabling limited energy resources to reach more people and be applied more productively.

Figure 1: Benefits and co-benefits of improving energy efficiency can contribute to progressing a broad number of Sustainable Development Goals

In addition, in order to meet the ambitious climate goal of limiting global warming to well below 2 ºC, and to meet the various domestic climate targets set forth by UNECE member states, a diverse set of decarbonization tools will need to be employed. One of the most impactful and cost-effective strategies for reducing emissions is to implement energy efficiency measures that lower demand for energy in the first place. Energy efficiency measures can take many forms depending on the sector, but at its core the strategy aims to deliver the same or better service or outcome at a lower energy demand by reduce energy waste and maximizing potential. When paired with other demand-side strategies such as electrification and behavioral change, the result is a faster, cleaner, and more resilient energy transition.

While the potential for energy use reduction through efficiency is great, investment in the space often lags behind that of clean energy supply side infrastructure such as renewables and grid improvements. In 2022 global clean energy investment is expected to exceed $1.4 trillion USD, according to the International Energy Agency[1]. Of that, just under $250 billion USD is expected to go toward energy efficiency and electrification in the buildings sector (primarily in Europe) and only $40 billion USD into energy efficiency in the industrial sector. The result is that progress toward meeting

[1] (IEA, World Energy Investment 2022, 2022)

the targets of SDG 7 is lagging behind where it should[2]. Despite having the technology and knowledge to progress efficiency, more investment is needed to get the region back on track.

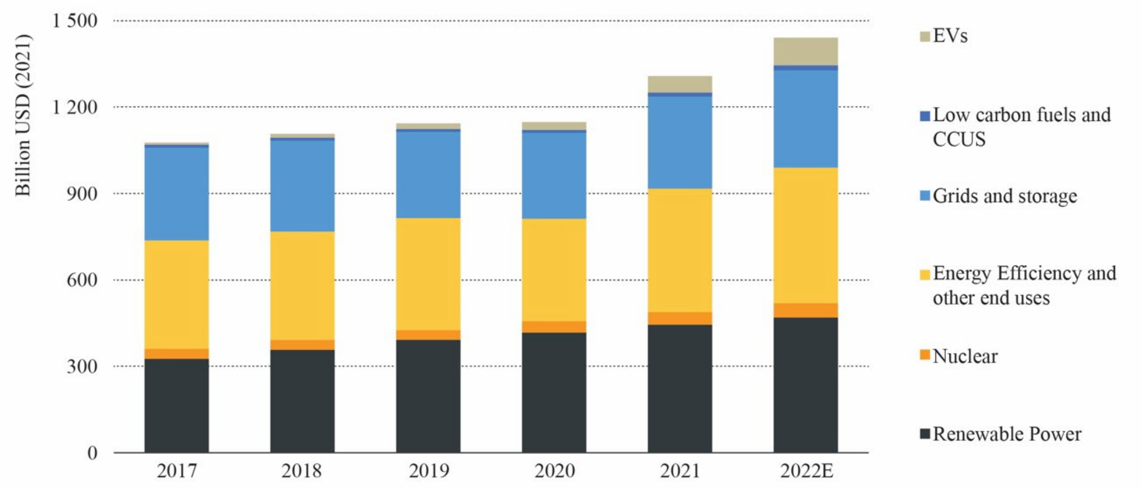

Figure 2: Annual clean energy investment (note that category "Energy Efficiency and other end uses" also includes investment in electrification and renewables for end uses). (IEA, World Energy Investment 2022, 2022)

This lag in funding is due to many factors. For one, renewable energy projects are typically much more palpable and easier to market for investors looking to showcase what their funding has produced. But beyond the perception and marketing potential, investment in energy efficiency is also challenged by higher perceived risks, large upfront costs, heterogenous nature, small project sizes, and less certainty about outcomes. This paper explores many of these perceived risks and shares potential mitigations, then investigates some of the emerging financing mechanisms that can help lower the barriers and expand the use of energy efficiency across economies.

2. THE ROLE FOR ENERGY EFFICIENCY

A. INVESTMENT AND SAVINGS POTENTIAL

Despite temporary setbacks in energy efficiency progress during the height of the COVID-19 pandemic period of 2020-2021, overall energy improvements seem to be returning to pre-pandemic levels. While global energy intensity only reduced by 0.5% in 2020, reductions were on track to return to its previous 1.9% 10-year average by the end of 2021. While this recovery is good progress, the IEA reports that in order to reach net zero by 2050 an annual global reduction in energy intensity of 4.2% per year needs to be achieved[3].

[2] (UNECE, Global Tracking Framework Regional Report 2022, 2022)
[3] (IEA, Energy Efficiency 2021, 2021)

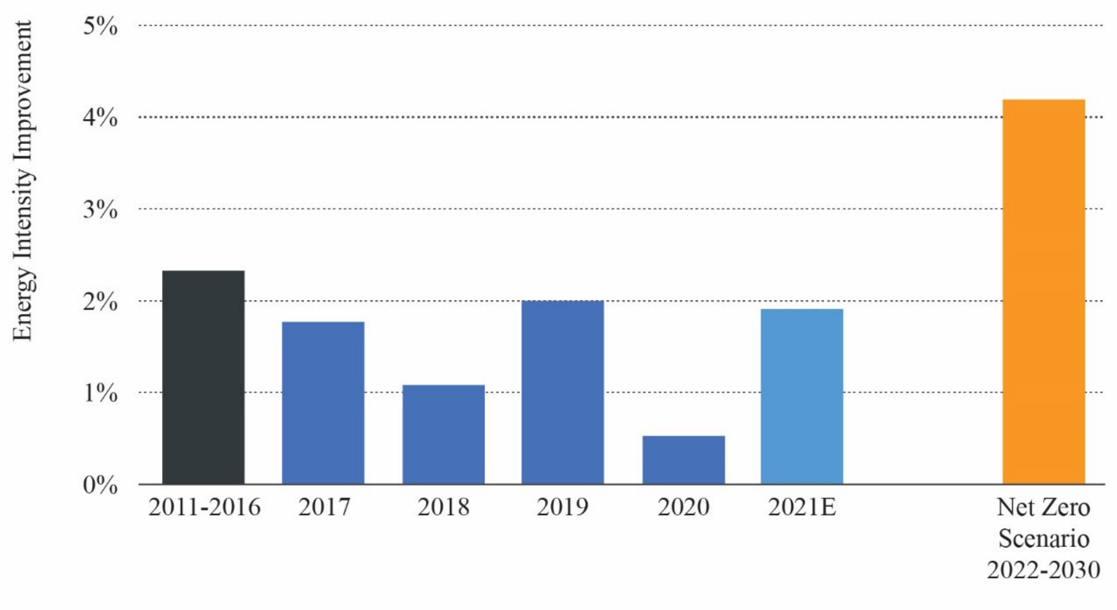

Figure 3: Primary Energy Intensity Improvement, 2011-2021 (IEA, Energy Efficiency 2021, 2021)

As governments plan and implement their COVID-19 economic recovery packages, the opportunity to leverage the synergies between energy efficiency, cost savings, and climate action should be considered. In 2021 government policies supported a 10% increase in energy efficiency investment for buildings, reaching almost $300 billion USD (Figure 4).

