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ORIGINAL ARTICLE

Measuring policy coherence on global access to clean energy between European countries

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Abstract
Amongst the Sustainable Development Goals (SDGs), ensuring energy access in developing countries while reducing global emissions of greenhouse gases is critical. To achieve such goals, international cooperation combined with investments in research, technology, infrastructures and capacity building are paramount. The Sustainable Development Goal (SDG) 7 on access to affordable and clean energy, includes both targets at the domestic and international stages of energy policy. However, trade-offs are emerging in the monitoring phase of SDG7 and its targets, signalling the need for stronger coherence at all stages. Here, we assess to what extent policy coherence exists, and is or is not maintained, considering internal and external energy policy in Europe. We find that a higher level of coherence exists in internal than external energy policy. This result questions the overall positive contribution and commitment of European countries when it comes to facilitating energy access in developing countries. The results also highlight the positive effect of common policy frameworks and the need to rely more extensively on new means for governing and improving international policy coherence. We identify key trade-offs and co-benefits to be addressed for achieving improved policy coherence and call for a common framework that unifies internal and external energy policy in Europe for accelerating progress towards global access to clean energy.

Keywords Sustainable Development Goals (SDGs) · Official development assistance (ODA) · Energy access · International cooperation

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1 Introduction

1.1 The multiple scales of policy coherence for the Sustainable Development Goals (SDGs)

The United Nations Sustainable Development Goals (UN SDGs) represent an outstanding policy achievement. The agreement achieved between UN member states on global action for Sustainability under Agenda 2030 reflects the awareness of national governments of the global importance of Sustainability issues. The Agenda 2030 also reflects the acknowledgement, at the highest policy levels, that collaboration between countries is essential for finding solutions to deeply intertwined challenges, including climate change, poverty and inequality and access to clean energy. These challenges demand for coherent solutions that can cut across national and sectorial barriers and anticipate societal and global dependencies (Mortensen and Petersen, 2017). Human-induced climate change, including more frequent and intense extreme events, has caused irreversible impacts to nature and people, with most vulnerable people disproportionately affected (IPCC, 2021). Unchecked, it will push up to 130 million people into poverty over the next 10 years and could cause over 200 million people to migrate by 2050 (Clement et al., 2021). At the same time, about 800 million people lack access to electricity, and about 3 billion have no access to clean cooking options, demanding increases in energy use with potential impacts in terms of carbon emissions (IEA et al. 2022).

The interconnections between environmental, social and economic challenges are fundamental to consider for achieving the SDGs at the global scale. Progress towards achieving the SDGs across countries provides global benefits, where failure to achieve the SDG targets in one country risks hampering SDG achievements in other countries. This is explicit in SDG17, to strengthen 'the means of implementation and revitalise the global partnership for sustainable development' (UN, 2015). Each individual SDG therefore includes specific targets with regards to international cooperation, for example, in terms of aid or financial investment in infrastructures, education and capacity building.

Policy coherence refers to the integration of all dimensions of sustainable development at all stages of domestic and international policymaking (OECD, 2015). In the ongoing phase of monitoring progress towards the SDGs, synergies and trade-offs are emerging between goals and targets, calling for stronger efforts to ensure policy coherence across the many areas of the SDGs (Lu et al., 2015; Le Blanc, 2015; Scherer et al., 2018; Nilsson et al., 2016). This calls for increased regional integration if the Agenda 2030 vision of 'leaving no one behind' is to be realised. Countries making the most progress towards the SDGs are, however, those with high income and high per-person demand on global natural resources (Wackernagel et al., 2017). In the context of the global economy, high levels of consumption in some countries have a direct impact on lowest-income people across the world, that are left exposed to resource insecurity and that lack the financial means to cope with the effects of global unsustainability. A recent report on progress towards the SDGs (Sachs et al., 2017) has raised concern that the international dimension covered by specific targets within each of the goals has been given less attention, while a stronger focus on domestic (i.e. national) progress prevails. This implementation gap contributes to a lack of assessment and monitoring of environmental spillovers, as well as spillovers related to the economy, finance, governance and security (Janoušková et al., 2018). These spillovers include the impacts of high-income countries development and growth patterns on the global environment (e.g. through high levels of consumption and greenhouse gas

emissions), as well as more localised impacts (e.g. weapon exports, extraction of natural resources), that negatively affect the capacity of low-income countries for achieving the SDGs.

