

Sharing Inspiration Virtual Conference

STEM Education for a Sustainable World



Teachers Teaching with Technology™

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the flip side of the UN SDG's

1. Some overview of the evolution of the meaning of "sustainability"

2. Reasons, why I do see a Flip-side on the SDG's

3. How can you use my Appendices on the 17 SD goals for your STEM teaching?

- sustainability-

a today's buzzword, whose meaning evolved dramatically during the last decades

Hans Carl von Carlowitz



As the origin of the term goes back to the forestry sector, its meaning was, to only cut this much of wood, that the next generation can use again the same amount.
 Means: just use such much of resources, that natural life-cycles are able to restore within a timespan of one generation. Not specifically mentioned- but obvious- such an idea provides enough natural resources for everybody. No scarcity!
 Just to make you think: How could the Aboriginal culture survive the last 50'000 years?



The new concept includes the economic and social aspects. Environment is obviously not anymore considered to be the base of our livelihood - as it does not include all the other circles.
 And to me- this represents exactly our missing appreciation and ignorance towards nature- and maybe explains the fact, why big mining enterprises can do „green-washing“ with their commitment to some of the SDG's





February 10, 2021

Satellites flag deforestation from illegal gold mines in Amazon rainforest

Mining companies are increasingly under pressure from investors and other stakeholders

Gender inequality runs deep in mining

Gender equality is clearly a challenge for the mining industry. In mining companies and mining-affected communities, women are most often at a disadvantage compared to their male counterparts. Are companies

January 21, 2021

Tailings storage facilities still pose huge threat of harm, RMF says

As many as one-third of the current global portfolio of tailings storage facilities (TSFs) are impaired and in need of urgent intervention, according to the Switzerland-based Responsible Mining Foundation (RMF).

[Metal Bulletin](#)



Mining and the SDGs: how to address the materiality mismatch?

This Research Insight dives into the results found for three topics that have been on the list of "material" issues of most mining companies, shareholders, investors and lenders for years: Communities, Water and Gender. They all show a significant gap between what is being addressed

Jamaican government ramps up plans for deep-sea metals exploration

A moratorium on deep sea mining should be enforced until the process is fully researched and understood, the Responsible Mining Foundation said Nov. 10.

[S&P Global Platts](#)

Heritage lost to mining: a collective responsibility

Last month's destruction by Rio Tinto of a 46,000-year-old site in Australia's Juukan Gorge is part of a wider problem within the industry. The Foundation's RMI Report 2020 reveals that many mining companies are still

Mining and Water: Are operational concerns overriding public interest?

While companies' operational concerns about their water supply promote more regular reporting of water consumption levels, companies have largely neglected to publicly



Chile is the biggest exporter and extractor of Copper worldwide. In 2019- its estimated, that it has reserves left of about **200 Million tonnes**.

Chile is a country with very dry regions- most famous I guess is the Atacama desert- where it rains normally about 8mm-25mm per Year! But sometimes not at all. Never the less: in this region, they are running mines...



Space mining enthusiasts t funding

Lucia Jarman / Apr 18, 2021 10:0 am Battery Street Education Escape News Site
New Global Center Designed with 3D-printed House Stone

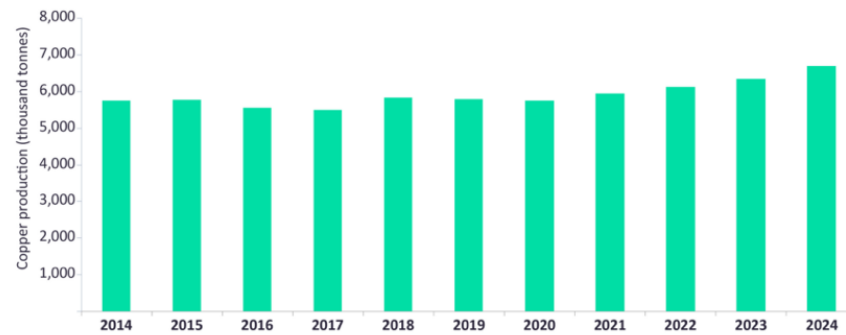


NASA outlined in 2019 its long-term approach to lunar exploration, with camp on the moon's south pole. (Image courtesy Scientists, economists and space mining enthusiasts are