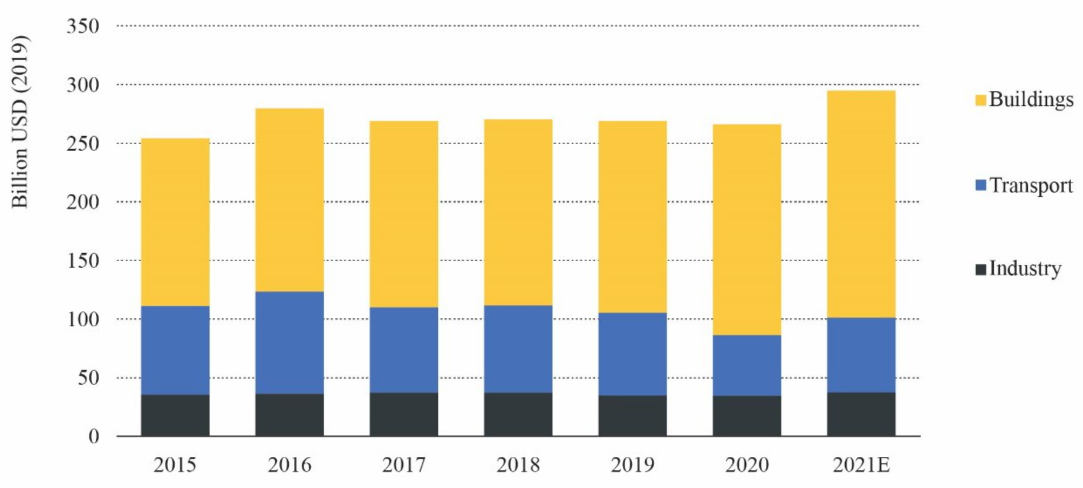

Figure 4: Global investment in energy efficiency by sector, 2015-2021 (IEA, Energy Efficiency 2021, 2021)

But in order to reach net zero by 2050, investment needs to triple by 2030[4]. The European Union has identified a need to increase investment in energy efficiency by as much as EUR 260 billion per year for the period 2021-2030 to meet their 2030 target of 40% reduction in emission from 1990 levels and an energy efficiency target of 32.5%[5]. Much of this, the EU states, will need to come from the private sector. Similar magnitude spending needs were identified in recent pathway modeling conducted by UNECE. These models project that a cumulative investment in energy efficiency of $1,380 billion USD over 2020-2050 is needed to meet the Nationally Determined

[4] (IEA, Energy Efficiency 2021, 2021)
[5] (European Commission, CORDIS Results Pack on Private Finance for Energy Efficiency, 2022)

Contributions (NDCs) of UNECE Member States, and a much higher $4,784 billion USD to limit warming to 2ºC[6]. Equally important to addressing the absolute growth in investment into energy efficiency is ensuring that those funds are made available not only to advanced economies but to emerging economies and developing nations as well. Across the big energy using sectors of buildings, industry and transportation, investment in energy efficiency in buildings has been by far the largest.

The savings that can be achieved from energy efficiency initiatives is substantial. In 2018, energy efficiency standards across the nine largest countries and regions (including the EU, US, and China) helped save 1,500 TWh of energy; equivalent to that year's total wind and solar installation[7]. If all countries implemented similar standards, total savings could exceed 3,500 TWh—the same as cutting China's electricity consumption by half. Savings from individual projects can have impressive results, with standard energy efficiency retrofits in buildings saving 20-30% of energy use and deep retrofits savings up to 75% of energy use in some cases. While these outcomes can be quite substantial, the diversity of projects even within the buildings sector, as well as variation in quality, can result in a huge range of savings at the individual project level.

As energy efficiency is applied more rapidly, the resulting savings in aggregate enable the growth in renewable energy to outpace the growth in demand for energy. This is a critical component of the energy transition, as it means that renewable energy serves to actually replace fossil fuels rather than just meet the growth needs of the energy sector. Currently energy efficiency is reducing consumption at a slower rate than demand is growing. To shift this trend, energy efficiency should be valued as an "energy source" of its own and should be considered as first priority before investing in new generation and infrastructure expansion.

B. DEFINING ENERGY EFFICIENCY INVESTMENT

The types of investment that fall within the energy efficiency umbrella can be classified into four main categories, shown below. However, the technologies utilized are myriad, which can make it difficult to track scale and progress. The 2017 *G20 Energy Efficiency Investment Toolkit*[8] differentiates between two primary types of investments. "Core" energy efficiency investments encompass standalone projects where generating energy savings is the primary goal. These include projects that energy service companies (ESCOs) implement, wherein there is a target to save energy and/or cost through more efficient systems. "Integrated" energy efficiency investments cover a much broader range of projects where overall asset performance is the primary objective and is realized through incremental "embedded" investment. This includes initiatives such as sustainable real estate; environmental, social, governance (ESG) investing; and socially responsible investing (SRI). Figure 5 illustrates the various types of energy efficiency investment, ranging from most targeted to more broad-based in which energy efficiency is one of many outcomes.

[6] (UNECE Committee on Sustainable Energy, 2020)
[7] (IEA, Energy Efficiency 2021, 2021)
[8] (G20 Energy Efficiency Finance Task Group, 2017)

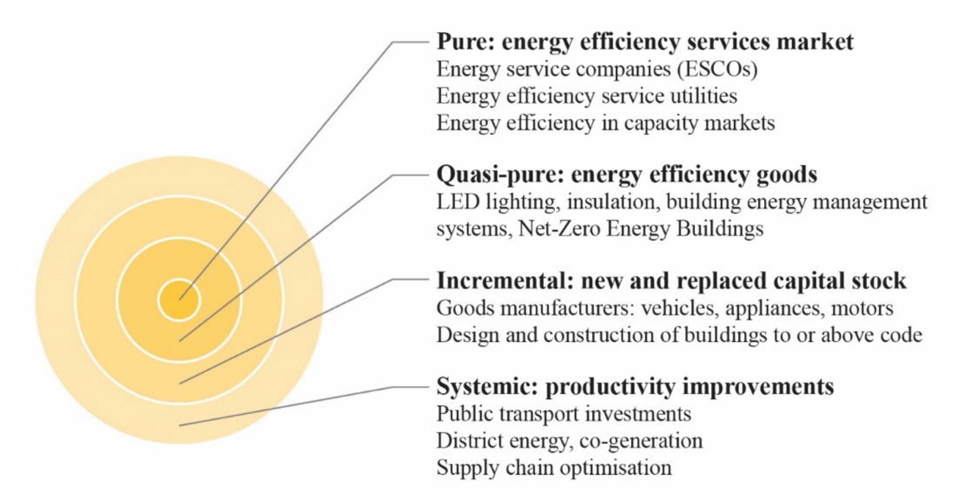

Figure 5: Broad categories of energy efficiency investments (G20 Energy Efficiency Finance Task Group, 2017)