A recent study from the European Union Directorate-General for International Policies (Niestroy et al., 2019) has highlighted that while the 2030 Agenda emphasises 'leaving no one behind', few countries are making efforts for implementing this principle in SDG roadmaps. More specifically, there is a general underperformance in terms of measuring spillovers to third countries and accounting for interdependencies between countries with regards to the SDGs. This undesired outcome can be attributed to poor framing of some indicators (see Schleicher et al., 2018 for a case on indicators linking poverty and the natural environment), poor data availability, inconsistencies across some of the goals and their indicators (see Coscieme et al., 2020 for a case on SDG8), or poor tracking methods. The general lack of monitoring SDG implementation through aid and financial investments risks undermining the overall achievement of the SDGs as a global endeavour and endangers positive trends that could be capitalised on to accelerate progress towards the SDGs.

In the European Union (EU), policy coherence for the SDGs takes on an additional layer of scale and complexity (compared to individual countries), as a certain level of coherence is expected between EU member states in terms of internal and external policies. In particular, internal EU policies (also known as common policies) are in place in areas such as agriculture (European Commission, 2019a), food safety (De Schutter, 2019) and environmental standards (Orlando, 2013), and express the democratic legitimacy of the EU and the coherence of its actions. External policies cover aspects such as aid and humanitarian assistance (Bandov and Gošović, 2018), trade, and international relations with non-EU countries. The 2017 European Consensus on Development stressed the need for further cooperation in these areas, reaffirming the EU member states' commitment to policy coherence for development (EU, 2017; European Commission, 2019b). Furthermore, policy coherence boundaries need to be extended further for engaging business and civil society, as well as other stakeholders, as fundamental actors with an active role in implementing and influencing sustainable policies across national borders (Mortensen and Petersen, 2017; Cole, 2011; OECD, 2012; O'Connor et al., 2016; Smith & Guarnizo, 1998). It is increasingly clear how new business models, social media impacts, social behaviour, along with corporate norms and compliance systems, as well as other processes beyond national legislation and implementation, will affect progress towards achieving the SDGs (Costanza et al., 2016; EEA, 2016).

1.2 Enhancing policy coherence for meeting SDG7: affordable and clean energy

Given the multi-dimensional impacts of the energy sector that transcend regional boundaries, synergies across national governments and global business and civil society groups are particularly important. Energy is ultimately a global resource, as both renewable and non-renewable energy sources depend on global biogeochemical cycles and are distributed heterogeneously across the planet (Mohr et al., 2015). As a consequence, energy markets are largely globalised.

Energy is an enabling resource that underpins production of a multiplicity of goods (Fantazzini et al., 2011; Seppelt et al., 2014). Energy prices therefore influence prices of a very wide range of commodities and services, including food. In addition to commodity supply chains, consumption of energy and local as well as common energy policies have a wide range of global implications. For example, even though African countries have

the lowest per capita footprint of energy consumption (Hertwich and Peters, 2009), they are considered amongst the most vulnerable to the impacts of climate change (Collier et al., 2008) arising from greenhouse gas emissions driven by energy consumption in high income countries. Another example of such global linkages are energy subsidies. For instance, there is evidence for EU's fossil fuel subsidies to distort energy markets and disincentivise investments in renewable energy and energy efficiency (Whitley and van der Burg, 2015), with cascading global effects.