Copper production in Chile to rise by 3.7% in 2021 — report

MINING.COM Staff Writer | April 12, 2021 | 9:29 am Top Companies Latin America Copper

 Chile copper production (kt), 2014-2024



Source: GlobalData Mining Intelligence Center

 GlobalData.

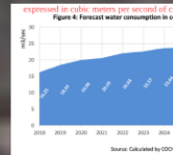
Copper price jumped last week as investors assessed the decision by Chile to close its borders during April due to a spike in covid-19 cases.

Copper for delivery in May was down 0.78% on Monday, with futures at \$4.0075 per pound (\$8,816 a tonne) on the Comex market in New York.

Quelle: <https://www.mining.com/copper-production-in-chile-to-rise-by-3-7-in-2021-report/> last accessed: 2021/04/13

In 2019, the sector produced 5.79 million tons of copper
--> reserves lasting for not more than 34 years...

a good amount is al
This means- you ha



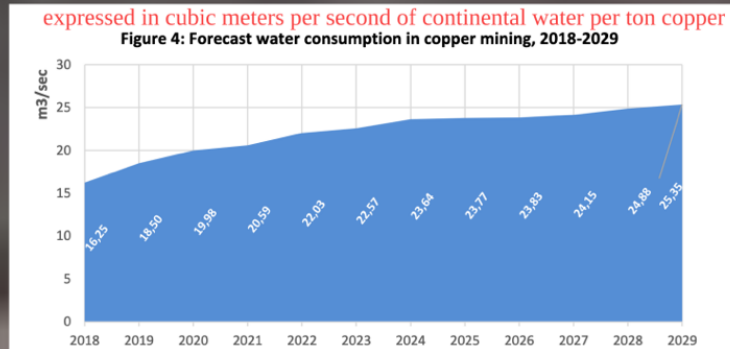
With a growth of 3.7
be doubled within 19

is this sustainable ? fo

Do an estimation:
how much copper can be gained from 1000 kg of earth?