The potential for investments in energy efficiency globally is estimated at $221 billion USD, which includes both core investment and green premiums. The US, EU, and China alone represented close to 70% of global incremental investment in energy efficiency in 2015, and hold even larger share of global investment today. Of that funding, the majority was directed to the buildings sector. In the EU, 80% of total efficiency investments went to the building sector, with Germany, France, and the UK reaching as much as 90%. This concentration suggests that there may be additional opportunities to increase energy efficiency funding beyond the buildings sector, particularly in the industrial and transportation sectors[9]. In emerging economies in the same year, the spread was much more balanced across sectors, with China sending only 34% of incremental investment in energy efficiency to the buildings sector and India just 19%. While this paper focuses primarily on financing mechanisms applicable to the buildings sector, and to a lesser extent the industrial sector as well, further research into how more funding can be directed into a broader set of energy efficiency areas would be valuable.

In developing strategies to grow investment in energy efficiency, a broad range of stakeholders should be included in the conversation. This includes policy makers, regulators, standardization bodies, public and private financial institutions, insurance companies, ESCOs, and utilities, to name just a few. Each stakeholder has a role to play, whether that is developing financing mechanisms, fostering a beneficial regulatory and legislative environment, or de-risking such investments. Engagement of owners and end users is also critical to increase the understanding, the awareness and the value of the benefits and co-benefits of energy efficiency investment.

C. A TOOL FOR ADDRESSING ENERGY SECTOR DISRUPTIONS

The ongoing geopolitical crises are currently disrupting the reliability of the energy system and impeding the energy flows across the UNECE region and beyond. In a number of countries, disruptions in energy trade and supplies are expected to threaten economic growth and to create further pressure on the consumers, in particular by elevating the energy prices in short- to medium-term. Energy efficiency plays prominent role in addressing the crisis. Taking steps to direct meaningful funding toward energy efficiency can help address both these geopolitical crises and the

[9] The transportation sector has seen a steady increase in internal combustion engine efficiency in the preceding decades. As electric vehicles become more popular, however, this sector will converge with end uses in buildings and industrial processes in adding additional load to the power grids. At that point efficiency becomes not only a benefit to reducing emissions and cost, but also an energy management tool to reducing the burden on energy grids and generation fleets.

long-term climate issue concurrently. Many of the mitigation measures and funding mechanisms described in this report can be considered as a tool to this end.

3. CHALLENGES FOR GROWING INVESTMENT

While the benefits of increasing energy efficiency across sectors are myriad, investment in efficiency technologies and projects has lagged compared to other areas of climate and clean energy spending. Several barriers to growing investment in energy efficiency exist, which include a combination of both real and perceived challenges. The following table includes a description of several prominent challenges, as well as potential mitigations that may be employed to help lessen or eliminate such challenges:

Challenge	Description	Mitigation(s)
High upfront costs and long payback periods	Energy efficiency projects typically require the acquisition and installation of new equipment or processes, which can incur a high upfront cost that takes longer to pay back with energy savings than other investments. This can require a higher level of financial liquidity and incur an opportunity cost, particularly if funding is scarce and must be balanced with other basic expenses or business needs.	Financing mechanisms that can reduce or eliminate upfront costs to owners Bulk procurement of energy savings technologies by developers to help foster economies of scale for technology providers to reduce costs Dedicated patient capital with longer investment horizons Monetization of additional benefits beyond energy cost savings
Lack of access to financing	Financing projects is a key enabler if upfront funding is not readily available. Often access to financing options are limited, however. This is particularly true in emerging economies and developing nations, but also in underserved communities in more developed markets. Limited access to financing and capital can be both systemic and pervasive, particularly in places where fewer financial institutions are available, where lack of transparency and accountability undermines trust, and in areas devoid of strong regulatory and policy instruments to facilitate financial infrastructure.	Innovative and established financing mechanisms such as energy performance contracts and on-bill financing that can be made available to end users who may not qualify for traditional financing options (see Section 5. Financing Mechanisms) Integration of development and multilateral funds with local financial institutions reserved specifically for energy efficiency projects Microfinance that can provide near-term resources and grow long-term credit for the future
Competing investment priorities	Financing of energy efficiency projects, whether by an entity itself or a third party, ties up capital that could be used elsewhere. Projects that improve energy efficiency and contain other co-benefits, but with longer payback periods or lower monetary returns, may not be	Education and awareness raising about the benefits of energy efficiency Financing mechanisms that eliminate capital expenditure for the end client so that they can continue to put scarce financial resources toward priority areas

Challenge	Description	Mitigation(s)
	prioritized as much as others. This is particularly relevant with small- and medium-enterprises (SME), which tend to prioritize investments closer to their core competencies and thus forego beneficial but less direct energy efficiency projects.	Integration of energy efficiency into strategic business analysis where applicable
High perceived risk[10]	Because of the more technical nature of energy efficiency projects that typically rely on expected savings for financial return, investors who lack the technical prowess to assess such projects typically perceive a higher level of risk in investing. This can be particularly true for local financial institutions, which may be unfamiliar with the energy efficiency investment landscape and are likely to prioritize more familiar investments with a limited pool of capital. Performance gaps between projected and actual energy saving can negatively reinforce perceived risk associated with such projects.	Partnering financial institutions with trusted local technology providers and developers for project execution and due diligence Implementing standardized risk assessment and project evaluation protocols Requiring third party verification Aggregation of investment projects to limit risk exposure through a more distributed set of projects Benchmarking of performance to improve predictability of results
Lack of trust in new technology	Energy efficiency technologies, including heating and cooling systems, lighting, insulation, and process equipment, tend to evolve quickly as research and development in the space continues. While new technologies may be able to provide higher energy savings, customers, developers, and investors can sometimes be wary of new systems that lack mature use cases. This can make it difficult for new technologies to be adopted and may serve to "lock-in" less efficient but validated legacy technologies while newer alternatives are available.	Technology pilots that demonstrate effectiveness Developer and manufacturer arrangements that guarantee cost savings even in the case of non-performance (such as Energy Savings Insurance) "Positive Lists" of pre-approved technologies and technology providers to enable greater certainty and clarity into the technical nature of projects seeking financing[11]
Lack of knowledge and awareness	Often a lack of investment in energy efficiency can be traced back to a lack of understanding or awareness of the potential benefits. Whether the end user is a homeowner, a business, a government, or any other entity, the	Public awareness campaigns and case study sharing can demonstrate the benefit of energy efficiency investments Simplification of, and transparency into, the project financing and

[10] See Section 4 for risk types and descriptions

[11] Note that while Positive Lists can deliver benefits such as increased trust in energy efficiency measures and more streamlined project implementation, such lists can perversely serve to lock in outdated technologies if not updated regularly. Institutions creating or maintaining Positive Lists should regularly research and update with new technologies as they become available.