Amongst the seventeen SDGs, SDG7 aims to ensure 'access to affordable, reliable, sustainable and modern energy for all' and includes two specific targets on international cooperation. Both targets stress the global dimension of energy policy, including the important role of investment in energy research and technology (Target 7.a), and expanded infrastructure and upgrade of technology for supplying modern and sustainable energy services for all in developing countries (Target 7.b). Targets 7.a and 7.b offer the means for implementation of other key targets of SDG7, in particular: (Target 7.1) to ensure universal access to affordable, reliable and modern energy services, (Target 7.2) to increase substantially the share of renewable energy in the global energy mix, and (Target 7.3) to double the global rate of improvement in energy efficiency. According to the latest tracking report by the Custodian Agencies for SDG7 (IEA et al., 2022), at the current rate of progress energy access targets will not be met globally in 2030, jeopardising the achievement of several related SDGs, such as SDG1 'no poverty' and SDG13 'climate action', amongst others (International Council for Science, 2017). Furthermore, 'the pace of progress on the SDG 7 targets is expected to further slow down because of the energy crisis provoked by the Russian invasion of Ukraine' (IEA et al., 2022). According to the scenarios from the tracking report, energy sector investment related to all SDG7 targets will need to more than double if SDG7 and related SDGs are to be realised by 2030. Focusing on Europe, good progress has been made in most of SDG7 areas. However, progressing trends have been slowing down or reversing in the short-term (2015-2021), with increasing levels of energy consumption in households per capita, and increased energy import dependency (Eurostat, 2022). At the same time, current EU sets of targets of emission reductions are still not compatible with the Paris Agreement on climate change (Climate Action Tracker, 2021; Romanello et al., 2021), highlighting incoherence across sustainability domains and policy stages.

While some of the SDG7 targets (e.g. energy access targets assessed by means of indicators accounting for household electrification and access to clean fuels for cooking) have largely been achieved in high-income countries (including in EU member states), the universality of the SDGs requires all countries to support those who are far from reaching these targets. The SDG7 targets on international cooperation call for a joint effort of the international community, in particular high-income countries, to assist developing countries for SDG7 to be achieved for all.

Here, we investigate policy coherence for SDG7 in Europe and the EU, and how this coherence is maintained or lost when it comes to international cooperation. Specifically, we examine whether (1) actions and progresses for SDG7 are coherent across European countries and EU member states, and (2) EU member states show a coherent behaviour in terms of international cooperation, foreign investments, knowledge transfer and other international aspects related to energy. To answer these questions, and following the approach proposed by Coscieme et al. (2021) for quantifying policy coherence, we evaluate the correlation across indicator values by means of principal component analysis (PCA) considering the SDG7 indicators used in the recent Eurostat monitoring report on progress towards the SDGs (Eurostat, 2020). As the Eurostat report includes only national

measures of energy sustainability, we use the indicators of SDG17 to assess international policy coherence, which, despite not focusing exclusively on energy, represent the most accurate picture of development assistance, financing and trade with developing countries across Europe in the context of the SDGs. In addition, we considered indicators of foreign financial support for climate action and foreign investments in the energy sector from further databases to provide a focus on international cooperation and foreign investments specific to the energy sector. As some of these indicators refer to other SDGs, in particular to SDG13, this extends our assessment of policy coherence across some of the SDGs most strongly connected to SDG7 to further investigate the extent of cooperation with impact on energy systems.

2 Methods and data

2.1 Assessing policy coherence of the SDGs

Enhancing coherence between science and policy demands the definition of clear, unambiguous and measurable targets (Donohue et al., 2016, Coscieme et al., 2021). While the SDGs outline the multiple areas that define sustainable development, synergy and consistency amongst SDGs ultimately depend on how coherent or contradictory are policy targets that expound the goals. Achieving coherence across the goal-target chain is thus fundamental to allow the possibility of simultaneously meet all SDGs, minimising and overcoming all existing trade-offs.

If all targets are aligned, the overall SDGs can be considered coherent (Coscieme et al., 2021). For example, one target for SDG 13 'climate action' is to 'strengthen resilience and adaptive capacity to climate-related hazards and natural disasters…' (Target 13.5), while one target for SDG 15 'life on land' is to 'ensure the conservation, restoration and sustainable use of… ecosystems and their services' (Target 15.1). These targets align closely, as progress towards one will likely reflect progress towards the other. When targets are not aligned, the SDGs become increasingly less coherent. For example, another target (15.6) of SDG 15 is to 'promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources'. Progress towards this target could be made independently of the others, and even hinder progress towards them.

