Building society

How to improve the building sector's social impact through retrofitting and affordable construction

A report by the UBS Sustainability and Impact Institute
December 2023

Contents

Executive Summary 3

1. Why better buildings are key to achieving social goals 5

2. Growing the built environment inclusively 7

3. Optimizing the social impacts of retrofitting 15

4. Summing up 19

About the Institute 20

Disclaimer 21

Authors:
Richard Mylles, William Nicolle, Nalini Tarakeshwar

Reviewers:
Mike Ryan, Jackie Bauer, Veronica Weisser

Editor:
Juhi Singh

Project Management:
Jackie Bauer
Stevica Levajkovski
Camila Kaiser

The authors thank the following people for their input: Chris Clubb (Convergence), Sebastien Delpont (Energiesprong France), Sebastian Groh (SOLshare), Kenneth Gould (Brooklyn College), Florian Idenburg (SO-IL), Salma Islam (SOLshare), Lucie Middlemiss (Leeds University), Sebastien More-Chevalier (Baan Dek Foundation), Leah Pedersen (Convergence) Ian Shapiro (Reall Foundation), Kyle Smilon (UBS), Becci Taylor (Arup), Dan Viederman (Working Capital).

Executive Summary

The primary role of our built environment is to meet human needs for shelter, connection, work, and services. Yet, the inadequacy of numerous current buildings contributes to many of society's problems, like poverty, ill-health, and climate change. In this report we look at how the social impact of our built environment can be optimized by retrofitting existing buildings; expanding the stock of adequate, affordable housing; and improving construction practices.

Improvements to the built environment can contribute to achieving various other sustainability goals, like reducing poverty and inequality, improving health outcomes and physical comfort, ensuring more equitable access to education, and improving the resilience of the energy infrastructure.

The 3 R's of socially inclusive new construction

In this report we introduce a three-pillar framework to determine whether new development projects fulfill the criteria to be considered socially inclusive and, therefore, sustainable. We call this framework the 3 R's—Right building; Right way; Right place.

- **Right building**: Is the building economically accessible to the local community, and does it fulfill its needs? Whether the need is more housing, community areas, or commercial space, it requires the correct building type, at the needed capacity with the right facilities, and, with a view to the future, ease of convertibility to an alternative use.
- **Right way**: Is the building being constructed in a way that benefits the local economy, e.g., using local materials and suppliers where possible, providing employment for local people at living wages? Is it minimizing social costs e.g., enforcing safety protocols onsite and ensuring workers are not being exploited offsite? And is it designed inclusively, e.g., incorporating natural light, efficient insulation, healthy ventilation, and, where appropriate, space for communal areas?
- **Right place:** Is it located in an area with good connection to others, to public transport, in reasonable proximity to job opportunities, and outside of areas prone to environmental and social risks?

Addressing the global shortage of affordable housing

Housing in the biggest developed markets has become increasingly unaffordable in recent years—between 2019 and 2021 the number of severely unaffordable markets rose by 60%. In emerging markets too there are severe shortages—the number of urban residents living in slums or slum-like conditions amid a lack of adequate, affordable housing has hit an estimated 1.1 billion, with a further 2 billion more projected over the next 30 years. Addressing this problem will require significant investment, an estimated USD 17tr in emerging markets alone, with 90% of that in Africa and Asia. While individual markets have their own particularities, we outline five key areas holding back the

supply of affordable housing and suggest potential reforms. These include regulation and policy; finance availability; skill shortages; insufficient harnessing of innovation; and lack of stakeholder coordination.

Part of the solution is likely to be provided via blended finance instruments to address liquidity constraints and funding bottlenecks.

The social opportunity from retrofitting existing buildings

The profound social effects of the existing built environment and the significant potential for both positive and negative direct impacts as well as externalities make building retrofits a key part of the toolkit for reducing social harms and improving societal outcomes. Retrofitting can contribute to revitalizing economically struggling communities, creating jobs, reducing energy bills, improving local human capital via the benefit to physical and mental health outcomes, and reducing harmful emissions. For this to be meaningfully achieved, however, retrofitting needs to take place at scale. For that to happen, communities must be brought on board. In this sense, retrofitting and area regeneration are symbiotic processes, with the success of one partially dependent on the other. Aligning communities with retrofitting priorities requires communicating and demonstrating the benefits of retrofitting to individuals and the broader public sphere.

Two key factors to spur large-scale retrofitting

Perhaps the most straightforward route is establishing and expanding a retrofit supply chain for governments at local and national levels to commit to retrofitting social housing stocks, i.e., government-owned housing. This has the advantage of laying out a clear policy path and can provide a pipeline of projects, clarity to market participants, and a signal to expand retrofitting capacity.

But most buildings are privately owned. Achieving community-level retrofitting in the private sector is likely to demand the kind of coordinating role played by "one-stop-shops" both to group retrofitting projects to reduce costs, and to effectively coordinate stakeholders across the value chain in public and private spheres.

Find more insights in our latest white paper:
"Rethink, rebuild, reimagine—Laying the foundation for better buildings."

www.ubs.com/better-buildings

1. Why better buildings are key to achieving social goals

At a glance

- Optimizing the built environment via energy-focused retrofitting can support many other sustainability goals, like reducing poverty and inequality, improving health outcomes, and enhancing the resilience of energy infrastructure.
- The construction needs of the coming decades, particularly in emerging markets, necessitate changes to construction practices if social harms are to be minimized.
- Major investment and innovative financing will be needed to provide adequate, affordable housing to the hundreds of millions dwelling in slums today and in future.

Over the coming decades a large amount of new construction will be necessary—an additional 75% of floor area—particularly in emerging markets, which are expected to see 80% of global new construction through 2050.[1] This is required to accommodate growing and shifting populations, rising living standards, and continued urbanization. It is also needed to address the acute shortage of affordable housing. But new construction needs to happen in a way that avoids practices that are exploitative and exacerbate existing inequalities. Construction should promote social inclusion by considering the needs of the local population and impact on its quality of life, by building more affordable, locally appropriate, and ecologically sustainable housing, while ensuring that housing is built in places where social opportunities are maximized, i.e., ready access to jobs, social services, and not far from dynamic cities.

In this report we outline the importance of improvements in new construction practices and modifications to the existing building stock, not just to Sustainable Development Goal 11—"*Make cities and human settlements inclusive, safe, resilient and sustainable*"—but also to various others. Retrofitting of the existing building stock is essential for example, to improve energy efficiency, reduce emissions, and improve resilience to climate change (Interview 1), but also to address the social impacts on physical and mental health caused by today's buildings, reduce the impact of high energy costs, and improve living standards more broadly. This will require large-scale retrofitting of existing buildings, particularly in developed markets, where new construction needs are lower and existing buildings will be in use for decades.

[1] International Energy Agency (2021), Net Zero by 2050: A Roadmap for the global energy sector, P141.

Interview 1

Decentralized energy. Sebastien Groh, Founder of SOLshare (Bangladesh)

What is the relationship between the reliability and affordability of access to electricity and social outcomes?
The UN's SDG 7 calls for affordable access to reliable and sustainable energy—which over 700 million people lack today. Research suggests that access to sustainable electricity is also a key enabler of the other SDGs, so it's hugely important. Lack of access keeps people poor. For example, a consumer in a developed market, connected to the main grid, might pay USD 0.40 per kwh for electricity, but that might rise to USD 7–10 for someone with no grid connection. It costs 20 times more for someone who is perhaps 20 times poorer, a classic poverty penalty, where the poor are penalized for being poor, which keeps them in a vicious cycle.

What are the potential solutions?
We need to connect the resources we already have. First, in Bangladesh, there are 6 million solar home systems (consisting of a rooftop solar panel and a battery inside the home), which is by far a record. These can't be connected individually to the grid as it's too expensive, but pooled together, it becomes cost effective. Second, we have over 4 million electric three-wheeler vehicles (taxis). Most of these use lead batteries, so the first step is to replace them with smart lithium batteries, then connect them to create a virtual power plant. So, we can use the electric vehicle batteries as distributed energy storage, connect them to the grid, and allow them to provide grid ancillary services, thereby balancing demand and supply.

Do you think decentralized systems are the future of power?
Yes. The old paradigm of a large power plant generating electricity, not near people's homes, is outmoded. It's very prone to failures—if there's a natural disaster, and there is one node, system failures occur. In Bangladesh we have one hurricane after another, but our grids stay up, because we have decentralized systems that have redundancy. Up until recently there weren't any reasonable alternatives to centralized systems. Developed countries have the sunk cost of their existing systems, so they won't switch. But climate change means these are under more stress and it's very expensive to maintain them. In an emerging market, one can leapfrog that outmoded tech.

2. Growing the built environment inclusively

At a glance

- New construction is necessary, but to be socially inclusive, it should fulfill the 3 R's—the right building, built in the right way, in the right place.
- The world faces an acute shortage of adequate, affordable housing with appropriate living standards. Expanding it is both a social imperative and a major investment opportunity.
- We identify five key reform areas to tackle affordable housing shortages. Part of the solution could be via blended finance instruments that address liquidity constraints and funding bottlenecks.