Challenge	Description	Mitigation(s)
	benefits of investing in energy efficiency may not be clear. This in turn reduces the origination and development of energy efficiency projects as customers do not know to pursue these works in the first place.	implementation processes can serve to grow end user confidence and reduce barriers to adoption Policy measures to force change (e.g. Minimum Energy Performance Standards)
Split incentives	One of the more complicated challenges to energy efficiency is that of split incentives, wherein the entity responsible for implementing efficiency upgrades is not the one responsible for utility payments or other costs. This is common in the residential and commercial real estate sectors, where tenants are often responsible for utility payments, but capital projects remain the responsibility of the property owner. In this case neither entity has the incentive to invest in energy efficiency projects. This challenge is pervasive globally as rental arrangements make up a large portion of building occupancy around the world.	Programs that benefit building owners beyond reduction in utility bills, such as green mortgages and demonstration of higher rent potential, higher occupancy rates, and increase in property value Energy-as-a-Service models that incentivize a third-party entity to maintain maximum system performance and energy efficiency (see Section 5. Financing Mechanisms)
Price of energy	As a commodity, the price of energy is variable across all of its current forms. For most end users, price fluctuation of electricity and gas can introduce an element of uncertainty into operational expenses. It also affects the financial viability and return of energy efficiency projects, as unexpected energy price drops can greatly reduce or even eliminate the return on energy efficiency investment. The presence of subsidies and lack of accounting for negative externalities of energy consumption, such as carbon emissions and local air pollution, also serves to distort the market and leads to the undervaluation of energy efficiency investments and energy savings[12].	Projects should be based on a multi-year average cost of energy, and risk should be assessed under both high and low energy cost scenarios Investments with co-benefits beyond energy savings can help broaden the economic case for undertaking the project Agreed upon energy price floors can help protect credit risk for developers offering financing options directly
Small project scale	Individual investments in energy efficiency projects can be relatively small compared to the needs of investors, particularly in the residential sector. As these small	Consolidating a portfolio of energy efficiency projects to leverage economies of scale in project initiation and execution

[12] (Magallón, et al., 2019)

Challenge	Description	Mitigation(s)
	projects are often pursued individually rather than in aggregate, the due diligence required to assess and verify savings cannot take advantage of economies of scale, and thus results in higher transaction costs than other competing investments. This in turn can lower the appeal of energy efficiency investments for financial institutions.	Standardized protocols to reduce due diligence costs and requirements
Lack of recognized asset class	Due to factors such as the variety, technical needs, and the bespoke nature of many financing agreements, energy efficiency as an investment is not clearly defined as a standalone asset class, particularly in integrated energy efficiency investments. Instead, such investment typically falls into a variety of other classes, including public and private real assets, corporate entities, private equity, etc. This makes it more difficult to finance with traditional mechanisms and limits the ability of financial institutions to securitize such investments. While many financial institutions indicate that energy efficiency has a strong business potential[13], it remains limited in part due to this lack of classification.	By introducing standardized processes, due diligence, insurance, and other measures, such investments can become more transparent and reliable Benchmarking performance of energy efficiency projects to provide a clear, reliable understanding of investment outcomes and benefits Policy measures that help define energy efficiency investment, such as the EU's Taxonomy, Non-Financial Reporting Directive (NFRD), Corporate Sustainability Reporting Directive (CSRD). European Sustainability Reporting Standards (ESRS), etc.

Many of these challenges are being addressed through a growing body of research and case studies based on the increasing prevalence of energy efficiency projects across sectors, geographies, economic contexts, and other factors. For example, growing amounts of evidence show that risks associated with investments in energy efficiency are actually much lower than previously perceived by the financial industry[14]. The next step thus becomes to effectively communicate such evidence to the markets to demonstrate not only the soundness of such investments but also the substantial opportunities for financial return. In order to grow private investment in the space and take advantage of these opportunities, available innovative financing mechanisms can be applied to shift and reduce risk, to lessen barriers to entry, and ultimately to broaden the penetration and results of energy efficiency investment across sectors.

[13] (G20 Energy Efficiency Finance Task Group, 2017)
[14] (European Commission, CORDIS Results Pack on Private Finance for Energy Efficiency, 2022)

4. PROJECT RISK TYPES

Energy efficiency projects face a number of risks to the stakeholders involved. Many of the mechanisms described in Section 5 can serve to lessen or distribute these risks across project stakeholders. Depending on the financial arrangements and the potential upside for each stakeholder, entities may be willing to take on different levels and types of risk. For example, project developers may be willing to take on performance risk of a project by guaranteeing a certain payback to customers regardless of the actual energy saved in arrangements where their return is higher or takes a "first out" contract model. The risk in this case is that the project does not end up realizing the savings the developer had planned, while they are still contractually obligated to cover the promised utility bill reduction without the benefit of energy cost savings income.

Four key risk types are primarily relevant to energy efficiency projects and associated financing mechanisms:

- Performance Risk: The risk that a project, program, product, or service will not perform as intended or promised. Particularly important for projects where payback is linked to performance, such as energy savings realized from a new piece of equipment. In the case of non-performance, expected energy savings may not be available to repay loans or finance agreements.

- Credit risk: Arises from borrower's failure to repay a loan or meet financing contract requirements. The credit risk shifts depending on which party takes on the role of the borrower (for example the end customer, the technology provider, or an ESCO).

- Financial risk: The ability to manage debt and fulfill finance obligations. The risk varies depending on the financial conditions. Insurance and credit guarantees are common financial risk mitigation tools.

- Regulatory risk: The risk that changes in regulation and legislation governing a project or geography will affect project feasibility, conditions, and/or financial performance. This could include changes in government incentive programs, technology and building codes, and other related rules.

5. FINANCING MECHANISMS

In order to overcome many of the challenges listed above and increase the amount and availability of investment into energy efficiency, a number of established and emerging financing mechanisms are being successfully applied. Each mechanism utilizes a unique mix of factors that can be applied to specific situations and project types. Conversely, each also has its own set of limitations, which may not make it appropriate nor available to use in all instances. Several include engagement with stakeholders beyond the immediate project parties, such as local and regional governments, financing groups, and insurance agencies. In these cases, it is important to consider the opportunity and challenges of what a broad stakeholder engagement will entail and set forth a clear plan about how to align the parties and secure the necessary actions to get the mechanism in place. While not exhaustive, this list provides a range of mechanisms that may be applicable across a diverse set of project types, geographies, financial and governance contexts, and other such factors.