Following our previous works (Coscieme et al., 2020, 2021) and studies on interactions between the SDGs (Lu et al., 2015; Le Blanc, 2015; Scherer et al., 2018; Nilsson et al., 2016), it is possible to assess the level of coherence across targets by considering relationships between their respective indicators. In particular, the prevalence of potential trade-offs amongst targets can be quantified by the proportion of pairwise correlations between indicators that are significantly negative, after accounting for the directionality of the indicators (that is, whether an increase or decrease in their value indicates progress towards targets).

2.2 EU SDG indicators

Since 2017, progress towards the SDGs in the EU has been monitored by the EU statistical office Eurostat. The Eurostat SDG monitoring reports (Eurostat, 2020), published annually, are based on a set of 100 indicators adopted in 2017 by the European Statistical System

Committee and reviewed periodically. Progress towards SDG7 is assessed with regard to sub-themes, namely 'energy consumption', 'energy supply' and 'access to affordable energy' by means of seven indicators related directly to SDG7, plus one multipurpose indicator related to SDG13 on 'climate action', but considered relevant for progress towards SDG7 targets (Table 1). While the sub-themes recall the Agenda 2030 targets for SDG7, they miss out on targets for international cooperation and support for developing countries. To fill this gap, we relied firstly on indicators for SDG17 'partnership for the goals'. Eurostat reports on progress towards SDG17 using five indicators under two sub-themes: 'global partnership' and 'financial governance within the EU'. As we consider SDG17 indicators as proxies for international cooperation in the energy sector, we considered only the three indicators under the sub-theme 'global partnership' (Table 1). Indicator values are reported in a time series for all EU member states, plus Iceland, Norway, Switzerland and the United Kingdom. Indicator values are disaggregated, where relevant, by income, sex, age or other characteristics. We extracted the most recent available value (all data between 2018-2019) per indicator per country in the most suitable unit for cross-country comparison (Table 1). This returned a total of eight indicator values per country for SDG7, and three indicator values per country for SDG17, for a total of 30 countries (Table S1).

2.3 Indicators of international cooperation and investment for achieving SDG7

The EU SDG indicators do not include aspects of international investment and cooperation with regard to SDG7 (including indicators for Target 7.a and 7.b from the global indicator set adopted by the United Nations Statistical Commission – UNSC – in March 2017). In addition, the EU SDG17 indicators, despite measuring development assistance and trade with developing countries, are not specific to the energy sector. For these reasons, to assess policy coherence on international aspects of SDG7 across the EU, we relied on further indicators of international cooperation with regard to the energy sector, available across countries. For this, we used two groups of indicators: indicators of (1) Financial support to the United Nations Framework Convention on Climate Change (UNFCCC); and (2) foreign direct investments (net outwards) in the energy sector (Table 3). Together, these groups of indicators consider both key aspects of SDG7, i.e. clean energy, and access to energy, also considering relevant synergies and trade-offs between SDG7 and SDG13. The first group include four indicators on financial support to developing countries for clean energy research and development, and investments in energy efficiency. Each indicator refers to a specific allocation channel (data available from https://www4.unfccc.int/ - last accessed 31 March 2020; Table 2). The second group of indicators include net outward foreign direct investments to different industrial sectors for groups of energy sources as reported to the OECD (data from: stats.oecd.org; last accessed 25 June 2020). For these two groups of indicators, we were able to collect data for 10 EU countries between 2017 and 2018 (Table S1). Despite not covering the full diversity across EU member states and their coherence in international investment and cooperation, the data for these countries were nonetheless sufficiently extensive to provide informative results. Even though it also considers investment in non-renewable energy sources such as fossil fuels, this dataset (Table 2) has a strong focus on energy indicators related to climate action. As well as complementing the EU SDG7 indicators in the Eurostat report, it covers aspects of selected EU countries roles in influencing energy access and energy sustainability/unsustainability outside EU borders.