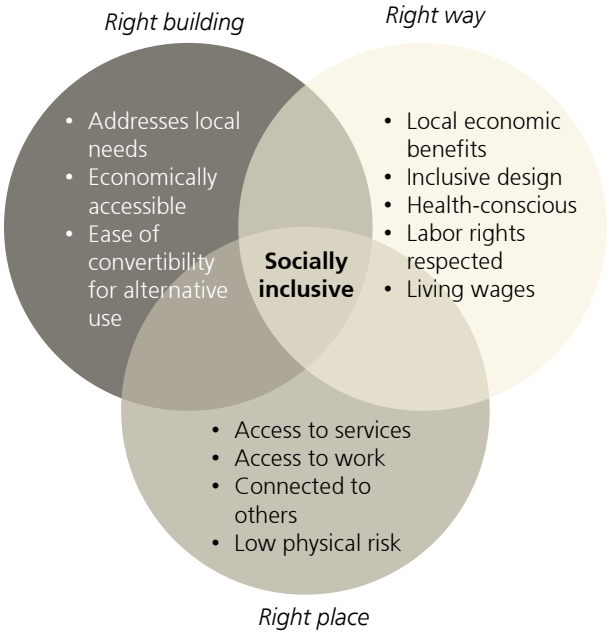
2.1. Principles of socially inclusive building

There is no one-size-fits-all approach to inclusive building—each real estate market has its own idiosyncrasies driven by differences in climate, aesthetics, stage of economic development, available materials, demographics, local regulatory regime, and other factors, not to mention politics. But in our view, the three broad principles that new buildings should fulfill to be considered sustainable from a social perspective are (Figure 1):

1) **The right building:** Does the building meet the economic, physical, and social needs of citizens for whom it is designed?
2) **Built in the right way:** Is the building constructed such that it minimizes social costs, i.e., is it inclusively designed, with occupant safety and well-being in mind, and workers that are ethically recruited and treated fairly? This should be in addition to minimizing greenhouse gas emissions, pollution, and resource waste during construction and over the building's lifecycle.
3) **Built in the right place:** Is the building located in an area with good connection to others, to public transport, in reasonable proximity to job opportunities, and outside of areas prone to environmental and social risks?

Figure 1: Broad principles of socially inclusive buildings

Our three-pillar framework (the 3 R's) is useful to gauge whether new development projects fulfill the criteria to be considered socially inclusive and, therefore, sustainable



Source: UBS

The right building…

- **Economically accessible to the local community:** Economic accessibility is about pricing at a level that allows the local community to partake in the benefits of a development at a reasonable cost. Affordability does not imply fully subsidized, non-market rate housing. In some cases, a non-affordable development will include an affordable element or service offering or enable a related affordable development in the same or nearby area. For example, in New York City, permission for a luxury residential tower at 5 World Trade Center was granted on the condition that one-third of the 1,200 units be reserved for low- and middle-income renters, spread throughout the development.[2]
- **Fulfilling local needs:** Whether the need is more housing, community, or commercial space, (Box 1) it requires the correct building type, at the needed capacity with the appropriate facilities, and, with a view to the future, ease of convertibility to alternative use.

Box 1: UBS Detroit office community spaces

In 2019 UBS opened a branch of UBS Financial Services on Woodward Avenue in downtown Detroit, the first wealth management firm to do so since 2010. The opening was part of UBS's commitment to downtown Detroit and the local community. As part of this, 50% of the available space of the 11,000 square foot office is made available for local, UBS-approved, non-profit organizations to host board meetings and other activities. In addition, UBS piloted its Keys to Your Future program in Detroit, a personalized digital curriculum designed to help local high schoolers.[3]

[2] New York Times article, (2023), *Affordable apartments are coming to the top of New York's skyline,* Accessed on 12/1/23.
[3] Businesswire, (2019), *UBS Financial Services Inc. Opens First Detroit Office In Historic Downtown Woodward Shopping District*, Accessed on 12/13/23

… the right way…

- **Local economy benefits:** To maximize the economic benefits to the surrounding area, a development should use sustainably sourced and preferably local materials and suppliers where possible, provide employment for diverse local people (Box 2), and pay those workers living wages. In cases where skill shortages are a problem, investment may be needed in training and upskilling. In some developments this may inform the design and type of materials used, e.g., using smaller concrete bricks that individual workers can lift rather than large blocks that require an expensive crane and crew to move. The Better Brick Nepal (BBN) initiative**,** supported by Humanity United, for example, is creating a market-based model that incentivizes brick-kiln owners to transform traditional business practices to business models involving zero tolerance of debt bondage and child labor, and implementation of safe and humane working conditions. Partners such as GoodWeave and the Global Fairness Initiative provide technical assistance and equipment to produce better quality bricks and access to a larger market, provided they meet labor standards.

Box 2: UBS Arena and the boost to the local economy

UBS Arena, an events space and sports venue, home to the New York Islanders ice hockey team, opened in 2021. Located within Belmont Park, New York, US, it is part of a USD 1.5bn redevelopment expected to generate around USD 25bn in economic activity, including 3,000 permanent jobs and major infrastructure improvements like the newly constructed Elmont Station. The project has a goal of earmarking 30% of construction contracting dollars for state-certified minority and female-owned business, and an additional 6% to service-disabled, veteran-owned businesses. UBS Arena also plans to work with community organizations and elected officials with the aim of filling 30% of jobs at the venue with local residents.[4]

- **Minimized social costs:** Beyond onsite conditions (e.g., enforcing safety protocols, as in the BBN initiative), the offsite conditions in which vulnerable workers and their families are housed can exacerbate social ills such as inequality, lack of access to services like health and education, or predatory behavior, unless proactively addressed. The Baan Dek Foundation assists companies in Thailand with monitoring the living conditions of their workforce and advises them on best practices to improve opportunities and living standards.[5] Similarly, the Working Capital Fund invests in solutions to reduce labor exploitation using new technology to improve transparency in supply chains.[6]
- **Inclusive design:** Here we refer to a combination of socially relevant factors, including connection to a building's surroundings, which may mean more open facades rather than hermitically sealed, closed-off hard edges, which has the added benefit of providing recesses for natural shading as temperatures rise; natural light and greenery, which are important for mental health;[7] healthy ventilation, be that mechanical (more likely in developed markets) or passive (more likely in emerging markets); and which leave gaps for communal spaces. The Las Americas Social Housing development by SO-IL in Leon, Mexico offers one such example.[8] This is a

[4] UBS Arena, *Community*, Accessed on 12/13/23
[5] Baan Dek Foundation, (2022), *Building better lives, together: Strategic plan (2022-2025).*
[6] The Working Capital Fund is a double bottom line fund with the goal to reduce labor exploitation by accelerating the development and deployment of ethical supply chain solutions to the benefit of the hundreds of millions of vulnerable workers. The solutions focus on sectors with a high risk of labor exploitation such as manufacturing, agriculture, and construction, but can be applied more widely.
[7] Bratman G. N. et al., (2019), Nature and mental health: An ecosystem service perspective, Science Advances.
[8] Architect Magazine article, (2021), *An intimate look at SO-IL's Las Americas.*

prototype development, which is specifically aimed to avoid flat, squared-off facades and dark, window-less corridors. It favors irregular shapes made from low-cost prefabricated components that provide privacy, a sense of ownership, and shading, while also maximizing communal shared spaces and natural ventilation.

… the right place

- **Access to work and services:** Just as real estate valuations stem from location, so do social outcomes, to a large degree.[9] Housing is attractive from a social perspective when it offers ready access to services like education, retail, and healthcare; when work opportunities can be accessed; and health risks avoided. Buildings that do not tick these boxes risk reinforcing existing inequalities and inequities. In practice this typically means proximity to vibrant towns or cities or strong transport links, an emphasis on density over urban sprawl, and building up rather than out. This runs counter to the trend of recent decades, in which urban sprawl has outpaced population growth in most cities, "*with detrimental effects on the sustainability of urban development.*"[10]
- **Connection to others:** From an environmental and a social point of view, dense, walkable, mixed-use neighborhoods have higher levels of social capital—i.e., social and community engagement—compared with car-oriented suburbs. People who live in walkable neighborhoods are "*more likely to know their neighbors, participate politically, trust others, and be socially engaged.*"[11]
- **Minimize physical risks:** Constructing in areas vulnerable to natural disasters like earthquakes, flooding, or wildfires is clearly undesirable, but that has not stopped it from happening on a large scale. A study found that 57% of structures in the US were in "*hazard hotspots,*" with around 1.5 million buildings in hotspots "*for two or more hazards.*"[12] Rising global temperatures are amplifying risks and bringing more areas into danger. New construction should avoid adding to the stock of buildings threatened by intensifying physical risks.

