



PAYNE INSTITUTE COMMENTARY SERIES: VIEWPOINT

ENERGY EFFICIENCY AND THE SUSTAINABLE DEVELOPMENT GOALS

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August, 2018

Introducing the “golden thread”

The United Nations Sustainable Development Goals (SDGs) were adopted in September 2015. They significantly broaden the areas covered by the Millennium Development Goals (MDGs) and give an official recognition of the central role of energy as an enabler for development. This role has been summarized by the then-Secretary General Ban Ki-moon who would describe energy as “the golden thread that connects economic growth, environmental health, social fairness and opportunity”¹. By doing so, he not only highlighted on the key role of energy, but also gave some general hints on how what would become SDG 7 (dedicated to energy) would relate to other key SDGs such as the ones on Decent Work and Economic Growth (SDG 8), Good Health and Well-Being (SDG 3), and No Poverty (SDG 1). In addition, Ban Ki-moon would also refer to the three targets of Sustainable Energy for All (SE4All) then headed by the Special Representative of the Secretary General of the UN, Dr. Kandeh K. Yumkella. These targets were to become the basis of SDG 7 and would cover Renewable Energy, Energy Efficiency and Energy Access.

Having Energy Efficiency mentioned in the SDGs is another great achievement. Energy efficiency is often referred to as the “hidden fuel” or “first fuel”². It is defined as using less energy to provide the same service or using the same amount of energy to produce more. One of its major benefits is to limit the waste of energy and it can be a means to save energy. But energy efficiency does much more than that: the International Energy Agency (IEA) has highlighted the multiple benefits of energy efficiency in a landmark report published in 2014 but limited its focus on benefits in IEA member economies and did not linked it to developing countries issues (nor, obviously, to the SDGs that were adopted a year after the publication came out)³.

At the same time, work on the connections between SDGs have recognized that promoting energy efficiency benefit number of other SDGs. This is not the case for all SDG7 targets. For instance, improving energy access can require the use of fossil fuel and can have a negative impact on greenhouse gas emission, and as such

¹ “UN Secretary General Ban Ki-moon addresses World Energy Congress”, worldenergy.org, 17 October 2013.

² “From hidden fuel to world’s first fuel?”, IEA Newsroom, 16 October 2013.

³ IEA (2014) *Capturing the Multiple Benefits of Energy Efficiency*, IEA: Paris, 232 pp.

contradict objectives of SDG 13 on Climate Change. On the opposite, there is a growing recognition that “the energy efficiency target [of doubling the rate of improvement of energy efficiency] is a ‘win-win’ strategy on essentially all accounts”⁴. This highlights the importance of energy efficiency, especially as Goal 7 is recognized as being on the most synergistic with the other SDGs. The World Bank has developed a methodology that help prioritizing the SDGs, based on the interactions between the different goals⁵.

This paper aims at identifying these ‘win-win’ situations where energy efficiency can significantly help achieving other SDGs. It consists in a quick overview of these potential interactions, and will remain mostly at a theoretical level, with the objective to generate further research that would support policy decisions and allocate more resources to the promotion of energy efficiency policies.

Understanding the interactions between the SDGs

Academics, think tanks and other stakeholders have produced a number of analyses on how the SDGs can articulate. Some of these works focus on one sector. As an example, figure 1 reproduces the so-called “wedding cake” developed by the Stockholm Resilience Center, used to highlight the importance of SDGs for food security. Other examples include an important report published by the International Council for Science. The interactions identified there are reproduced in Figure 2 and we will further elaborate on them⁶. Other analyses focus on regions or even one country, stressing the importance of local conditions in SDGs implementation⁷. Some approaches would even combine the two⁸.

⁴ See for instance the International Council for Science (ICSU) (2017) *A Guide to SDG Interactions from Science to Implementation* [D.J. Griggs, M. Nilsson, A. Stevance, D. MacCollum (eds)], Paris: International Council for Science, p 130.