Table 1 Indicators used for policy coherence assessment across European countries and EU member states under SDGs 7 and 17

SDG	Indicator	Unit of measure
7	**Energy consumption**	
	Primary energy consumption	Tonnes of oil equivalent (TOE) per capita
	Final energy consumption	Tonnes of oil equivalent (TOE) per capita
	Final energy consumption in households per capita	kg of oil equivalent
	Energy productivity	Purchasing power standard (PPS) per kg of oil equivalent
	Greenhouse gas emissions intensity of energy consumption	Index (2000 = 100)
	Energy supply	
	Share of renewable energy in gross final energy consumption	% (all sectors)
	Energy import dependency	% of imports in total energy consumption (all products)
	Access to affordable energy	
	Population unable to keep home adequately warm	% of population (total)
17	**Global partnership**	
	Official development assistance	% of gross national income (GNI)
	EU financing to developing countries by financing source (total)	Million EUR (current prices)
	EU imports from least developed countries	Million EUR

Table 2 Indicators used to assess coherence in international cooperation and foreign investments in the energy sector across EU member states. All indicators are expressed as % of gross domestic product (GDP)

Indicator
Financial support to UNFCCC
Multilateral climate change funds
Multilateral financial institutions, including regional development banks
Other multilateral climate change funds
Specialized United Nations bodies
Foreign direct investments (net outwards)
Electricity, gas, steam and air conditioning supply
Extraction of crude petroleum and natural gas, mining support service activities
Manufacture of coke and refined petroleum products

Overall, while the first group of indicators focus on international cooperation and environmental sustainability, the second group is intended to track investments which are relevant for energy access.

2.4 Principal component analysis (PCA) as a tool for policy coherence assessment

Principal component analysis (PCA) is a method used to reduce data dimensionality while conserving variation (Rignér, 2008; Pearson, 1901). Depending on the data structure, the first principal component (PC1) represents groups of correlated elements which retain a substantial amount of the total variance within the dataset. Here, we performed a PCA on cross-country indicator values to assess how much of the total variance in the data is retained by just a group, or a few groups, of related indicators. As policy coherence can be understood as multiple policies and their monitoring indicators progressing at the same time towards their respective targets (Coscieme et al., 2021), the variance retained by PC1 is indicative of coherence in observed impacts on indicator values across countries.

We performed five distinct PCAs. The first two PCAs were performed on the EU SDG7 and SDG17 indicators (Table 1) by considering 30 European countries with available data. In order to ensure consistency in cross-country comparisons across the indicator sets, the other PCAs, which include indicators of international cooperation and investment with limited data, were performed on a group of 10 EU countries (Table S1). The latter analysis includes EU SDG7 indicators and, separately, indicators of financial support to UNFCCC and foreign investments (Table 2), providing for a comparative assessment of levels of internal and external (international) coherence in the EU. To account for the different numbers of indicators for SDGs 7 and 17, and the two groups of indicators of international cooperation and investment, we calculated the relative coherence of indicators within each group as the log response ratio (LRR) of observed proportional variance accounted for by PC1 relative to the variance expected if there was zero coherence amongst indicators (calculated as 1/[number of contributing indicators]). Higher LRRs correspond to greater coherence. It is important to note that while this analysis does not provide any insight on the level of achievement of policy goals, it does quantitatively assess coherence across indicator values. Analyses were done using the *factoextra* package in R (version 3.4.3; Kassambara & Mundt, 2020), which include data normalisation and a multiple imputation method for modelling missing values (23 over 400 data points across all indicators).

Table 3 Pearson's correlation coefficient (r) between EU SDG7 indicators for 30 European countries (significant values in bold, $^{*}P \leq 0.05$, $^{**}P \leq 0.01$, $^{***}P \leq 0.001$)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	Primary energy consumption		**0.95*****	**0.83*****	**−0.43***	**0.57****	−0.12	**−0.35***	**−0.55****
(2)	Final energy consumption			**0.86*****	−0.28	**0.50****	−0.11	**−0.40***	**−0.43***
(3)	Final energy consumption in households per capita				−0.25	**0.65*****	−0.28	**−0.57*****	**−0.43***
(4)	Energy productivity					−0.30	<0.1	<0.1	0.31
(5)	Renewable energy sources						**−0.61*****	−0.21	**−0.38***
(6)	Energy import dependency							0.22	<0.1
(7)	Population unable to keep home adequately warm								**0.42***
(8)	Greenhouse gas emissions intensity of energy consumption								