A. ESTABLISHED MODELS

ENERGY PERFORMANCE CONTRACTS (EPC)[15]

EPCs are a well-established practice, strongly supported by policies and legislations in Europe, North America, and other parts of the UNECE region. At its core, an EPC model uses an ESCO to implement a project (either energy efficiency or renewable energy) and applies the stream of energy cost savings to repay the project costs. Under this model the ESCO is responsible for delivery of the project. The ESCO will not receive payment until the project delivers energy savings as expected, thus protecting the owner from potential performance risk and/or non-delivery. This model is particularly useful for cash-poor but creditworthy owners who are seeking to implement such projects. EPCs can be structured as either shared savings or guaranteed savings models:

- Shared Savings EPC: Cost savings realized from the project are split for a pre-determined length at an agreed percentage. In this case the ESCO will likely take on the credit risk as the owner is agreeing to take on part of the performance risk. This model however is limiting for smaller ESCOs, as multiple projects can quickly lead to over-leveraging and the company is stuck unable to finance new projects until payments materialize. Some contracts include "first out" clauses, whereby the ESCO is paid 100% of savings until the project costs are paid out.

- Guaranteed Savings EPC: In order to shield the owner from performance risk, the ESCO guarantees a certain energy savings, and is forced to cover the difference if the full savings do not materialize. Such agreements typically have a minimum energy price to protect the ESCO from energy price fluctuations that effect the value of energy savings and are outside its control. In this case it is the owner's responsibility to secure financing from a financial institution and take on the credit risk, but the ESCO can help facilitate this process. This model works best in locations with well-established banking structures and where financial institutions are familiar with energy efficiency projects, and thus may be challenging to implement in emerging markets. This model is most suited for large projects and with sophisticated clients who have the capacity to deal with the complexity of the contracting process. This primarily encompasses municipalities, universities, schools, and hospitals.

- Standard Term: 5 to 20 years

- Financing Size: $500,000-$5 million USD

LOAN/DEBT FINANCING

In this standard financing model, the project owner borrows funds to pay for energy efficiency upgrades to their property. The lender is typically a third-party financial institution that can be accessed by the owner or coordinated through by the developer (indirect financing), though financing options are also often offered by equipment manufacturers, vendors, and contractors as well (direct financing). The loan can cover part or all of the upfront project cost and is to be repaid over time through an agreed upon repayment plan. Direct financing options can be especially helpful in emerging economies where credit lines from financial institutions may not be available.

[15] Also known as energy savings performance contracting (ESPC)

ON-BILL FINANCING (OBF)

For this model, the utility or a third-party financial institution provides capital to an owner for an energy efficiency or distributed renewable energy project, then is repaid through regular payments added to the existing utility bill. For the financier this provides lower non-payment risk, as the rate of default on energy bills is low, and for the owner it avoids the capital costs and simplifies the repayment system through integration with the existing utility payments. The bill repayments are typically scaled to be less than or equal to the project's energy savings, resulting in a net monthly utility bill that is equal to or less than what the customer paid prior to the project (known as "bill neutrality"). The OBF model has been in used since the 1970s between utilities and customers, but more recently a wider array of third-party financiers have been offering services with the utility playing a collection and remittance role. In 2016 over 232,000 OBF loans were extended to residential and commercial customers in the US alone at a total value of roughly $1.83 billion[16]. While not commonly used for government facilities, this model is applicable to projects such as commercial, industrial, private universities, schools, hospitals, and single and multi-family dwellings.

- Standard Term: 2 to 15 years
- Financing Size: $5,000-$350,000 USD
- Benefits: Often accessible to customers who may not qualify for traditional financing; utilities can address capacity limits through more cost-effective demand reduction rather than expensive investment in new generation infrastructure; strengthens relationship between utilities and financial institutions to unlock further capital; incentive alignment for utilities to achieve savings targets set by governments or other entities

ENERGY SERVICE AGREEMENT (ESA)

ESAs are pay-for-performance models for energy efficiency work, which closely resemble Power Purchase Agreements (PPA) used for renewable energy projects. In this model, the provider covers all development and construction costs of the project and is paid back by the customers through service charge payments on the actual energy saved. ESA is an off-balance sheet financing mechanism, meaning that payments are treated as operating expenses rather than capital expenditure for the customer. Unit price for energy saved is set at or below the existing utility price, which allows for customers to see immediate savings upon completion of the project and enables them to redirect a piece of existing utility payments toward the project. At the end of the agreement term, the customer has the option to either 1) purchase the equipment at market value, 2) extend the contract, or 3) return the equipment.

- Standard Term: 5 to 15 years
- Financing Size: $1 million+ USD (however, smaller projects on the order of $200,000-$500,000 USD can be bundled into single ESA financing packages)
- Managed Energy Service Agreement (MESA): A specific kind of ESA, the MESA is a model in which the ESA provider takes on the complete management of a facility's energy program, becoming the intermediary between the owner and the utility. The MESA puts the ESA provider in charge of energy projects (including hiring contractors/ESCOs), utility bills, and energy management, for which the provider charges an agreed upon fixed rate (thus

[16] (Leventis, Martin Fadrhonc, Kramer, & Goldman, 2016)

protecting the owner from utility rate fluctuations). The MESA model can be useful in split incentive situations, particularly between building owners and tenants.

GREEN BONDS

One of the most successful financial tools in the energy efficiency space, green bonds are a fixed income debt instrument whereby corporations, governments, and financial institutions have access to borrowing from investors specifically for sustainability-related projects. In 2018 green bonds in Europe alone reached over EUR 40 billion in value[17]. These bonds typically come with lower rates and provide the issuer with full discretion of funds so long as the "green" requirements are met. Green bonds are typically for very capital intensive, large projects (i.e., on order of $25 million). These funds can be put toward funding a project directly or directed through other mechanisms such as an ESA or EPC with an ESCO.

- Standard term: Up to 10 years
- Financing size: $25 million+ USD

ECONOMIC INCENTIVES

Rebates or subsidies offered by governments or utilities can greatly increase the adoption of energy efficiency technologies, helping correct the market failure that leads to under investment in economic projects and undervalues the positive externalities of more efficient systems. Such incentives can be paired with many of the financing mechanisms included in this report, reducing the overall cost of energy efficiency projects and supporting the growth of energy efficient product and service sectors.

- Standard term: As decided by regulators/legislators
- Financing size: Incentives can range from individual product incentives on the order of $100s to $1000s USD, up to process and systems incentives in the $100,000-$1 million+ USD range

B. EMERGING MODELS

ENERGY EFFICIENCY MORTGAGES (EEM)

EEMs provide preferential financial conditions linked to mortgages for buildings that have undertaken projects to improve energy efficiency or were designed and constructed using energy efficient techniques. In many situations lenders will recognize the verified savings of an energy efficiency project and offer an option to combine the project cost into the existing mortgage while also improving the mortgage conditions. Various studies[18] have connected improved energy efficiency in homes with a lower mortgage risk to banks. Based on this reduced risk, banks can pass along benefits to the mortgage holders such as reduced interest rates and greater borrowing power, which can help owners secure funds for energy efficiency upgrades and new construction. Programs

[17] (European Commission, CORDIS Results Pack on Private Finance for Energy Efficiency, 2022)
[18] (Billio, Costola, Pelizzon, & Riedel, 2021) and (Baccega, Bedin, Billio, Hristova, & Riedel, 2019)

such as the Energy Efficiency Mortgage Initiative (EEMI), funded by EU Horizon 2020, have been working to grow the EEM ecosystem within the mortgage lending community.