2.2. The shortage of affordable housing

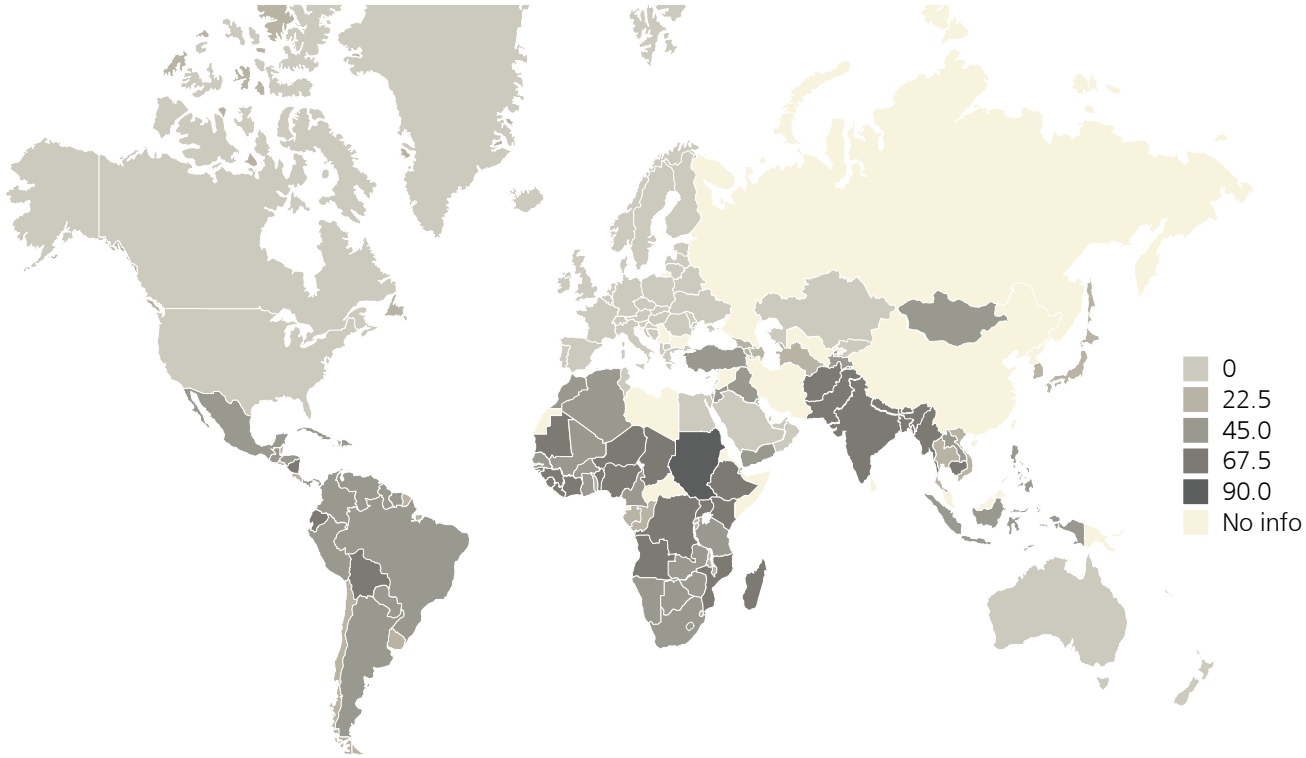
Affordable housing is a somewhat slippery concept, with varying definitions. Some use it as a synonym for social housing, rented at subsidized or below-market rates.[13] In the US, EU, and OECD, it typically means housing where costs such as rent, mortgage payments, and utility bills do not exceed 30% of post-tax household income, with over 40% being an indicator of "overburden."[14,15] Other definitions may look at disposable income instead.[16] But while there may not be a universally accepted definition, there is general consensus that there is a major global shortage of housing that is both affordable and that offers an appropriate standard of living.

[9] Acolin, A., & Wachter, S. (2017). *Opportunity and Housing Access*, Penn Institute for Urban Research, P7.
[10] UN, (2023), *Sustainable Development Goals Report*, P35.
[11] Leyden, K. M., (2003), *Social capital and the built environment: Importance of walkable neighborhoods*, American Journal of Public Health.
[12] Iglesias, V., et al., (2021), *Risky development: Increasing exposure to natural hazards in the United States*, Earth's Future.
[13] Czischke, D., & van Bortel, G., (2018), *An exploration of concepts and polices on 'affordable housing' in England, Italy, Poland and The Netherlands*, Journal of Housing and the Built Environment.
[14] US Department of Housing and Urban Development, *HUDUser Glossary Resources*, Accessed on 11/28/23.
[15] Rosenfeld, O. (2017) *Analysis of interpretations of the term affordable housing in the EU Urban Agenda Partnership for Housing*, P9.
[16] Ibid, P9.

Housing in the biggest markets has become increasingly unaffordable in recent years—between 2019 and 2021 the number of severely unaffordable markets rose by 60%.[17] This is not just a developed market story. Roughly 80% of the world's cities do not have enough affordable housing for their population.[18] Continuing urbanization in emerging markets coupled with the lack of sufficient affordable housing has resulted in the growth of informal settlements, with a commensurate rise in the number of people in sub-standard housing, unconnected to basic services. An estimated 1.1 billion urban residents live in slums or slum-like conditions (Figure 2), with 2 billion more projected over the next 30 years.[19] Just providing adequate housing for those in sub-standard dwellings would require an estimated 300 million new homes to be built by 2030, with 90% of those being in Africa and Asia.[20] This would require an estimated investment of USD 17tr, according to the Reall Foundation (Interview 2). In developed markets trillions more are needed to expand the stock of affordable housing, with an estimated CAD 1tr needed by 2030 in Canada alone.[21]

Figure 2: Proportion of urban populations living in slums, 2020

Affordable housing is a dire need and an opportunity. Blended finance instruments can catalyze investment in this segment



Sources: Sustainable Development Report, UBS

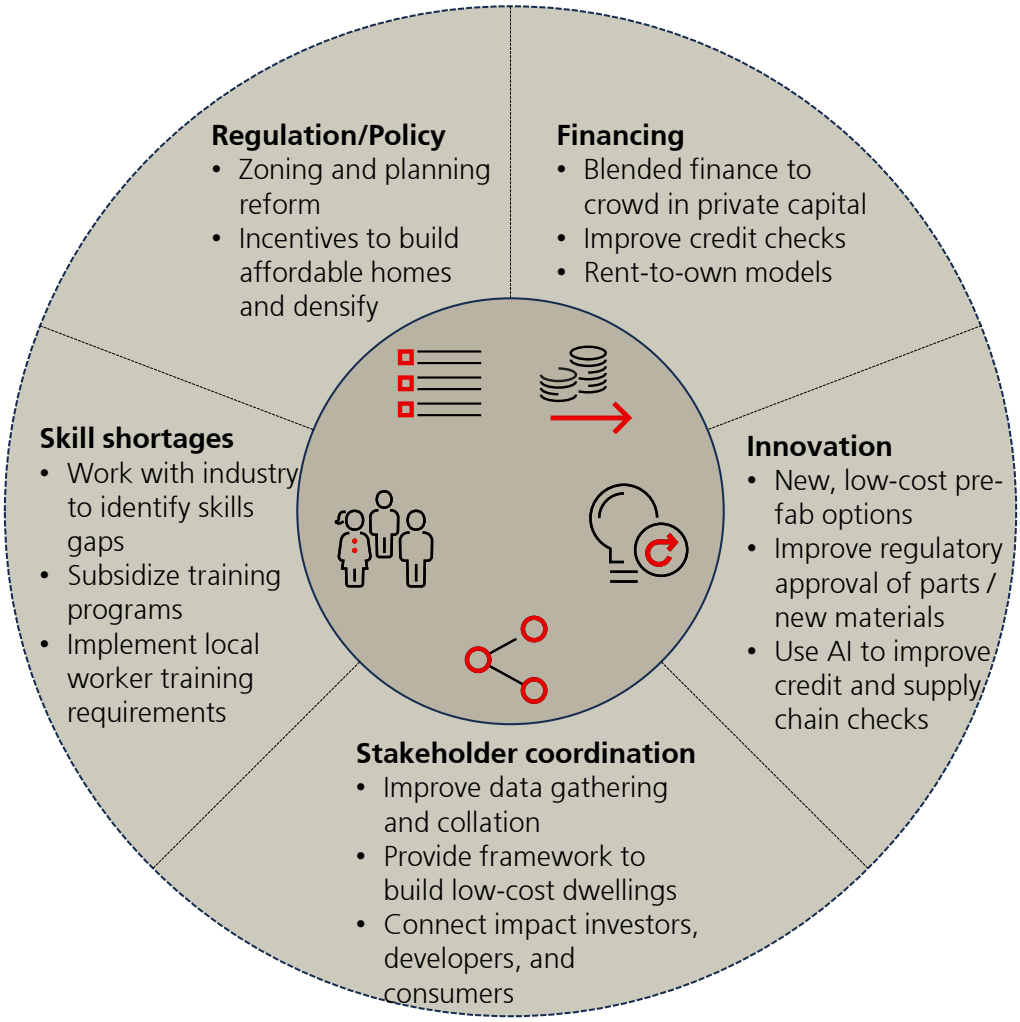
Money alone is not enough. Securing the right level of investment and putting it to work effectively will require progress in multiple areas. Solutions are diverse, with various market particularities at play. In Mexico, where most residential properties are self-built,[22] purely targeting traditional developers and their supply chains would miss a large portion of the challenge. But there are issues common to

[17] Urban Reform Institute, (2022), *Demographia International Housing Affordability*, P5.
[18] World Green Building Council, (2023), *Sustainable and Affordable Housing*, P9.
[19] UN, (2023), *Sustainable Development Goals Report*, P34.
[20] Reall Foundation, (2020), *Impact Report Briefing*, P3.
[21] CMHC-SCHL, (2023), *Achieving housing affordability by the next decade.*
[22] Edge, (2020), *Mexico: Green Building Market Maturity Snapshot*, P1.

most markets that are holding affordable housing back. We outline five key areas that would, over time, shift the needle on affordable housing (Figure 3). This is not an exhaustive list—not included for example is the role played by immigration policies and their impact both on skill shortages and housing demand, or the potential for converting underutilized spaces, e.g., office-to-residential conversions.