3 Results and discussion

3.1 Correlations across SDG7 indicators in Europe

We performed a first PCA for the EU SDG7 indicators (Table 1) to assess internal policy coherence for 'access to affordable and clean energy'. Significant both positive and negative correlations characterise SDG7 indicator values for the 30 European countries investigated (Table 3). Primary and final energy consumption are related positively, both reflecting energy demand, the latter excluding energy consumption of the energy sector itself and losses occurring during transformation and distribution. Final energy consumption in households per capita is inversely related with the share of population unable to keep home adequately warm.

All the indicators of energy consumption correlate positively with the share of renewable energy in gross final energy consumption. The share of renewables is also correlated negatively with energy import dependency. These results suggest that countries with higher share of renewables tend to consume more (and vice-versa) and are more likely to be self-sufficient in terms of energy. This might be indicative of proactive efforts, by high-energy consumption countries in Europe (e.g. Norway, Iceland, Finland, Sweden and Denmark) to reduce their carbon footprint. Trends in consumption might also reflect energy prices or even differences in consumer behaviours between countries with high or low share of renewables.

Though higher consumption in high-income countries is out of line with the principles of Sustainable Development, increased share of renewable energy sources in these countries implies reduced contributions to climate change as well as imports of energy from non-renewable sources, reducing in turn the severity of environmental spillovers to other countries.

Energy consumption correlates negatively with greenhouse gas emissions intensity (Table 3). As the latter is measured as an index tracking change from 2000 as a reference year, this result implies that countries that managed to reduce their greenhouse gas emissions intensity are the ones with higher energy consumption levels. This correlation might point to the occurrence of rebound effects, with decreasing intensity leading to increasing consumptions (Coscieme et al., 2019), or it might result from implementing shorter-term targets with regards to greenhouse gas intensity as a response to high consumption levels. As SDG targets require reductions in energy consumption in the EU by 2030, while at the same time reducing greenhouse gas energy intensity, this result suggests that technological improvements in terms of greenhouse gas intensity are a necessary, though not sufficient, condition for achieving decoupling of economic development from increasing use of environmental resources and, ultimately, SDG7 (and SDG13) targets.

Despite consistent improvements from 2017 to 2020, the EU is not on track to meet its 2030 energy consumption targets for SDG7 (Eurostat, 2020). Energy imports (of crude oil, natural gas and hard coal) have been expanding since 2002, constituting a negative trend towards the respective SDG7 target. In general, European countries show positive trends for all the other SDG7 indicators. However, there are substantial differences across countries. For example, the share of renewable energy in gross final energy consumption varies from around 70% for Iceland and Norway, to 50% for Sweden, to 30% for Austria, to less than 20% for Italy and less than 10% for the Netherlands (Eurostat, 2020).

3.2 Internal and external policy coherence for SDG7

After normalising by the number of indicators, we found higher coherence amongst SDG7 indicators than amongst those for SDG17 (Fig. 1a). This highlights a less coherent (i.e. more heterogeneous) behaviour across countries with regards to development assistance, financing to, and imports from developing countries, when compared to internal energy policy. In other words, while European countries generally perform in accordance with each other on local targets for SDG7, they perform very differently when it comes to partnerships for the SDGs with developing countries.

By restricting the analysis to the 10 EU countries for which data were available across further indicators, we also found a higher level of coherence across EU SDG7 indicators than across indicators of financial support to UNFCCC and foreign investments (Fig 1b). These results confirm what we observe for coherence across SDG7 and SDG17 in all the European countries, which highlights that when we consider indicators more directly related to the energy sector, there is a low level of coherence between countries in relation to international cooperation and foreign investments. The higher coherence characterising EU countries contributions to UNFCCC, compared to other measures of international coherence (including coherence on SDG17 for a larger group of countries) is, however, notable, and approximates the observed values of domestic coherence for SDG7.