PROPERTY ASSESSED CLEAN ENERGY (PACE)

The PACE mechanism, originally developed in California in 2007 and now used broadly in the United States[19], enables investment in energy efficiency and distributed renewable energy systems in existing buildings and new construction. PACE programs offer up-front, long-term (up to 25 years) financing which is repaid through property tax bills. PACE is thus considered an asset-based financing mechanism rather than a personal loan, enabling building owners to sell the property without carrying over the debt. This program requires engagement and policy implementation from local government to allow private lenders to place a lien on the property and to enable the governments to remit the payments to investors. The model is typically applied to private property projects, such as those undertaken on residential or commercial properties. The PACE model has been adapted around the world with varied success. Additional PACE-like programs exist in Australia, Canada, and the Netherlands; South Africa and the UK are exploring the concept; and the EuroPACE[20] project, now concluded, has set the stage for additional programs to be introduced elsewhere in Europe.

- Standard Term: 10-25 years (long-term)
- Financing Size: $75,000-$750,000 USD
- Risk reductions: Consequences of nonpayment results in the same consequences as nonpayment on any other part of the property tax, providing security of repayment to the lenders; repayment is typically a “senior lien” on the property, providing certainty in repayment to the investor(s)
- Benefits: Reduces/eliminates high upfront project cost, providing 100% up front financing for efficiency and renewable energy projects and ensuring that such projects remain cash-flow positive; debt can be transferred with the property to a new owner (given agreement between buyer and seller); PACE financing instruments can be collected and securitized
- Model: An owner seeking funding for an energy efficiency project can secure long-term PACE financing through a public or private PACE program, working with a dedicated lender or a group of lenders. The local government collects payments on a property tax bill, typically PACE assessments is added as a separate line on a tax bill, then remits those payments to the original finance provider.
- Challenges: Program setup requires policy change within local municipalities to adjust established tax collection structures by including the necessary steps to add a new charge; decentralized nature of programs allows for substantial variation in scope, type of financing, and eligibility by location; requires well established and transparent local tax structures;

[19] The US defined both Residential PACE (RPACE) and commercial PACE (CPACE) programs. RPACE was originally introduced in 2007, followed by CPACE in 2009. PACE-enabling legislation is active in 38 states plus Washington D.C., and PACE programs are now active (launched and operating) in 30 states plus Washington D.C. Residential PACE is currently offered in California, Florida, and Missouri with over $10 billion USD in deployed financing (PACENation, 2022)

[20] (European Commission, Developing, piloting and standardising on-tax financing for residential energy efficiency retrofits in European cities, 2018)

susceptible to predatory developer behavior of lenders and energy services contractors, thus requires customer protections and safeguards to be put in place

ENERGY SAVINGS INSURANCE (ESI)

ESI is a novel risk reduction mechanism whereby the energy savings claimed by project developers are insured against non-performance. This reduces risk for the owner by ensuring that the promised financial savings will be realized, incentivizes project developers to be accurate in their estimates and project execution, and increases the financial certainty for energy efficiency projects. The increased certainty is vital to assuage financial institutions of concerns around energy efficiency investments and paves the path toward securitization of debt[21]. It allows banks and other investors to focus on the credit and process components of the project rather than the technical details. ESI is particularly useful for encouraging energy efficiency projects among small and medium enterprises (SME), enhancing trust between SMEs, project developers, and financial institutions. Programs such as ESI Europe[22] are expanding the reach and recognition of such programs, and ESI has already been proven at scale in many places in Latin America and recognized by the Global Innovation Lab for Climate Finance[23].

- Applicability: Residential, commercial, public sector
- Model: ESI can applied to more common financing models such as on-bill financing or traditional energy performance contracts. Typically, a project developer will engage an insurance firm that offers ESI to form a policy. The project developer will serve as the policy holder, while the owner, who is the credit taker financing the project, is designated as the beneficiary to receive remittance in the case of energy savings not meeting the agreed upon level. This then avoids the credit risk to the owner, who can use the remittance in place of the missing energy savings to continue paying their loan or other financing agreement. The agreement is underpinned by a set of standardized contracts that improve transparency and accessibility, and third-party validation of proposed and actual energy savings.
- Benefits: Increases financial institutions' willingness to lend; particularly useful in emerging economies where SMEs and local financial institutions lack the technical ability to assess energy efficiency projects themselves; opens a broader range of credit lines for SMEs to financing energy efficiency projects; large data needed by the insurance industry creates strong evidence for energy efficiency projects, helping to underpin the entire industry
- Challenges: Lack of availability, as ESIs require special knowledge and offering from insurance providers

GUARANTEE FACILITY

Guarantees, similar to ESIs, de-risk investments in energy efficiency by guaranteeing the projected returns of a project. Such guarantees can be provided by governments, utilities, or

[21] Securitization involves the consolidation of financial assets and/or debts into a financial instrument that can then be sold to investors. Securitization of assets increases the opportunities for investors to engage and frees capital for the security originator. Such a process is beneficial to growing private investment in energy efficiency, as investor can, for example, trade future cash flow with investors.
[22] (ESI Europe, 2022)
[23] (Climate Finance Lab, 2022)

international and large financial institutions. The added certainty around financial returns can help grow private sector investment in viable energy efficiency among financial institutions less familiar with such projects. Guarantees are typically set below 100% of the loan value to maintain the incentive for financial institutions to undertake proper due diligence. Use of guarantees is also most useful in environments where energy efficiency lending already exists.

- Applicability: Residential, commercial, public sector
- Benefits: Increases financial institutions' willingness to lend (including to borrowers who may not otherwise have access to credit and other resources); reduces performance risk of energy efficiency projects

EFFICIENCY-AS-A-SERVICE

This pay-for-performance model, typically utilized for larger projects, is part of a larger transition toward energy-as-a-service models whereby a customer makes service payments based on actual energy savings (based on per unit energy saved) or other performance metrics once a project is delivered. In this case the developer is responsible for funding the project development, construction, and maintenance, thereby taking on both the performance risk and the implementation responsibility. This model shifts the incentive structure to motivate the developer to achieve maximum energy savings with the newest technologies, and to keep those energy savings up over time.

- Benefits: Reduced performance and financial risk for owners; "off-balance sheet" model allows payments to be treated as an operating expense rather than a capital expense, freeing capital for other projects

ENERGY-AS-A-SERVICE

Moving one step beyond Efficiency-as-a-Service, Energy-as-a-Service (EaaS) transforms the entire customer experience around energy procurement from a product-based commodity business model to a service-based one. In this case the customer pays a fixed cost for the end service of energy access, thus shifting the procurement of the energy itself and installation and operation of systems to an EaaS provider. This model shifts the incentive for energy savings to the provider, who benefits from providing the end service at the lowest possible energy use and thus will invest in efficient systems and maintenance to maximize their own profits.