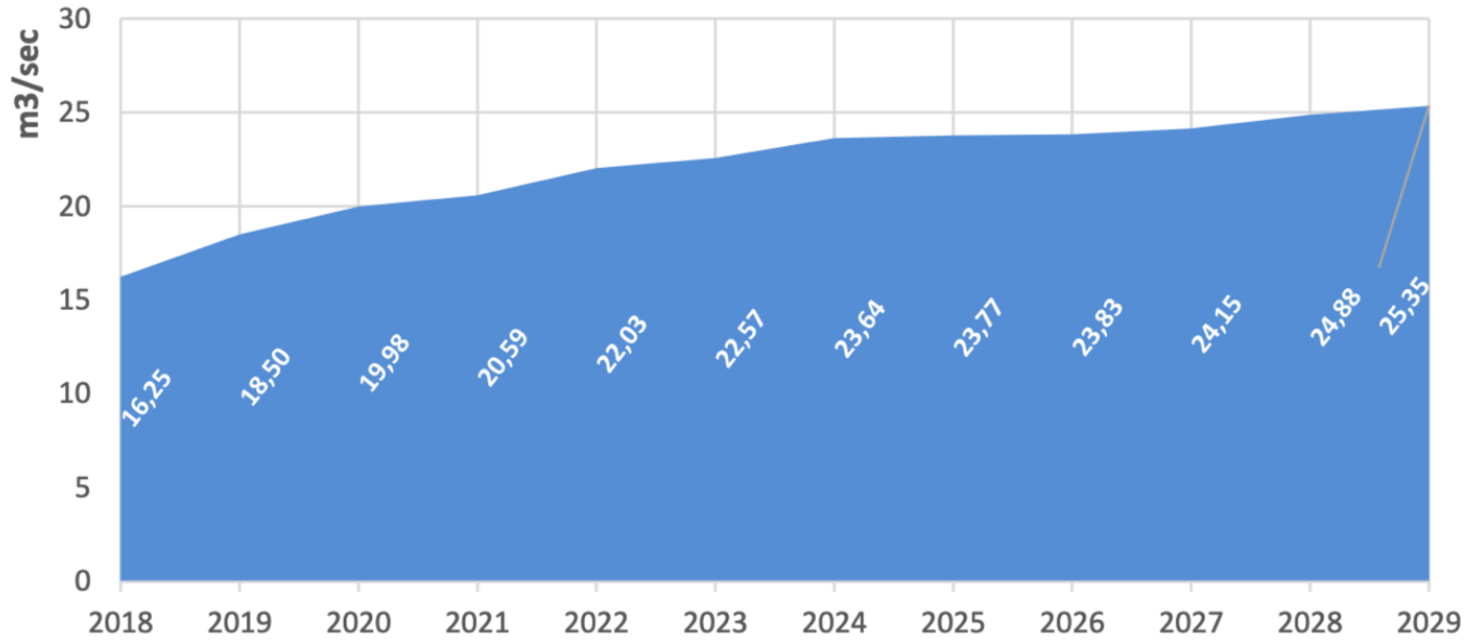
--> write it in the chat!

a good amount is already 33 gramms
This means- you have 999'967g of tailing (trash)



expressed in cubic meters per second of continental water per ton copper

Figure 4: Forecast water consumption in copper mining, 2018-2029



Source: Calculated by COCHILCO.

How much further do we want to push our ideas about production - and: is not the motivation for production-consumption ?

- Can production be „sustainable“ at all?
- Can consuming be „sustainable“ at all?

Space mining enthusiasts to discuss legal framework, funding

Cecilia Jamasmie | April 13, 2021 | 9:13 am Battery Metals Education Energy News Suppliers & Equipment Canada China Europe Russia and Central Asia Cobalt Copper Diamond Gold Lithium Nickel Silver



NASA outlined in 2019 its long-term approach to lunar exploration, which includes setting up a "base camp" on the moon's south pole. (Image courtesy of NASA.) --> **and where they will take the resources from? (CHB)**

Scientists, economists and space mining enthusiasts are [set to gather next week](#)

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Sign Up



the flip side of the UN SDG's

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Illustration: Seppo Leinosen

5g Gold-ring has a MIPS of 2000kg

--> This can vary a lot! --> depends on the mining site; the tendency is much more!



Leinosen

ing site; the tendency

I. Abiotic raw materials

- ▶ mineral raw materials (used extraction of raw materials, such as ores, sand, gravel, slate, granite)
- ▶ fossil energy carriers (amongst others coal, petroleum oil, petroleum gas) unused extraction (overburden, gangue etc.)
- ▶ soil excavation (e.g. excavation of earth or sediment)

II. Biotic raw material

- ▶ plant biomass from cultivation
- ▶ biomass from uncultivated areas (plants, animals etc.)

(Domesticated animals are already part of the technosphere, and are therefore referred back to biomass taken directly from nature, e.g. plant or animal fodder.)