Figure 3: Five key reform areas to address affordable housing shortages

Realistic actions by stakeholders including governments, investors, corporates, and NGOs could most readily move the needle



Sources: World Economic Forum, World Green Building Council, UBS

Regulation and policy come in many stripes, from measures to increase the stock of publicly owned housing e.g., via increased spending allocations to government building, to those designed to increase private construction e.g., via tax breaks or other fiscal incentives. Non-financial changes might include upzoning—increasing the number of units permitted on a plot—which can help encourage density, increase infrastructure efficiency and use, decrease commuting times, and increase the number of properties in desirable areas.

Innovative financing can help address liquidity and funding bottlenecks. Domestic and foreign private finance (mostly debt) for "green" construction has been increasing, although the use of such

instruments remains low in emerging markets. This is due to the fragmented structure of construction value chains, highly localized regulations, the presence of informational asymmetries between the segments of the value chains and policymakers, and the prevalence of small and medium-sized construction companies.

Blended finance instruments can be part of the solution. It utilizes limited pools of concessional funds to mobilize larger sums of public and private sector financing toward development goals, often with climate-related objectives. The concessional component can be used to increase the commercial viability of projects via risk mitigation and improvement of the risk-return profile of cutting-edge investments. The concessional element can be philanthropic or from development institutions and is typically structured as co-investment (primarily as debt, but also as equity, risk-sharing, or guarantee products) with expectation of reinvestment for future projects or other uses.

Innovation to improve supply chain transparency: There is increasing investor and consumer interest in knowing the sources and ways of manufacturing the materials that make up their products.[23] This is also true for the construction supply chain, which is fragmented and has a tendency toward informal working arrangements. Several innovative tools are now being used to allow the voices of workers to be heard and facilitate the availability of such data to companies.[24]

Stakeholder coordination across the value chain through third parties like the Reall Foundation can promote best practice and bolster the business case for affordable developments by establishing and demonstrating the market for affordable green housing in emerging markets. This can involve working with building designers and developers, to ensure the buildings are built to the right specifications and price point; working with providers of capital to increase the pipeline of projects with the appropriate scale and risk profile; and working with, with governments to align with policy and planning goals. Lastly, they may work with the purchasers of the homes themselves, e.g., by helping them demonstrate that they are a reliable payer and therefore credit worthy.

Skills shortages in sustainable construction techniques limit the potential of investment in green buildings or materials. Government subsidization of training programs is one obvious way to increase the number and scale of efforts to upskill the labor supply. Another, less direct way is to provide confidence of the demand for such skills, e.g., by allocating government funds for building programs. Finally planning and funding incentives can be used, e.g., permitting new construction and providing preferential tax treatment based on the use of local labor can incentivize the training of local workers.

[23] Financial Times, (2023), *So you think you know your supply chain?* Accessed on 12/05/23.
[24] For example, the Working Capital Fund invests in solutions to reduce labor exploitation using new technology to improve transparency in supply chains.

Interview 2

The affordable housing opportunity. Ian Shapiro, CEO of the Reall Foundation

How big is the affordable housing investment opportunity?

If we just look at emerging markets, we have 1.2 billion people in inadequate housing and roughly 2 billion more will be added to that in the next generation. We need to house populations sustainably. We estimate that 300 million new homes are required by 2030, 90% of those in Africa and Asia, which will require an investment of USD 17tr. Green affordable houses are the solution for those in inadequate housing, and that is currently a largely untapped green investment opportunity.

What are the key challenges to expanding the stock of affordable housing?

First, you must demonstrate that there are reliable payers. Of course, homeless people will need a charitable solution, but many millions of people are currently paying rents comparable with the cost of much nicer homes. The problem is that they pay in cash, have no written record of reliable payment, and don't have proof of employment to get a better rental agreement or mortgage. Lack of paperwork fosters risk aversion. So, we need data and evidence of viability.

Then you have the problem with affordable housing itself—its low margins. So, a USD 100,000 property in Nigeria will have a 25–30% margin, hence that market is saturated. However, a USD 25,000 property has a 10–12% margin, so that market is barely served, but is therefore a huge opportunity. It's a volume play, not a margin play.

Finally, there's the financial risk issue. Developers can't risk building in a low-income market and being stuck with large numbers of houses they can't sell, so de-risking of the proposition is necessary.

Is this fundamentally a commercial or an impact investing opportunity?

It's both. Grant finance is needed to build up the evidence base. We also need philanthropic capital to take first-loss positions and unlock other more risk-averse capital. We have people queuing up to give us senior investment, but we need junior investment to take the first-loss risk. We think they will get their money back, but it's about getting the USD 10mn to unlock the USD 50mn.

Ultimately, we are only looking to get these markets going—we can't do it all ourselves! We are confident this is a commercially viable area even without organizations like Reall, and indeed, without us involved and our associated costs, the returns will be higher.

3. Optimizing the social impacts of retrofitting

At a glance

- Retrofitting improves the environmental and social impacts of the built environment. It needs to be thoughtfully done so that it does not inadvertently exacerbate existing inequalities.
- Leaning into retrofitting's social potential can help achieve the community acceptance required to scale the retrofit revolution, which is essential to realize climate goals.

3.1. The social opportunity of retrofitting

The profound social effects of the existing built environment and the significant potential for both positive and negative direct externalities make building retrofits—changes to the building that upgrade various aspects, which may include insulation, energy efficiency, and ventilation among other things—a key part of the toolkit for reducing social harms and improving social outcomes.

Improving the living standards and health outcomes of building occupants

Besides the obvious effect of lower energy bills and associated energy poverty reduction, there are various potential health and socio-economic benefits. Poor ventilation is associated with respiratory disease—mold and damp, which takes hold in poorly ventilated buildings, is the cause of an estimated quarter of the 22 million asthma cases in the US.[25] Another study has found that if one moves to a cold home from a warm one, the risk of severe mental distress doubles.[26] Cold homes are also associated with higher blood pressure.[27] A 2018 paper prepared for the UK government by National Energy Action estimated that the full societal costs of cold homes in the UK, including health impacts, treatment costs, and lost education and employment opportunities, amounted to GBP 18.6bn per year,[28] equivalent to almost 1% of GDP.

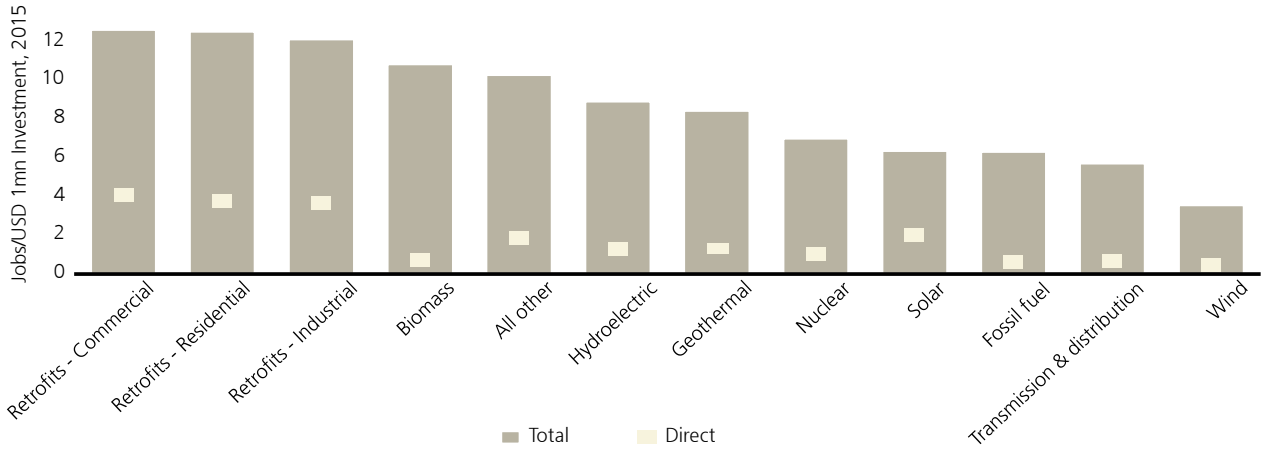
[25] Cox-Ganser, J. M., (2015), *Indoor dampness and mould health effects–Ongoing questions on microbial exposures and allergic versus nonallergic mechanisms*, National Library of Medicine.
[26] Clair, A., Baker, E., (2022), *Cold homes and mental health harm: Evidence from the UK Household Longitudinal Study*, Social Science & Medicine
[27] Zhao, H., Jivraj, S., & Moody, A., (2019), *My blood pressure is low today, do you have the heating on? The association between indoor temperature and blood pressure*, Journal of Hypertension.
[28] National Energy Action, (2018), *Under one roof: Health & housing sectors tackling fuel poverty and cold-related ill health together*, P24.