- Benefits: Customers are insulated from fluctuating energy costs, procurement and maintenance expenditures, and equipment failures; providers can maximize profit by maximizing energy efficiency and thus reducing their cost while maintaining a constant revenue; customer capital expense is converted to operating expense, freeing capital for other projects; helps overcome split incentives for maximizing efficiency between technology providers and customers/end users; encourages providers to embrace circular economy practices to recover maximum value at product's end-of-life

CROWD FUNDING

Crowd funding has gained popularity for a variety of uses in recent years, including for funding energy efficiency investments. For this model, ESCOs or other developers can contract with a crowd funding platform to list projects for individual investors to pledge funds toward. A loan is then issued to the ESCO for project implementation, which is repaid by savings. Value is delivered back to the individual investor through interest payment, equity with dividends, or other financial returns. Crowd funding removes the presence of established financial institutions from projects, opening the door to small-scale investors and impact investors, among others.

- Standard Term: Variable, depending on provider's financing model and crowd funding agreement
- Financing Size: $1,000-$1 million USD

GREEN CREDIT LINES

Green credit lines, similar to green bonds on a smaller scale, encourage projects in sustainability-related areas by making dedicated funding available and accessible. Given limited access to loans and capital, households and SMEs typically prioritize investments other than energy efficiency, such as those that provide more immediate benefit or align with core business activities. Green credit lines can be made available for projects that meet certain sustainability criteria such as energy efficiency or renewable energy. These are typically offered through local financial institutions at lower interest rates and for longer-term payback periods. For funding such credit lines, local financial institutions may access conditional funding through multilateral funds (such as multilateral development banks) or set aside dedicated capital within their investment portfolios.

- Benefits: Favorable terms align closely to the economic reality of energy efficiency projects; dedicated credit lines do not impede on the ability for households or SMEs to access more traditional loans and financing concurrently

MICROFINANCE

Microfinance services typically target smaller transactions available to low-income households, serving parts of the economy that may not have access to traditional financial resources. While the use of microfinance for energy efficiency work is currently quite limited, the potential for accessing large numbers of communities underserved by traditional financial institutions is significant. Microfinance institutions (MFI) are typically funded by concessional loans or grants from established banks, which in turn can receive funding for such programs from entities such as multilateral development banks. Eligible borrows who meet certain financial criteria can then access concessional financing to help reduce or eliminate the upfront cost of energy efficiency projects.

- Financing Size: $500-$300,000 USD
- Benefits: Financing that can be made available to often unbanked or underbanked communities; supports the longer-term establishment of institutional credit history and paves the way for more traditional financial institutions to engage
- Challenges: The microfinance model may not be self-sustaining as funds are limited and payback periods can be long; MFIs often lack the technical capacity to assess energy efficiency projects and cost-effective technologies themselves, which can lead to missed opportunities to cost-effective energy savings

REMITTANCE-BASED PROCUREMENT

For emerging economies with high populations of migrant workers living abroad and transferring back remittance payments to families at home, this model allows these workers to redirect some of the payments earmarked for energy consumption (e.g. purchases of fuel, woods, etc.) to be used for sustainable energy products instead. In 2017 alone, $466 billion USD in remittance payment globally flowed to low- and middle-income countries, almost three times the amount of official development funding[24]. Redirecting even a small fraction of that funding could result in major energy savings, particularly in areas with limited energy access where increased efficiency can help alleviate energy poverty. Such products include home lighting, improved cookstoves, insulation, and small-scale solar systems, for example. Adopting this option requires coordinating with local money transfer organizations to sell energy products to migrant workers abroad for their families to collect at home. Workers seeking more discretion in how remittance payments are used back home are empowered through this model to make decisions that support long-term, tangible benefits to their families.

C. SECTOR INVESTMENT MODELS

Beyond individual project investment mechanisms, it is also important to consider and foster tools for increasing the overall availability of funds available for energy efficiency projects. A number of emerging mechanisms are being proven as effective in mobilizing larger amounts of private capital to initiatives and projects that support sustainable development and climate action.

BLENDED FINANCE

Building upon a long and successful history in the development finance space, blended finance mechanisms are an effective way to de-risk and mobilize private capital into investments with particular targeted impacts. Blended finance is a structuring approach that integrates funding from public and philanthropic institutions in order to jumpstart self-sustaining markets. Instruments can include concessional debt or equity where public and/or philanthropic finance is junior to private coinventors, guarantees and insurance to protect against private capital losses, preparation and design funding to support projects in becoming bankable, and technical assistance grants to add to the capacity of private finance. In order to be effective, blended finance investment should 1) generate positive environmental and/or social impacts (which could be tracked against the targets defined in the SDGs), 2) mobilize private capital that otherwise would not have been mobilized (additionality), and 3) achieve positive financial returns toward creating a self-sustaining market when the public and/or philanthropic finance expires[25]. Blended finance is particularly useful in driving investment in the energy efficiency space as positive cashflow from energy savings is often predicable and steady. Governments, philanthropic organizations, and other entities that are able to provide various forms of concessional finance can consider investing in blended finance tools to help establish and accelerate energy efficiency investment where its effects can be most impactful.

ADVANCED MARKET COMMITMENTS (AMC)

AMCs are a tool based upon an agreement to purchase large quantities of a product at an agreed price before it exists as an incentive for development and production. The recent success of

[24] (Magallón, et al., 2019)
[25] (Swiss Sustainable Finance, 2020)

global vaccine development for the COVID-19 pandemic can be tracked in large part to AMCs made by governments that served to de-risk development and guarantee a market for effective vaccines[26]. A similar approach can be used for nascent technologies in the energy space, including innovative energy efficiency products and services. AMCs provide a "demand-pull" signal rather than a "supply-push", which serve as a temporary tool to make markets for a new product or service move certain and more lucrative, thus accelerating investment. This tool is particularly effective in instances like energy efficiency where there is a positive externality (see Section 6 on co-benefits below) for society that is not reflected in the customer demand alone. These commitments tend to work best when the technology development process includes clear milestones, challenges, and a strong research and development base, as well as a healthy competitive environment that provides multiple avenues to successful product marketability[27]. Through this mechanism, governments with large purchasing power can encourage the private sector to take on the risk of developing new energy efficiency and adjacent technologies, thus leveraging private market capital and fostering healthy competition. To do so governments or other sponsors must make legally binding commitments at an agreed upon value in order to guarantee the initial product market. While traditionally a product-base tool, similar processes could be used for encouraging the development and implementation of innovative services associated with energy efficiency work, so long as the AMC sponsor clearly defines the criteria for success and the provider can demonstrate that their projects deliver upon those requirements.