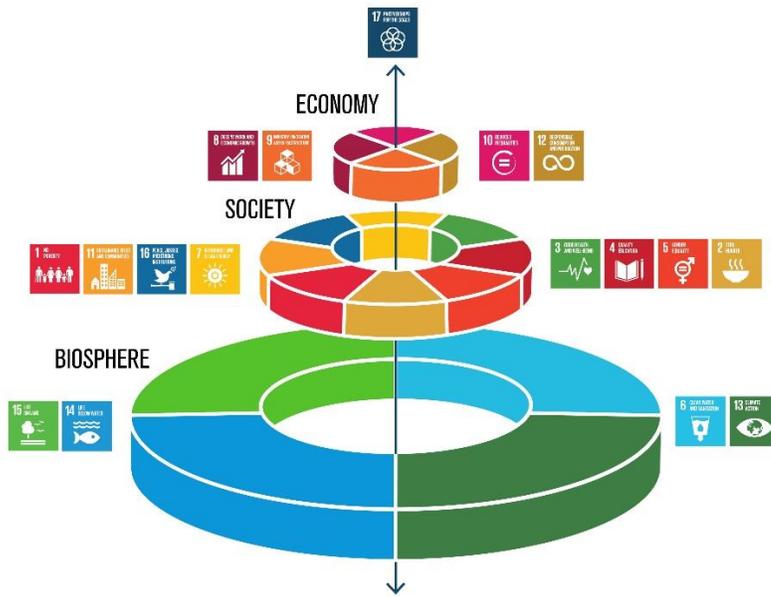
⁵ El-Magharbi M. H., Gable S., Osorio Rodarte I., Verbeek J. (2018) “Sustainable Development Goals Diagnostics. An Application of Network Theory and Complexity Measures to Set Country Priorities”, World Bank Group, Policy Research Working Papers 841, 22 pp.

⁶ ICSU. (2017), *op. cit.*

⁷ Mainali, B.; Luukkanen, J.; Silveira, S.; Kaivo-oja, J. (2018) “Evaluating Synergies and Trade-Offs among Sustainable Development Goals (SDGs): Explorative Analyses of Development Paths in South Asia and Sub-Saharan Africa”, *Sustainability*, 10, 815

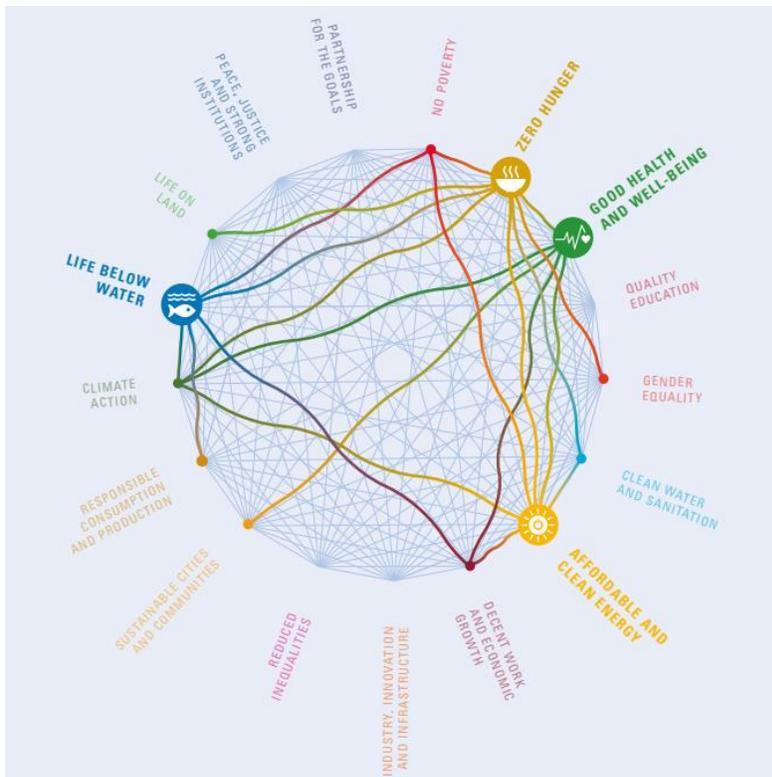
⁸ Sturesson A., Standley S. (2018) “What have we learned applying the SDG interactions framework?”, UNDP Asia and the Pacific, *Our Perspective*, 3, 22 and United Nations Issue-Based Coalition on Gender Equality (2018) *Gender Equality: a Key SDG Accelerator. A Case Study from the Republic of Moldova*, United Nations Development Group, 12 pp.