The socio-economic boost from establishing retrofit supply chains

Large-scale retrofitting has the potential to create jobs in the local area and raise the quality and value of its buildings at the same time. However, simply directing capital toward retrofits is not enough. It must be accompanied by the building out of retrofit supply chains to get costs down, with the associated training and upskilling that it entails (Interview 3). Done right, a retrofit revolution can be a better job creator than most other forms of energy-related investment (Figure 4). In the US and EU alone, it has been estimated that retrofitting could add over 3.5 million new jobs in the transition to Net Zero.[29] McKinsey estimates global direct and indirect job gains from just the installation of insulation could number 6 million by 2050 in a Net Zero scenario, with additional jobs expected from other retrofit activities like the installation of heat pumps and replacement windows.[30]

Figure 4: Comparison of employment multipliers across energy sectors in the United States

Investment in retrofitting can generate more jobs than most other forms of energy-related investment



Sources: Brown, M.A. et al., (2020), Estimating employment from energy-efficiency investments, MethodsX; UBS

The risk of exacerbating existing inequalities

It is important to be wary of, and manage, the risk that retrofitting could reinforce existing inequalities, both within and between regions. There are several ways this could happen:

- **Poorer communities in lower value properties could be left behind** as these building owners may on average have weak credit risk profiles, while the retrofit cost to property value is also likely to be less attractive from a lender's perspective. Furthermore, studies suggest people are reluctant to take on debt, even at zero interest, to fund retrofitting.[31] This will favor wealthier owners that have significant savings. It is important, therefore, to ensure that financing, particularly non-debt financing, flows to properties in low-income areas, e.g., in the form of grants or pay-as-you-save models.
- **Tenants could be excluded,** especially those from lower-income backgrounds. First, because the owner makes the decision to retrofit, and second because that decision is influenced by a split incentive, i.e., building owners face the upfront costs to fund retrofits without seeing the benefit themselves, and are therefore often reluctant to pay for the works.[32] This can be solved to

[29] Brown, M. A. et al., (2020), *Estimating employment from energy-efficiency investments, MethodsX.*
[30] McKinsey & Co., (2022), *The net zero transition: What it would cost, what it could bring*, P131.
[31] Institute for Public Policy Research, (2023), *More Than Money: Moving Towards a Relational Approach to Retrofitting*, P16.
[32] Middlemiss, L. et al., (2023), *Conceptualising socially inclusive environmental policy: A just transition to Net Zero*, Social Policy and Society.

some extent with stricter regulatory requirements on landlords, but done too aggressively, could result in properties being withdrawn from the rental market altogether.

- **Gentrification risks** arise if retrofits lead to higher rents and thus force poorer tenants to move out, a process sometimes called green or low-carbon gentrification.[33] This is particularly a problem in "hot" real estate markets where prices are more sensitive to improvements in amenities. An effective way of countering this is to ensure that retrofits in these markets are combined with an expansion in the stock of affordable housing. Gentrification also refers to the access of current buildings owners to building upgrades. For example, adaptation gentrification refers to the ability of wealthier households to afford to adapt their properties to physical climate effects, e.g., adapting to rising sea levels or worse storm surges by putting properties on stilts or building water defenses, while poorer neighborhoods suffer the full effects.

3.2. Retrofitting as a route to area regeneration

Retrofitting can contribute to revitalizing economically struggling communities, potentially raising property values, creating jobs, and improving local human capital via the benefit to physical and mental health. For this kind of effect to be meaningfully achieved, however, retrofitting needs to take place at scale. For that to happen, communities must be brought on board. In this sense, retrofitting and area regeneration are symbiotic processes, with the success of one dependent, at least in part, on the other. Aligning communities with retrofitting priorities requires communicating and demonstrating the benefits of retrofitting to individuals and the broader public sphere. This means not just communicating the benefits of lower energy bills, the comfort benefits of better insulation, or the environmental benefits of lower emissions. One of the strongest motivating factors to take environmentally positive actions is improving people's health.[34,35] In imposing charges on polluting vehicles, for example, the UK's Bradford City Council focused on its role in improving respiratory health of local people, rather than preserving the environment.[36]

Retrofitting and area regeneration can go hand-in-hand. Indeed, both are likely to be more effective if that is the case. Focusing retrofitting funding in poorer areas has dual social and environmental benefits—poorer areas will typically have the most inefficient homes whose energy consumption and related emissions will see the greatest improvements;[37] their residents are also more likely to suffer from the related physical and mental health ailments that retrofitting helps to ameliorate. More meaningful conclusions require more data regarding the long-term impact of regeneration on the prosperity and quality of residents' lives. The Prosperity in East London 2021–2031[38] is a 10-year longitudinal study across 15 sites where large-scale regeneration is taking place. Using measures of prosperity defined by residents, communities and businesses, the study will understand who benefits how, and what are barriers to prosperity.

[33] Bouzarovsk, S. et al., (2018), *From urban sustainability transformations to green gentrification: Urban renewal in Gaziosmanpaşa, Istanbul*, International Journal of Urban and Regional Research, P845.
[34] Amelung, D. et al., (2019), *Human health as a motivator for climate change mitigation: Results from four European high-income countries*, Global Environmental Change.
[35] Petrovic, N. et al., (2014), *Motivating mitigation: When health matters more than climate change*, Climatic Change.
[36] Bradford City Council, (2022), *Breathe better Bradford*, Accessed on 12/1/23.
[37] Willand, N. et al., (2020), *Retrofit poverty: Socioeconomic spatial disparities in retrofit subsidies uptake*, Buildings & Cities.
[38] London Prosperity Board, *Prosperity in East London 2021-2031*, Accessed on 12/04/23.

Two key factors to spur large-scale retrofitting

Perhaps the most straightforward route to achieving a retrofitting revolution[39] is for governments at local and national levels to commit to retrofitting social housing stocks, i.e., government-owned housing. This has the advantage of laying out a clear policy path, providing a pipeline of projects, clarity to market participants, and a signal to expand retrofit capacity in the supply chain. Such a commitment is admittedly expensive in terms of upfront capital, even if it contributes to lower ongoing expenditure on healthcare etc. in the longer term. A key problem is that the expenditure from one arm of government e.g., housing authorities, worsens its capital position in the short term, potentially conflicting with its statutory fiscal requirements, while potential improvements resulting in savings accrue elsewhere, e.g., to health or social care departments. There is a need not just for greater funding of housing authorities, but also greater policy alignment on a reflection of the broader benefits of retrofitting housing authority and government decisions.

Most buildings globally are privately owned and some social housing estates may have a mix of homeowners and tenants. Achieving community level retrofitting in the private sector is likely to require the kind of coordinating role played by "one-stop-shops" like Energiesprong, both to group retrofitting projects (to reduce costs), and to coordinate stakeholders up and down the value chain and public and private spheres effectively. These types of organizations are likely part of the longer-term solution, but are at an early stage in their development, and will likely need greater investment, both public and private, before they become self-sustaining.

Interview 3

Improving areas by retrofitting. Sebastien Delpont, Energiesprong France

How do you see retrofits being rolled out at community scale?

At first, we work with social housing organizations, who can purchase thousands of retrofits. You see a two-fold cost decrease when you increase numbers by that amount. If you expand from 1,000 houses in the Netherlands to tens of thousands in the UK, France Ireland, etc., then it becomes worthwhile for people to invest in the solutions.

We are now operating in the UK, Germany, France, the Netherlands, the US, Canada, and others. We have to adapt to local regulations, local climate, so retrofits are not the same everywhere. But we have standards that allow offsite manufacturing to industrialize retrofit panels and reduce costs. Offsite manufacturing means people don't have to be onsite for more than two weeks.

How do you view the social benefits of retrofitting?

We want to improve quality of life and increase pride in the area. Properties can have a completely different look and feel after the retrofit—social housing doesn't look or feel like social housing anymore. And there is a community impact when you're doing dozens in the same area. You start with the least efficient, worst performing buildings, as the case for retrofitting is the best there. And the more retrofits we do over time, the more costs should come down.

What type of people do Energiesprong projects tend to help?

Currently our clients are public authorities—we are a free consultant paid by the state to support these policies and help people work together. But eventually we want to find an approach that could be used via one-stop-shops to work with private households, which could afford to have higher transaction costs.

[39] UBS, (2023), *Retrofit Revolution.*

4. Summing up

1. Improving the social and environmental impact of our buildings are connected goals—success on one is likely to aid success on the other, and vice versa.

2. Where new construction is necessary, it should, from a social desirability perspective, fulfill three criteria. First, meet the economic, physical, and social needs of the citizens for whom it is designed. Second, be constructed in a way that minimizes social costs, both from labor and occupant perspectives. Third, be located in areas with good connection to others, to public transport, to job opportunities, and outside of areas prone to environmental and social risks.

3. A key aim of new construction should be to address the worldwide shortage of affordable housing. Various stakeholders, from governments and investors to corporates and NGOs, can take realistic actions to address the available land, finance, skilled labor, and other bottlenecks constraining the affordable housing supply.