III. Earth movement in agriculture and silviculture

- ▶ mechanical earth movement or
- ▶ erosion

IV. Water

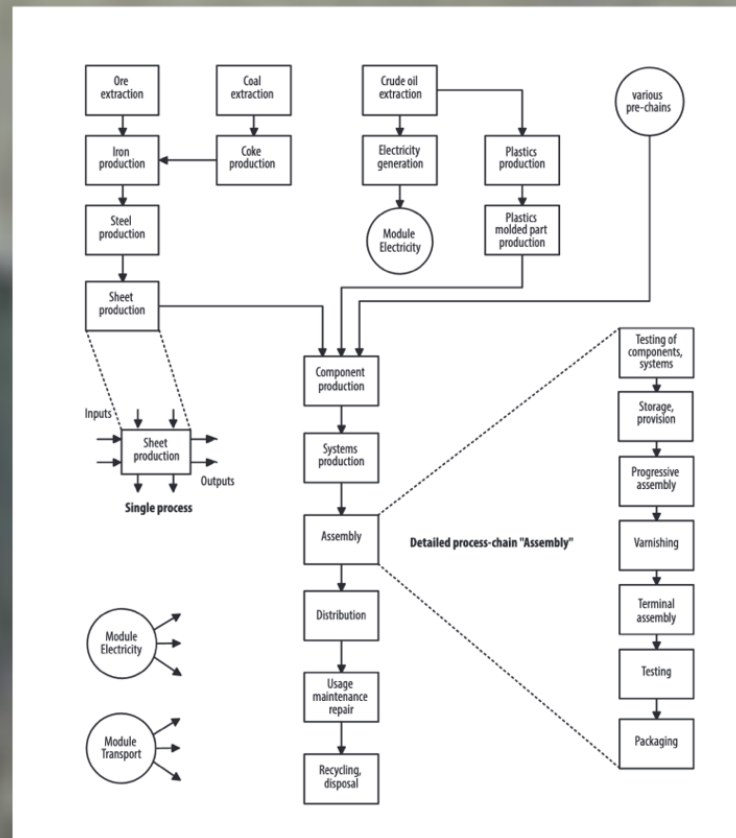
(separated according to processing and cooling water)

- ▶ surface water
- ▶ ground water
- ▶ deep ground water (subterranean)

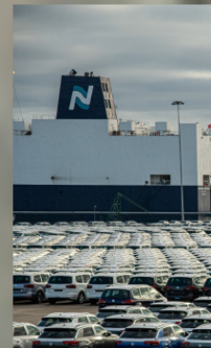
V. Air

- ▶ combustion
- ▶ chemical transformation
- ▶ physical transformation (aggregate state)

whole history of a Product! Production, Transport, Disposal



name Name	specification Spezifikation	Material intensity [kg]		
		basic material Grundstoffe	basic material Grundstoffe	value Wasser
Construction materials / Baustoffe				
brick Ziegel	lightweight clay brick (pore ceramic) - solid clay brick Leichtbaustein (Ziegel) / Vollbaustein (Ziegel)	2,11		5
concrete Beton	lightweight clay brick (pore ceramic) - hollow brick Leichtbaustein (Ziegel) / Hohlbaustein (Ziegel)	1,97		5
concrete Beton	load-bearing concrete Lastbeton	2,31		5
concrete Beton	concrete Beton	2,51		14
concrete Beton	concrete Beton	2,78		13
concrete Beton	concrete Beton	2,64		14
concrete Beton	concrete Beton	2,19		11
concrete Beton	concrete Beton	2,37		12
concrete Beton	concrete Beton	3,27		16
concrete Beton	concrete Beton	2,78		18
concrete Beton	concrete Beton	2,22		21
concrete Beton	concrete Beton	1,33		3
concrete Beton	concrete Beton	1,92		3
concrete Beton	concrete Beton	1,78		2
concrete Beton	concrete Beton	2,81		11
concrete Beton	concrete Beton	2,88		12