Figure 1. “The Wedding Cake” SDG connections to food, according to the Stockholm Resilience Centre



Source: Rockström J., Sukhdev P. (2016), How food connects all the SDGs, Stockholm Resilience Centre

Figure 2. SDG interactions according to the International Council for Science



Source: ICSU (2017), op. cit.

Addressing all SDGs require some prioritization. Some policy-makers reckon that they do not have the resources to address all the sectors covered by the goals and have to prioritize some of them and leave others aside for now. Some also argue that SDGs have complex relations between each other: sometimes a goal or target reinforces another one, sometimes it cancels it. These interactions may also change in the time, because of the evolution of various factors (changes in the availability and/or price of goods, for instance). In order to enhance the understanding of the policies promoting the SDGs, the authors of a report from the International Council for Science have set up a matrix that enables an analysis of the interactions between different SDGs. Researchers created a scale, with scoring helping to understand the interactions, as summarized in table 1⁹. The same researchers tried to map the interactions between a selected number of SDGs.

Table 1. Summary of SDG Goal Scoring¹⁰

Interaction	Name
+3	Indivisible
+2	Reinforcing
+1	Enabling
0	Consistent
- 1	Constraining
- 2	Counteracting
- 3	Cancelling

SDG 7 is part of the analysis and this report, given its depth, the robustness of its findings and wide coverage, can be considered as a major achievement. However, the report somehow fails to identify some important benefits of energy efficiency. For instance, energy efficiency is considered along with renewable energy as being “consistent” or “constraining” to Goal 1’s target 4 on access to economic resources¹¹. The report states that “Decarbonizing the energy system through renewables and efficiency is consistent with the provision of basic energy services as long as policies help to shield the poor from any fuel price increases that may result. Lacking such policies, 7.2 and 7.3 could constrain the options for achieving 1.4”¹². While energy efficiency measures require important upfront investment, they normally allow for a reduction of energy consumption and as such they lighten the burden of energy cost in household spending. Energy efficiency is indeed a major tool to reduce energy poverty and promote more affordable housing and we would suggest to consider it as “reinforcing” (grade +2) rather than “consistent” or “constraining” (see paragraph below for further analysis on the links between energy efficiency and SDG1).

Fuel for development

This section will now highlight interactions between energy efficiency and SDGs 1, 2 and 4. These SDGs have been selected in an empirical way, and two main reasons have motivated this choice: 1) the interactions of these SDGs with energy efficiency have been neglected by most of the literature dedicated to the SDGs (though these links are addressed in some works conducted on energy efficiency). We purposely left aside SDGs with more obvious links to energy efficiency, such as SDGs 6 (Clean Water and Sanitation), 9 (Industry, Innovation

⁹ ICSU (2017), *op. cit.* pp. 18 – 31.

¹⁰ *Ibid.*

¹¹ SDG 1.4 states as a target : “By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance” and with two indicators, namely: “Proportion of population living in households with access to basic services” (1.4.1) and “Proportion of total adult population with secure tenure rights to land, with legally recognized documentation and who perceive their rights to land as secure, by sex and by type of tenure” (1.4.2).

¹² ICSU (2017), *op. cit.*, p. 137.

and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production) or 13 (Climate Action). And 2) energy efficiency is able to significantly support policy efforts to achieve these targets. Further should be conducted on the links between energy efficiency and other SDGs.

Most of the following paragraphs use two seminal reports as a basis. On one hand, the report on SDG interactions commissioned by the International Council for Science (ICSU, 2017) which we already quoted several times in this paper. On the other hand, IEA (2014) on the multiple benefits of energy efficiency. We cross these reports between each other and add other elements to complement the analysis.