While it is not surprising to observe higher coherence across indicators and actions within a common framework, as opposed to indicators reflecting a broader range of different actors investing in different sectors, our results illustrate the positive effect of such

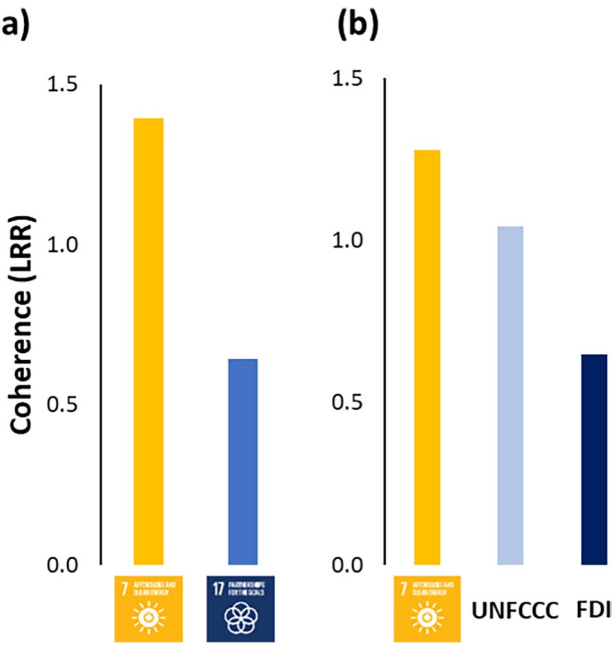

Fig. 1 The relative coherence of indicators within **a** SDG7 and SDG17 (30 European countries), and **b** SDG7, financial support to UNFCCC and foreign investments in the energy sector (FDI) (10 EU countries), measured as the log response ratio (LRR) of observed proportional variance accounted for by PC1 relative to the variance expected if there was zero coherence amongst indicators.

policy frameworks and the need to rely more extensively on new means for governing and improving international policy coherence with regard to business and investments in the energy sector. The trade-offs found amongst SDG7 indicators need to be addressed and synergies need to be highlighted, mainstreamed and achieved as a matter of urgency. For example, our results show how progress towards targets on renewables links with progress on energy security and energy access. As a consequence, international cooperation for renewable energy can be instrumental for providing access to energy and reduce import dependencies in developing countries. Overall, our results give important insights on which aspects should be central in monitoring frameworks for international cooperation for access to energy.

3.3 Enhancing international policy coherence for SDG7

Our results (Fig. 1) indicate that international policy coherence could be enhanced by developing a common framework and indicators for assessing international cooperation for access to energy. To facilitate implementation, such a framework could be built from existing indicators from the reference list compiled by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs), which constitutes a practical starting point for monitoring and reporting on the SDGs (as agreed at the 47th session of the UN Statistical Commission in March 2016). To illustrate this, we selected from this list indicators with high relevance for energy access, by considering the global scale of energy supply chains and recognising how aspects important for achieving SDGs at the local scale play a role in enabling or hampering the achievement of SDG7 in developing countries (Table S2). In addition to the indicators specific for SDG7 and SDG17, we included indicators which measure economic growth and levels of consumption. We also included indicators of international support for developing clean infrastructures directly referred to in SDG9, as well as indicators from SDG13 and SDG15, recognising the climate change mitigation potential of clean energy sources and the fact that energy extraction is a major source of deforestation and vegetation loss.