4. The social impacts of the existing building stock will be addressed through large-scale retrofitting, which can achieve various social goals, like improving health and even educational outcomes, in addition to improving energy efficiency. Achieving scale is more likely by leaning into the capacity for retrofitting to contribute to area regeneration. This will likely require a mixture of public- and private-led efforts.

About the Institute

The UBS Sustainability and Impact Institute was founded in 2021 to contribute to the sustainability debate, with a focus on actionable and timely contributions. The Institute is a collaborative effort with sustainability experts from across UBS's business divisions. We strive to encourage objective and fact-based debate, provide new impulses for action, and identify innovations that will help shape our collective efforts and awareness about sustainability and impact.

Fellows of the Institute

Jackie Bauer
Francis Condon
Gillian Dexter
Paul Donovan
Adam Gustafsson
Camila Kaiser
Vicki Kalb
Karianne Lancee
Andrew Lee
Stevica Levajkovski
Richard Morrow
Grégorie Muhr
Richard Mylles
William Nicolle
Mike Ryan
Antonia Sariyska
Nalini Tarakeshwar
Veronica Weisser
Annabel Willder
Maya Ziswiler

Disclaimer

Important Information: This material has been prepared by UBS AG, its subsidiary or affiliate ("UBS"). This material and the information contained herein are provided solely **for information purposes**. It is not to be regarded as investment advice, investment research, sales prospectus, an offer or a solicitation of an offer to enter in any investment activity. It has no regard to the specific investment objectives, financial situation or particular needs of any specific recipient. The information contained in this material is as of the date hereof only and is subject to change without notice. UBS is under no obligation to update or keep current the information contained herein. This material is not a complete statement of the markets and developments referred to herein. The information contained herein should not be regarded by recipients as a substitute for the exercise of their own judgment. Prior to entering into a transaction you should consult with your own legal, regulatory, tax, financial and accounting advisers to the extent you deem necessary to make your own investment, hedging and trading decisions. UBS does not provide legal or tax advice and makes no representations as to the tax treatment of assets or the investment returns thereon, either in general or with reference to specific client's circumstances and needs. Certain services and products are subject to legal provisions and cannot be offered world-wide on an unrestricted basis. In particular, this material is not intended for distribution into jurisdictions where its distribution by UBS would be restricted. UBS specifically prohibits the redistribution or reproduction of this material in whole or in part without the written permission of UBS and UBS accepts no liability whatsoever for the actions of third parties in this respect. Neither UBS nor any of its directors, officers, employees or agents accepts any liability for any loss or damage arising out of the use of all or any part of this material. Source of all information is UBS unless otherwise stated. UBS makes no representation or warranty relating to any information herein which is derived from independent sources. The views and opinions expressed in this material by third parties are not those of UBS. Accordingly, UBS does not accept any liability over the content shared by third parties or any claims, losses or damages arising from the use or reliance of all or any part thereof.

Important Information About Sustainable Investing: An increasing number of products and services are using terms or labels related to sustainable investments. However, industry standards and terminology related to sustainable investments will differ and are evolving. Therefore, you should carefully review the offering materials to understand why a particular product or strategy may or may not be classified as a sustainable investment and if their approach aligns with your goals and objectives. At UBS, we continue to develop our own standards and a framework for sustainable investing. However we do not review every product to determine consistency with our standards, nor do all products that we make available align with our approach.

At UBS, we believe sustainable investment strategies should have an explicit focus on sustainability objectives or outcomes. Sustainable investments across geographies and styles approach the integration of environmental, social and governance (ESG) factors and other sustainability considerations and incorporate the findings in a variety of ways. Sustainable investing-related strategies may or may not result in favorable investment performance and the strategy may forego favorable market opportunities in order to adhere to sustainable investing-related strategies or mandates. Issuers may not necessarily meet high performance standards on all aspects of ESG or other sustainability considerations. In addition, there is no guarantee that a product's sustainable investing-related strategy will be successful. The ability to implement the approaches to sustainable investing will depend on the product or service selected, they are not available for all products, services or accounts offered through UBS.

Bahrain: UBS is a Swiss bank not licensed, supervised or regulated in Bahrain by the Central Bank of Bahrain to undertake banking or investment business activities in Bahrain. Therefore, prospects/clients do not have any protection under local banking and investment services laws and regulations. **Brazil:** This publication is only intended for Brazilian residents who are directly purchasing or selling securities in the Brazil capital market through a local authorized institution. **Canada:** The information contained herein is not, and under no circumstances is to be construed as, a prospectus, an advertisement, a public offering, an offer to sell securities described herein, solicitation of an offer to buy securities described herein, in Canada or any province or territory thereof. Any offer or sale of the securities described herein in Canada will be made only under an exemption from the requirements to file a prospectus with the relevant Canadian securities regulators and only by a dealer properly registered under applicable securities laws or, alternatively, pursuant to an exemption from the dealer registration requirement in the relevant province or territory of Canada in which such offer or sale is made. Under no circumstances is the information contained herein to be construed as investment advice in any province or territory of Canada and is not tailored to the needs of the recipient. To the extent that the information contained herein references securities of an issuer incorporated, formed or created under the laws of Canada or a province or territory of Canada, any trades in such securities must be conducted through a dealer registered in Canada or, alternatively, pursuant to a dealer registration exemption. No securities commission or similar regulatory authority in Canada has reviewed or in any way passed upon these materials, the information contained herein or the merits of the securities described herein and any representation to the contrary is an offence. In Canada, this publication is distributed by UBS Investment Management Canada Inc.. **China:** This document and any offering material such as term sheet, research report, other product or service documentation or any other information (the "Material") sent with this document was done so as a result of a request received by UBS from you and/or persons entitled

to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete it and inform UBS immediately. This document is prepared by UBS Switzerland AG or its offshore subsidiary or affiliate (collectively as "UBS Offshore"). UBS Offshore is an entity incorporated out of China and is not licensed, supervised or regulated in China to carry out banking or securities business. The recipient should not contact UBS Offshore or authors who produced this report for advice as they are not licensed to provide securities investment advice in China. The recipient should not use this document or otherwise rely on any of the information contained in this document in making investment decisions and UBS takes no responsibility in this regard. **Czech Republic:** UBS is not a licensed bank in the Czech Republic and thus is not allowed to provide regulated banking or investment services in the Czech Republic. This communication and/or material is distributed for marketing purposes and constitutes a "Commercial Message" under the laws of the Czech Republic in relation to banking and/or investment services. Please notify UBS if you do not wish to receive any further correspondence.
Denmark: This publication is not intended to constitute a public offer under Danish law. It is distributed only for information purposes to clients of UBS Europe SE, Denmark Branch, filial af UBS Europe SE, with place of business at Sankt Annae Plads 13, 1250 Copenhagen, Denmark, registered with the Danish Commerce and Companies Agency, under No. 38 17 24 33. UBS Europe SE, Denmark Branch, filial af UBS Europe SE is subject to the joint supervision of the European Central Bank, the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, "BaFin"), as well as of the Danish Financial Supervisory Authority (Finanstilsynet), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by BaFin. **Egypt:** Securities or other investment products are not being offered or sold by UBS to the public in Egypt and they have not been and will not be registered with the Egyptian Financial Regulatory Authority (FRA). **France:** This publication is not intended to constitute a public offer under French law, it does not constitute a personal recommendation as it is distributed only for information purposes to clients of UBS (France) S.A., French "société anonyme" with share capital of € 132.975.556, at 69 boulevard Haussmann F-75008 Paris, registered with the "Registre du Commerce et des Sociétés" of Paris under N° B 421 255 670. UBS (France) S.A. is a provider of investment services duly authorized according to the terms of the "Code monétaire et financier", regulated by French banking and financial authorities as the "Autorité de contrôle prudentiel et de résolution" and "Autorité des marchés financiers", to which this publication has not been submitted for approval.
Germany: This publication is not intended to constitute a public offer under German law. It is distributed only for information purposes to clients of UBS Europe SE, Germany, with place of business at Bockenheimer Landstrasse 2-4, 60306 Frankfurt am Main. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, "BaFin") and supervised jointly by the European Central Bank, the German Central Bank (Deutsche Bundesbank) and the BaFin, to which this publication has not been submitted for approval.
Hong Kong SAR: This publication is distributed to clients of UBS AG Hong Kong Branch by UBS AG Hong Kong Branch, a licensed bank under the Hong Kong Banking Ordinance and a registered institution under the Securities and Futures Ordinance. UBS AG Hong Kong Branch is incorporated in Switzerland with limited liability. **India:** Distributed by UBS Securities India Private Ltd. (Corporate Identity Number U67120MH1996PTC097299) 2/F, 2 North Avenue, Maker Maxity, Bandra Kurla Complex, Bandra (East), Mumbai (India) 400051. Phone: +912261556000. It provides brokerage services bearing SEBI Registration Number INZ000259830; merchant banking services bearing SEBI Registration Number: INM000010809 and Research Analyst services bearing SEBI Registration Number: INH000001204. UBS AG, its affiliates or subsidiaries may have debt holdings or positions in the subject Indian company/companies. UBS AG, its affiliates or subsidiaries may have financial interests (e.g. like loan/derivative products, rights to or interests in investments, etc.) in the subject Indian company/companies from time to time. Within the past 12 months, UBS AG, its affiliates or subsidiaries may have received compensation for non-investment banking securities-related services and/or non-securities services from the subject Indian company/companies. The subject company/companies may have been a client/clients of UBS AG, its affiliates or subsidiaries during the 12 months preceding the date of distribution of this publication with respect to investment banking and/or non-investment banking securities-related services and/or non-securities services. With regard to information on associates, please refer to the Annual Report
at: http://www.ubs.com/global/en/about_ubs/investor_relations/annualreporting.html. **Indonesia:** This communication and any offering material term sheet, research report, other product or service documentation or any other information (the "Material") sent with this communication was done so as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete the e-mail and inform UBS immediately. The Material, where provided, was provided for your information only and is not to be further distributed without the consent of UBS. None of the Material has been registered or filed under the prevailing laws and with any financial or regulatory authority in your jurisdiction. The Material may not have been approved, disapproved, endorsed, registered or filed with any financial or regulatory authority in your jurisdiction. UBS has not, by virtue of the Material, made available, issued any invitation to subscribe for or to purchase any investment (including securities or products or futures contracts). The Material is neither an offer nor a solicitation to enter into any transaction or contract (including futures contracts) nor is it an offer to buy or to sell any securities or products. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the Material, and by receiving the Material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. Any and all advice provided on and/or trades executed by UBS pursuant to the Material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. **Israel:** UBS is a premier global financial firm offering wealth management, asset management and investment banking services from its headquarters in Switzerland and its operations in over 50 countries worldwide to individual, corporate and institutional investors. In Israel, UBS Switzerland AG is registered as Foreign Dealer in cooperation with UBS Wealth Management Israel Ltd., a wholly owned UBS subsidiary. UBS Wealth Management Israel Ltd. is an Investment Marketing licensee which engages in Investment Marketing and is regulated by the Israel Securities Authority. This publication is intended for information only and is not intended as an offer to buy or solicitation of an offer. Furthermore, this publication is not intended as an investment advice. No action has been, or will be, taken in Israel that would permit an offering of the product(s) mentioned in this document or a distribution of this document to the public in Israel. In particular, this document has not been reviewed or approved by the Israeli Securities Authority. The product(s) mentioned in this document is/are being offered to a limited number