SDG 1. Poverty

As mentioned above, energy efficiency requires important upfront investments – therefore, it suffers from the reputation of being costly and does not appear as an obvious tool for the fight against poverty. However, energy efficiency is key to address both the lack of energy access and fuel poverty. As for energy access, World Bank's ESMAP shows that energy efficiency has a positive effect on the peak capacity, the duration of service, the evening supply and the affordability of energy¹³. As such, it is indispensable to ensure electricity for basic goods such as lighting, fridges or others.

But energy efficiency also matters for people already connected to the grid but suffering from fuel poverty. Fuel poverty is defined as “a situation where individuals of households are not able to adequately heat or provide other required energy services in their homes at affordable costs”¹⁴. It is reached when an energy bill represents more than 10% of the annual income of a household¹⁵. The importance of fuel poverty is difficult to measure. However, it should not be underestimated as even in industrialised economies: in the European Union alone, fuel poverty is said to affect between 60 and 150 million people¹⁶.

According to a survey conducted in multifamily affordable housings in several states of the USA, energy efficiency programs can cut electricity usage by 32% and natural gas by 24%¹⁷. This survey was commissioned by the Energy Efficiency for All (EEFA) program, which is dedicated to improve the affordability of housing to low-income families, by promoting energy efficiency investments in order to achieve “energy saving, lower energy bills, more stable rental payments, reduced pollution, and a better quality of life for residents”¹⁸.

SDG 3. Good Health and Well-Being

A strong relation exists between energy efficiency and health and well-being. Indeed, energy efficiency can have an indirect but important impact (positive, but also sometimes negative) on different emissions that affect air quality. However, ICSU (2017) link indoor air quality to SDG7 target 1 (on energy access) and not with energy efficiency¹⁹.

Energy efficient heating and cooling systems improve the well-being of people, by adjusting temperatures, for instance in dwellings. Temperature regulation has also an impact on health, for instance by mitigating the effect of extreme weathers in-door, or by providing bedrooms with a temperature appropriate to sleep. The

¹³ Angelou N. (2014) *A New Multi-tier Approach to Measuring Energy Access*, ESMAP (Energy Sector Management Assistance Program), 34 pp.

¹⁴ Pye S., Dobbins A. *et al.* (2015), *Energy Poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures*, Insight Energy; and Energie-Control Austria (2013), *Energy Poverty in Austria, Definitions and Indicators*.

¹⁵ IEA (2014) *Capturing the Multiple Benefits of Energy Efficiency*, *op. cit.* p. 98.

¹⁶ *Ibid.*, as well Pye S., Dobbins A. *et al.* (2015) *op. cit.* The difference can probably be explained by the differences on how fuel poverty is defined and therefore calculated.

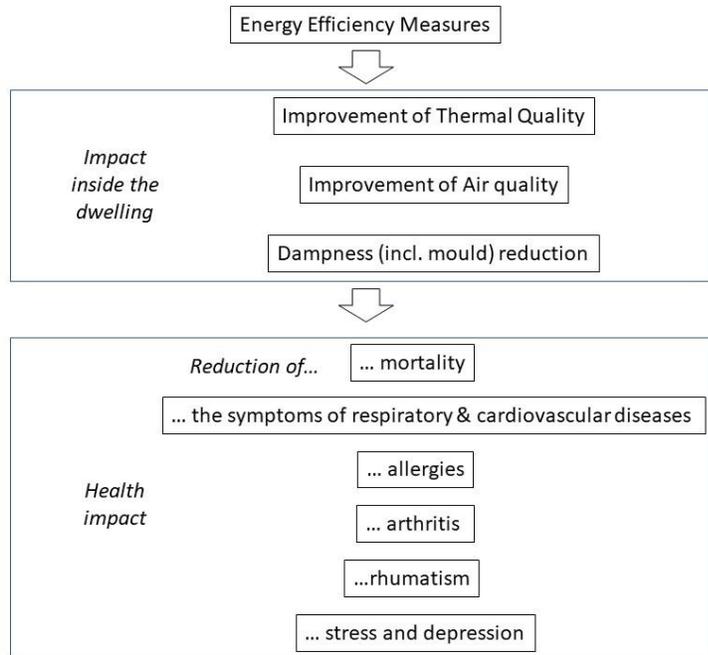
¹⁷ Optimal Energy (2015) *Potential for Energy Savings in Affordable Multifamily Housing*, NRDC and Energy Efficiency for All, May, 128 pp.