Even though there is a lack of formal tracking and cross-country data, we have identified highly relevant EU contribution in international cooperation on SDG7. Notable examples include the Africa-EU Energy Partnership (European Commission, 2018), a long-term framework for strategic dialogue aimed at sharing knowledge, setting political priorities and developing joint programmes on key energy issues. The EU Horizon 2020 Research and Innovation Program has also supported multiple initiatives targeted at EU-Africa research and innovation partnership on renewable energy (e.g. the PRE-LEAP-RE project - http://www.leap-re.eu/). The majority of initiatives are however conducted bilaterally, as part of development cooperation with target countries, or working through intermediaries such as development banks. Examples include the Power Africa Initiative (led by the USA and supported by European countries including Sweden, Norway, UK and France – USAID and EU, 2015), the Modern Energy Cooking Services Program (supported by the UK government - https://mecs.org.uk/) and the recent EU International Investment Plan (European Commission, 2020), a €216 million guarantee agreement that is expected to unlock €2 billion to invest in renewables, urban infrastructure and start-ups in Africa and neighbouring countries (by the European Bank for Reconstruction and Development - EBRD, the European Investment Bank - EIB, the German KfW Group and the Spanish Development Cooperation Agency).

SDG17 further includes indicators in other sectors that are important for SDG7 as they assess, for example, to what extent European and other higher income countries support rationalized fossil-fuel subsidies (12.c.1), conservation and sustainable use of terrestrial ecosystems (15.1), sustainable buildings and industries (9.a.1) and global resource efficiency in consumption and production (8.4), which impact on global biophysical cycles and climate change, affecting developing countries possibilities for improving energy access, energy efficiency and uptake of renewable energy. The EU's contribution and support towards initiatives in relation to these other sectors should therefore be considered and tracked as part of its contribution to SDG7.

The current reporting from the Custodian Agencies of SDG7 (World Bank, IEA and IRENA) do not disaggregate support at the country scale. Consequently, tracking of countries' progress in cooperation and investments for energy access is not possible, representing a missed opportunity for fostering further initiatives and highlight best practices and successful policies. We stress that disaggregation of international cooperation data is a crucial step for including these aspects in cross-country reports such as the Eurostat report on SDG progress, which undergoes regular reviews and consultations with policymakers and experts of National Statistical Offices in the EU Member States. Formalising these indicators would improve accountability for energy access targets, while at the same time highlighting positive trends to accelerate progress towards achieving the SDGs.

4 Conclusions

While sustainable development occurs when economic, social and environmental goals are simultaneously met, different policy approaches to sustainability have tended to generate trade-offs and inconsistencies which are part of the reason why many sustainability goals, such as for example the SDGs, are not globally achieved. Focusing on energy targets, to simultaneously progress at the local and the global scale, there is a need for integrated frameworks and tools for assessing policy coherence. To harmonise domestic and international energy policies, frameworks centred on common policy goals, such as the UNFCCC, are of great importance. Such frameworks should, however, be further improved to more effectively encourage precautionary and responsible actions in foreign investments and international cooperation. This entails pursuing increasing energy access in developing countries and societal groups that do not achieve minimum consumption levels without generating trade-offs with climate mitigation international targets.

In Europe, domestic and international energy policies are often misaligned. For example, policies to favour renewable energy use are in place in the local national contexts, while public international investments on non-renewables are prominent. Considering EU countries, the share of renewables in the national energy mix positively correlates with reduced import dependency and could then likely lead to more stable and resilient economies. In the current context of instabilities in energy supplies, the positive correlation observed between renewable share in the energy mix and reduced import dependency represents an important co-benefit of climate mitigation policies based on expanding renewable sources. These domestic policies could have a potential international impact by mitigating current spikes in energy prices that are further hampering developing countries to meet basic energy needs. Furthermore, the positive correlation of reduced intensities and high-energy consumption levels signals the need for integrated efforts on energy efficiency and energy savings for allowing to meet sufficiency levels of consumption while reducing carbon emissions. Such efforts would potentially increase coherence across domestic EU market interventions for reduced energy demand and international climate targets.

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Data availability The data used in this study are available from Eurostat SDG indicators (https://ec.europa.eu/eurostat/web/sdi/indicators - last accessed 6 July 2021), UNFCCC Climate Finance Data Portal (https://www4.unfccc.int/ - last accessed 31 March 2020), and OECD.Stat (https://stats.oecd.org/ - last accessed 6 July 2021). Further information on the data used is included in the supplementary information files.

Author contribution LC and CAO designed the study aims and research question. LC and ID designed the methodology. LC, CAO, CS and ID contributed in writing and reviewing the manuscript.

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Declarations

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