of sophisticated investors who qualify as one of the investors listed in the first supplement to the Israeli Securities Law, 5728-1968. This document may not be reproduced or used for any other purpose, nor be furnished to any other person other than those to whom copies have been sent. Anyone who purchases the product(s) mentioned herein shall do so for its own benefit and for its own account and not with the aim or intention of distributing or offering the product(s) to other parties. Anyone who purchases the product(s) shall do so in accordance with its own understanding and discretion and after it has received any relevant financial, legal, business, tax or other advice or opinion required by it in connection with such purchase(s). The word "advice" and/or any of its equivalent terms shall be read and construed in conjunction with the definition of the term "investment marketing" as defined under the Israeli Regulation of Investment Advice, Investment Marketing and Portfolio Management Law. **Italy:** This publication is not intended to constitute a public offer under Italian law. It is distributed only for information purposes to clients of UBS Europe SE, Succursale Italia, with place of business at Via del Vecchio Politecnico, 3-20121 Milano. UBS Europe SE, Succursale Italia is subject to the joint supervision of the European Central Bank, the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, "BaFin"), as well as of the Bank of Italy (Banca d'Italia) and the Italian Financial Markets Supervisory Authority (CONSOB—Commissione Nazionale per le Società e la Borsa), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by BaFin. **Jersey:** UBS AG, Jersey Branch, is regulated and authorized by the Jersey Financial Services Commission for the conduct of banking, funds and investment business. Where services are provided from outside Jersey, they will not be covered by the Jersey regulatory regime. UBS AG, Jersey Branch is a branch of UBS AG a public company limited by shares, incorporated in Switzerland whose registered offices are at Aeschenvorstadt 1, CH-4051 Basel and Bahnhofstrasse 45, CH 8001 Zurich. UBS AG, Jersey Branch's principal place of business is 1, IFC Jersey, St Helier, Jersey, JE2 3BX. **Luxembourg**: This publication is not intended to constitute a public offer under Luxembourg law. It is distributed only for information purposes to clients of UBS Europe SE, Luxembourg Branch ("UBS Luxembourg"), R.C.S. Luxembourg n° B209123, with registered office at 33A, Avenue J. F. Kennedy, L-1855 Luxembourg. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea (HRB n° 107046), with registered office at Bockenheimer Landstrasse 2-4, D-60306 Frankfurt am Main, Germany, duly authorized by the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, "BaFin") and subject to the joint prudential supervision of BaFin, the European Central Bank and the central bank of Germany (Deutsche Bundesbank). UBS Luxembourg is furthermore supervised by the Luxembourg prudential supervisory authority (Commission de Surveillance du Secteur Financier), in its role as host member state authority. This publication has not been submitted for approval to any public supervisory authority. **Malaysia:** This communication and any offering material term sheet, research report, other product or service documentation or any other information (the "Material") sent with this communication was done so as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete the e-mail and inform UBS immediately. The Material, where provided, was provided for your information only and is not to be further distributed in whole or in part in or into your jurisdiction without the consent of UBS. The Material may not have been reviewed, approved, disapproved, endorsed, registered or filed with any financial or regulatory authority in your jurisdiction. UBS has not, by virtue of the Material, made available, issued any invitation to subscribe for or to purchase any investment (including securities or derivatives products). The Material is neither an offer nor a solicitation to enter into any transaction or contract (including future contracts) nor is it an offer to buy or to sell any securities or derivatives products. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the Material, and by receiving the Material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. Any and all advice provided on and/or trades executed by UBS pursuant to the Material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. **Mexico:** This information is distributed by UBS Asesores México, S.A. de C.V. ("UBS Asesores"), an affiliate of UBS Switzerland AG, incorporated as a non-independent investment advisor under the Mexican regulation due to the relation with a Foreign Bank. UBS Asesores is registered under number 30060-001-(14115)-21/06/2016 and subject to the supervision of the Mexican Banking and Securities Commission ("CNBV") exclusively regarding the rendering of (i) portfolio management services, (ii) securities investment advisory services, analysis and issuance of individual investment recommendations, and (iii) anti-money laundering and terrorism financing matters. Such registry does not imply the adherence of UBS Asesores to the regulations applicable to the services it provides, nor the accuracy or veracity of the information provided to its clients. This UBS publication or any material related thereto is addressed only to Sophisticated or Institutional Investors located in Mexico. **Monaco:** This document is not intended to constitute a public offering or a comparable solicitation under the Principality of Monaco laws, but might be made available for information purposes to clients of UBS (Monaco) SA, a regulated bank having its registered office 2 avenue de Grande Bretagne 98000 Monaco operating under a banking license granted by the "Autorité de Contrôle Prudentiel et de Résolution" (ACPR) and the Monegasque government which authorizes the provision of banking services in Monaco. UBS (Monaco) S.A. is also licensed by the "Commission de Contrôle des Activités Financières" (CCAF) to provide investment services in Monaco. The latter has not approved this publication. **Nigeria:** The investment products mentioned in this material are not being offered or sold by UBS to the public in Nigeria and they have not been submitted for approval nor registered with the Securities and Exchange Commission of Nigeria. If you are interested in products of this nature, please let us know. The investment products mentioned in this material are not being directed to, and are not being made available for subscription by any persons within Nigeria other than the selected investors to whom the offer materials have been addressed as a private sale or domestic concern within the exemption and meaning of Section 69(2) of the Investments and Securities Act, 2007 (ISA). This material has been provided to you at your specific unsolicited request and for your information only. **Philippines:** This communication was done so as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete the e-mail and inform UBS immediately. The Material, where provided, was provided for your information only and is not to be further distributed in whole or in part in or into your jurisdiction without the consent of UBS. The Material may not have been reviewed, approved, disapproved, endorsed, registered or filed with any financial or regulatory authority in your jurisdiction. UBS has not, by virtue of the Material, made available, issued any invitation to subscribe for or to purchase any investment (including securities or derivatives products). The Material is neither an offer nor a solicitation to enter into