¹⁸ The program is financed by Elevate Energy, the Energy Foundation, the JPB Foundation, the National Housing Trust and the Natural Resources Defense Council and was established in . See www.energyefficiencyforall.org. The quote is taken from <http://www.energyefficiencyforall.org/about-eeefa/project-objectives> (last retrieved on 29 June 2018).

¹⁹ P. 146.

importance of these heating and (especially) cooling systems is likely to grow in the coming years, as the climate changes, and is poised to lead to important temperature increases in most of the regions of the world²⁰. IEA (2014) findings on this topic have been summarized in Figure 3. Energy efficiency measures can improve insulation, addressing leaky windows issues and by doing so preventing cold drafts and avoiding indoor extreme temperatures. In addition, energy efficiency can also improve the sealing of building envelopes which in return will prevent pests and moisture infiltration and avoid mold growth and the introduction of allergens and diseases. As such, energy efficiency can reduce and mitigate health issues related to asthma and other respiratory illness, as for instance obstructive pulmonary disease and bronchitis. Energy efficiency can also bring benefits to people suffering from cardiovascular and mental health issues²¹. By addressing energy access and fuel poverty issues, energy efficiency also improves mental well-being and addresses some mental disorders linked to the stress of high energy bills and debts²². Finally, it should also be noted that energy efficiency can also help improve energy performance of hospitals, which are major energy consumers²³.

Figure 3. Energy efficiency measures’ impact on indoor air quality and health – a summary of the IEA’s analysis



Source: IEA (2014) *Capturing the Multiple Benefits of Energy Efficiency*, op. cit. pp. 97 - 119, adapted by the author

SDG 4. Education

Efficient lighting products, such as light-emitting diode (LED) extend the lifetime of a light-bulb and as such can help pupils studying when evenings are getting dark. But energy efficiency can also provide an appropriate

²⁰ IEA (2018) *The Future of Cooling. Opportunities for energy-efficient air conditioning*, Paris: IEA, 92 pp.

²¹ Denson R., Hayes S. (2018) “The Next Nexus: Exemplary Programs That Save Energy and Improve Health”, Washington DC: ACEEE, Report H1802, March, 40 pp.

²² IEA (2014), *Capturing the Multiple Benefits of Energy Efficiency*, op. cit., p. 100.

²³ Bonnema E., Studer D., Parker A., Pless S. and Torcellini P. (2010) *Large Hospital 50% Energy Savings: Technical Support Document*, Technical Report, National Renewable Energy Laboratory, September, 188 pp. and Carbon Trust () *Hospitals. Healthy budgets through energy efficiency*, London: Carbon Trust, 36 pp.

environment for children to study at school. For instance, ensuring proper heating is essential in regions with cold winter. In the early 2000s, concerns were raised about education in several Central Asia countries. In Kyrgyzstan, the Asian Development Bank estimate that, during the 1992 – 2000 period, 187 schools were built for 59,800 children, 92 schools renovated in the South and another 187 extensions were made to existing schools, to accommodate 25,700 additional children. However, some local governments in rural areas would not have the sufficient resources to bring heat to the schools on their jurisdictions. Though the impact of the lack of electricity and heat on learning in schools has not been documented in these regions, cold weather is likely to have had a significant and negative impact on the learning processes and school attendance²⁴.

Conclusion

This paper has outlined some obvious but often overlooked links between energy efficiency and the SDGs. It only focuses on three SDGs but in future research works, these links should be further analyzed and interactions with all other SDGs highlighted. However, a first conclusion is that energy efficiency is a key enabler for the SDGs. Energy efficiency should be a public policy and investment priority, as its benefits not only outgrow its costs, but also spread to the whole society.

²⁴ Huttova J., Silvova I., Voolma H. (2002) *Education Development in Kyrgyzstan, Tajikistan and Uzbekistan: Challenges and Ways Forward*, Budapest: Open Society, March.

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