FINANCIAL STANDARDIZATION AND AGGREGATION

As mentioned in Section 3, current investment into energy efficiency projects is limited by a lack of aggregation and definition as a traditional asset class. The first step in improving financing options is to standardize the process. This includes standardizing project feasibility and risk assessments, contracts, programs, and other aspects of the project initiation, implementation, and operation. Ideally this standardization extends across jurisdictions rather than remaining local, as larger financial institutions can most readily leverage the benefits of this approach at scale.

By applying this standardization to enable bundling smaller projects into an aggregated portfolio, the financial options for mobilizing the debt become much more broad; potentially increasing interest and engagement from financial institutions. For example, aggregated assets can be combined into Special Purpose Vehicles (SPV), which can subsequently be securitized into asset-based securities (ABS)[28]. These allow lenders to sell off the financial assets and free up capacity for more financing of energy efficiency projects. The investors who purchase the SPVs would see financial return through positive cashflows of the underlying assets, which in the case of energy efficiency projects would include the energy cost savings. When aggregated at a large enough scale, these vehicles can be used to potentially unlock even larger green and sustainability bonds. Aggregation also benefits investors by reducing risk through diversification and justifying the transaction costs through higher net gains. Banks have an important role to play in this aggregating process as the facilitators between individual projects and the wider financial ecosystem.

[26] (Das, Deodhar, Sharma, & Shrestha, 2015)
[27] (Ho & Taylor, 2021)
[28] (UNDP - Climate Bonds Initiative, 2022)

6. ENERGY EFFICIENCY CO-BENEFITS

One of the key advantages to pursuing energy efficiency is the wide range of co-benefits that such projects can provide. These positive externalities can at times be difficult to quantify, resulting in the undervaluation of investments in energy efficiency. While the monetary value may not always be factored in, the benefits to project owners and the energy sector at large can quickly add up.

Improved energy resilience is one such example of a common co-benefit to energy efficiency. While not every energy efficiency project improves energy resilience, may measures do in fact overlap. At its core, energy efficiency is about reducing the demand for energy to perform the same task or achieving the same outcome. If a system can deliver the same benefit at a lower energy use, then providing backup for those systems becomes easier. For example, a building that undergoes an LED lighting retrofit not only saves on energy cost but requires less backup capacity such as battery storage or standby generation for the lights to stay on in the case of a grid failure. Flipping the perspective to an example of a backup asset, a hospital's existing backup generator can keep even more systems running in the case of power failure in a hospital that has undergone an energy-efficient retrofit than what the generator was originally designed for prior to that retrofit. Many energy efficiency projects also improve passive resilience. For example, better insulation in a building means that an energy failure in the middle of a cold winter will have less of an adverse impact on building occupants.

Increased building value is also a well-documented outcome of investments in energy efficiency. Office buildings certified under the Leadership in Energy and Environmental Design (LEED) rating system, which attributes a large portion of points to energy efficiency, can realize rent premiums as high as 25-77%[29]. Other benefits of energy efficiency projects can include reductions in mortgage defaults, lower tenant turnover and vacancy rates, better indoor comfort, and reduced maintenance demands[30]. And when the life cycle cost of an energy efficiency upgrade is considered rather than only the capital cost, many efficient technologies and products in fact reach cost parity or end up more affordable over their lifetime than standard assets.

Beyond improving facility value, a large number of non-energy co-benefits are also associated with investments in energy efficiency[31]. At the macro-economic level, aggregated investment in energy efficiency can result in improvements to energy security, affordability and poverty alleviation, employment, disposable income, air pollution, and other factors. At the micro-economic scale–most relevant to the decision making of individual firms and organizations–investments can help benefit occupant health, workplace safety, process and machine reliability, production outputs, and corporate image, among many other outcomes. Figure 6 illustrates the diverse set of co-benefits that should be taken into account when considering and planning energy efficiency investments.

[29] (Benjamin, 2022)
[30] (European Commission, CORDIS Results Pack on Private Finance for Energy Efficiency, 2022)
[31] (Barkhausen, Hirzel, & Durand, 2021)

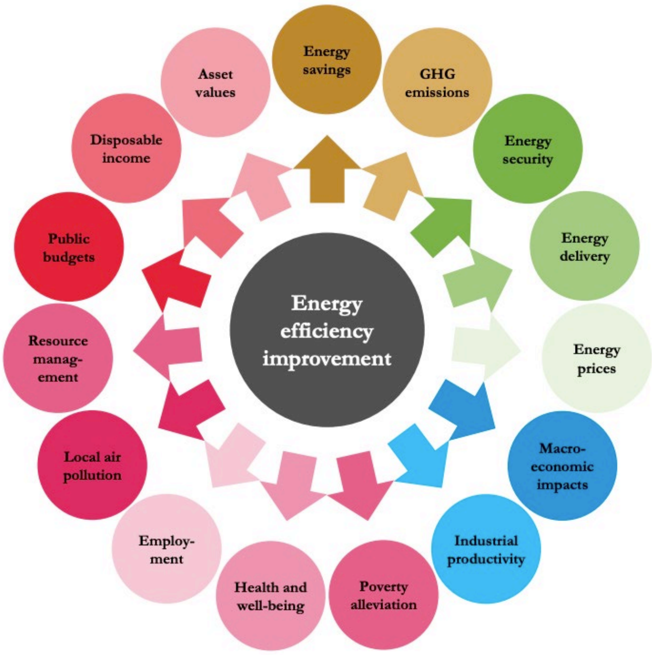

Figure 6: Diverse benefits of energy efficiency (Barkhausen, Hirzel, & Durand, 2021)

As more investment is directed into energy efficiency across sectors, the cost of efficient technologies and services will ultimately come down. As with the impressive reductions in cost for energy supply technologies such as wind and solar in the preceding decades, wide-spread adoption of energy efficient technologies will also lead to cost savings through improved manufacturing efficiency, supplier competition, and economies of scale. Concurrently, investment in the space will also create a wide variety of jobs, from auditors and installers to product manufacturers and service providers. By some estimates, upwards of several million efficiency-related jobs could be added globally in the coming decade[32], supporting economic growth and transition toward a green economy.

7. CONCLUSION & RECOMMENDATIONS

As UNECE member states and countries around the world continue to contend with the many challenges associated with the three pillars of the energy trilemma—energy security, energy equity, and environmental sustainability—increasing investment and deployment of energy efficiency across sectors is an impactful solution with multiple benefits. While the most direct outcomes of energy efficiency track to Sustainable Development Goal 7: Affordable and Clean Energy, in reality the primary and secondary benefits extend far beyond into SDGs that cover poverty, wellbeing, economic growth, and sustainable living. By employing the funding mechanisms identified in this paper, and continuing to develop and invent new ways to efficiency investments accessible and profitable, energy efficiency will continue to play a key role achieve these goals and furthering the energy transition.

[32] (IEA, Energy Efficiency 2021, 2021)

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