any transaction or contract (including future contracts) nor is it an offer to buy or to sell any securities or derivatives products. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the Material, and by receiving the Material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. Any and all advice provided on and/or trades executed by UBS pursuant to the Material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. **Portugal:** UBS Switzerland AG is not licensed to conduct banking and financial activities in Portugal nor is UBS Switzerland AG supervised by the portuguese regulators (Bank of Portugal "Banco de Portugal" and Portuguese Securities Exchange Commission "Comissão do Mercado de Valores Mobiliários"). **Qatar:** UBS Qatar LLC is authorized by the Qatar Financial Centre Regulatory Authority, with QFC no. 01169, and has its registered office at 14th Floor, Burj Alfardan Tower, Building 157, Street No. 301, Area No. 69, Al Majdami, Lusail, Qatar. UBS Qatar LLC neither offers any brokerage services nor executes any order with, for or on behalf of its clients. A client order will have to be placed with, and executed by, UBS Switzerland AG in Switzerland or an affiliate of UBS Switzerland AG, that is domiciled outside Qatar. It is in the sole discretion of UBS Switzerland AG in Switzerland or its affiliate to accept or reject an order and UBS Qatar LLC does not have authority to provide a confirmation in this respect. UBS Qatar LLC may however communicate payment orders and investment instructions to UBS Switzerland AG in Switzerland for receipt, acceptance and execution. UBS Qatar LLC is not authorized to act for and on behalf of UBS Switzerland AG or an affiliate of UBS Switzerland AG. This document and any attachments hereto are intended for eligible counterparties and business customers only. **Russia:** This document or information contained therein is for information purposes only and constitutes neither a public nor a private offering, is not an invitation to make offers, to sell, exchange or otherwise transfer any financial instruments in the Russian Federation to or for the benefit of any Russian person or entity and does not constitute an advertisement or offering of securities in the Russian Federation within the meaning of Russian securities laws. The information contained herein is not an "individual investment recommendation as defined in Federal Law of 22 April 1996 No 39-FZ "On Securities Market" (as amended) and the financial instruments and operations specified herein may not be suitable for your investment profile or your investment goals or expectations. The determination of whether or not such financial instruments and operations are in your interests or are suitable for your investment goals, investment horizon or the acceptable risk level is your responsibility. We assume no liability for any losses connected with making any such operations or investing into any such financial instruments and we do not recommend to use such information as the only source of information for making an investment decision. **Saudi Arabia:** UBS Saudi Arabia is authorised and regulated by the Capital Market Authority to conduct securities business under licence number 08113-37. **Singapore:** Clients of UBS AG Singapore branch are asked to please contact UBS AG Singapore branch, an exempt financial adviser under the Singapore Financial Advisers Act (Cap. 110) and a wholesale bank licensed under the Singapore Banking Act (Cap. 19) regulated by the Monetary Authority of Singapore, in respect of any matters arising from, or in connection with, the analysis or report. UBS AG is incorporated in Switzerland with limited liability. UBS AG has a branch registered in Singapore (UEN S98FC5560C). This communication and any offering material term sheet, research report, other product or service documentation or any other information (the "Material") sent with this communication was done so as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete the e-mail and inform UBS immediately. The Material, where provided, was provided for your information only and is not to be further distributed in whole or in part in or into your jurisdiction without the consent of UBS. The Material may not have been reviewed, approved, disapproved or endorsed by any financial or regulatory authority in your jurisdiction. UBS has not, by virtue of the Material, made available, issued any invitation to subscribe for or to purchase any investment (including securities or products or futures contracts). The Material is neither an offer nor a solicitation to enter into any transaction or contract (including future contracts) nor is it an offer to buy or to sell any securities or products. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the Material, and by receiving the Material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. Any and all advice provided on and/or trades executed by UBS pursuant to the Material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. **Sweden:** This publication is not intended to constitute a public offer under Swedish law. It is distributed only for information purposes to clients of UBS Europe SE, Sweden Bankfilial, with place of business at Regeringsgatan 38, 11153 Stockholm, Sweden, registered with the Swedish Companies Registration Office under Reg. No 516406-1011. UBS Europe SE, Sweden Bankfilial is subject to the joint supervision of the European Central Bank, the German Central Bank (Deutsche Bundesbank), the German Federal Financial Services Supervisory Authority (Bundesanstalt für Finanzdienstleistungsaufsicht, "BaFin"), as well as of the Swedish supervisory authority (Finansinspektionen), to which this publication has not been submitted for approval. UBS Europe SE is a credit institution constituted under German law in the form of a Societas Europaea, duly authorized by BaFin. **Taiwan:** This material is provided by UBS AG, Taipei Branch in accordance with laws of Taiwan, in agreement with or at the request of clients/prospects. **Thailand:** This communication and any offering material, term sheet, research report, other product or service documentation or any other information (the "Material") sent with this communication were done so as a result of a request received by UBS from you and/or persons entitled to make the request on your behalf. Should you have received the Material erroneously, UBS asks that you kindly delete the e-mail and inform UBS immediately. The Material, where provided, was provided for your information only and is not to be further distributed in whole or in part in or into your jurisdiction without the consent of UBS. The Material may not have been reviewed, approved, disapproved, endorsed, registered or filed with any financial or regulatory authority in your jurisdiction. UBS has not, by virtue of the Material, made available, issued any invitation to subscribe for or to purchase any investment (including securities or derivatives products). The Material is neither an offer nor a solicitation to enter into any transaction or contract (including future contracts) nor is it an offer to buy or to sell any securities or derivatives products. The relevant investments will be subject to restrictions and obligations on transfer as set forth in the Material, and by receiving the Material you undertake to comply fully with such restrictions and obligations. You should carefully study and ensure that you understand and exercise due care and discretion in considering your investment objective, risk appetite and personal circumstances against the risk of the investment. You are advised to seek independent professional advice in case of doubt. Any and all advice provided and/or trades

executed by UBS pursuant to the Material will only have been provided upon your specific request or executed upon your specific instructions, as the case may be, and may be deemed as such by UBS and you. **Turkey:** The information in this document is not provided for the purpose of offering, marketing or sale of any capital market instrument or service in the Republic of Turkey. Therefore, this document may not be considered as an offer made, or to be made, to residents of the Republic of Turkey in the Republic of Turkey. UBS Switzerland AG is not licensed by the Turkish Capital Market Board (the CMB) under the provisions of the Capital Market Law (Law No. 6362). Accordingly, neither this document nor any other offering material related to the instrument/service may be utilized in connection with providing any capital market services to persons within the Republic of Turkey without the prior approval of the CMB. However, according to article 15 (d) (ii) of the Decree No. 32 residents of the Republic of Turkey are allowed to purchase or sell the financial instruments traded in financial markets outside of the Republic of Turkey. Further to this, pursuant to article 9 of the Communiqué on Principles Regarding Investment Services, Activities and Ancillary Services No. III-37.1, investment services provided abroad to residents of the Republic of Turkey based on their own initiative are not restricted. **United Arab Emirates (UAE):** UBS is not a financial institution licensed in the UAE by the Central Bank of the UAE nor by the Emirates' Securities and Commodities Authority and does not undertake banking activities in the UAE. UBS AG Dubai Branch is licensed by the DFSA in the DIFC. This document is provided for your information only and does not constitute financial advice. **United Kingdom:** This document is issued by UBS Wealth Management, a division of UBS AG which is authorised and regulated by the Financial Market Supervisory Authority in Switzerland. In the United Kingdom, UBS AG is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and limited regulation by the Prudential Regulation Authority. Details about the extent of regulation by the Prudential Regulation Authority are available from us on request. A member of the London Stock Exchange. This publication is distributed to retail clients of UBS Wealth Management. Where products or services are provided from outside the UK, they will not be covered by the UK regulatory regime or the Financial Services Compensation Scheme. **Ukraine**: UBS is not registered and licensed as a bank/financial institution under Ukrainian legislation and does not provide banking and other financial services in Ukraine. UBS has not made and will not make any offer of the mentioned products to the public in Ukraine. No action has been taken to authorize an offer of the mentioned products to the public in Ukraine and the distribution of this document shall not constitute financial services for the purposes of the Law of Ukraine "On Financial Services and State Regulation of Financial Services Markets" dated 12 July 2001. Any offer of the mentioned products shall not constitute an investment advice, public offer, circulation, transfer, safekeeping, holding or custody of securities in the territory of Ukraine. Accordingly, nothing in this document or any other document, information or communication related to the mentioned products shall be interpreted as containing an offer, a public offer or invitation to offer or to a public offer, or solicitation of securities in the territory of Ukraine or investment advice under Ukrainian law. Electronic communication must not be considered as an offer to enter into an electronic agreement or other electronic instrument within the meaning of the Law of Ukraine "On Electronic Commerce" dated 3 September 2015. This document is strictly for private use by its holder and may not be passed on to third parties or otherwise publicly distributed. **USA**: **:** As a firm providing wealth management services to clients, UBS Financial Services Inc. offers investment advisory services in its capacity as an SEC-registered investment adviser and brokerage services in its capacity as an SEC-registered broker-dealer. Investment advisory services and brokerage services are separate and distinct, differ in material ways and are governed by different laws and separate arrangements. It is important that you understand the ways in which we conduct business and that you carefully read the agreements and disclosures that we provide about the products or services we offer. For more information, please review client relationship summary provided at ubs.com/relationshipsummary. There are two sources of UBS research. Reports from the first source, UBS CIO Wealth Management Research, are designed for individual investors and are produced by UBS Wealth Management Americas (which includes UBS Financial Services Inc. and UBS International Inc.) and UBS Wealth Management. The second research source is UBS Investment Research, and its reports are produced by UBS Investment Bank, whose primary business focus is institutional investors. The two sources operate independently and may therefore have different recommendations. The various research content provided does not take into account the unique investment objectives, financial situation or particular needs of any specific individual investor. This material is not independent research and not subject to regulatory rules regarding research in the US. This material is intended for educational purposes only. If you have any questions, please consult your Financial Advisor. UBS Financial Services Inc. is a subsidiary of UBS Group AG and an affiliate of UBS International Inc.

© 2023 UBS AG. The key symbol and UBS are among the registered and unregistered trademarks of UBS. All rights reserved.

Approval Date: 12/18/2023

Expiration: 12/31/2024

Review Code: IS2307438

www.ubs.com