<https://epub.wupperinst.org/frontdoor/deliver/index/docId/1577/file/WS27e.pdf>
/p. 21; last accessed: 2021/04/14

name Name	specification Spezifikation	Material intensity [kg/kg] / Materialintensität [kg/kg]						region Regionaler Bezug
		abiotic material abiotische Rohstoffe	biotic material biotische Rohstoffe	water Wasser	air Luft	earth movement in agriculture and silviculture Bodenbewegung in Land- und Forstwirtschaft		
						erosion Erosion	mechanical earth movement mechanische Bodenbearbeitung	
Construction materials / Baustoffe								
brick Ziegel	lightweight clay brick (polystyrene) / solid clay brick porosierte Leichtziegel (Polystyrol) / Vollziegel	2,11		5,74	0,05			Germany
	lightweight clay bricks (saw dust) porosierte Leichtzi (Sägemehl)	1,97		5,42	0,04			Germany
	roofing tile Dachziegel	2,11		5,30	0,07			Germany
cellular concrete Porenbeton	400 kg/m ³							
	400 kg/m ³	2,51		14,98	0,26			Germany
	500 kg/m ³							
	500 kg/m ³	2,28		13,42	0,22			Germany
	600 kg/m ³ ; statically reinforced							
	600 kg/m ³ ; bewehrt	2,64		14,62	0,28			Germany
cement Zement	600 kg/m ³							
	600 kg/m ³	2,10		11,49	0,17			Germany
	600 kg/m ³ ; statically reinforced							
	600 kg/m ³ ; bewehrt	2,37		12,15	0,23			Germany
concrete Beton	Portland cement Portland-Zement	3,22		16,94	0,33			Germany
	Portland blast-furnace cement Eisenportl.-Zement (72% Portl.-Zement; 24% Hüttensand; 4% Gips)	2,79		18,82	0,30			Germany
	blast-furnace cement Hüttenzement (40% Portl.-Zement; 56% Hüttensand; 4% Gips)	2,22		21,31	0,25			Germany
concrete Beton	B25	1,33		3,42	0,04			Germany
granite Granit	slabs, grinded, polished Platten, geschliffen, poliert	1,92		3,36	0,59			Germany
sandlime brick Kalksandstein		1,28		2,02	0,01			Germany
sheet glass Flachglas	float glass Floatglas	2,95		11,65	0,74			Germany
stoneware pipe Kanalisationssteinzeug		2,88		32,93	0,24			Germany



for 1 kg of beef --> 15 000 to 20 000 kg of water...

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Teachers Teaching with Technology™



Christine Bürki

Education for Sustainable Development

Complementary material and hints for the UN SDG no 11

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Complementary Mat



SDG no 11: Sustainable Cities and Communities

Make cities and human settlements resilient and sustainable

1. Introduction to the topic

In 2018, 55% of the world population lives in urban areas. This trend is expected to continue, with 68% of the world population living in urban areas by 2030. The UN Environment Global Status Report 2017 projects an additional 230'000'000'000 m² (no typing error!) of building area by 2030, which would be equivalent to building an entire New York City to the planet every 34 days for the next 17 years. This is a significant challenge for urban planning and infrastructure development. For the same issue in 2030, this amount of m² which will be used up represents the entire New York City to the planet every 34 days for the next 17 years. Reason enough, to think hard of how we want to manage our cities - or even better - a good place worth living. BUT- how to accomplish this- esp. in Megacities? (cities with 10 million or more by UN's definition)

Such cities are facing huge challenges for environmental sustainability and so on.

The biggest city today is Tokyo, with 37.98 Million people. Tokyo is followed by Jakarta (34.54 mio), Delhi (29.62 mio) and Shanghai (22.12 mio) (3)

In Europe, cities like Berlin, London, Moscow and Paris are also growing together with the Metropole.

Can a big city be sustainable? Or- with which under-standings? Again- and it will always stay the same - it has to be calculated (Material Input per ServiceUnit) to decide, if sth is sustainable.

chnology™



Development
hints for the UN SDG no 11



SDG no 11: Sustainable Cities and Communities

Make cities and human settlements inclusive, safe, resilient and sustainable

1. Introduction to the topic

In 2018, 55% of the world population lives in urban areas. By 2050, UN projects that this would be the case for 68% of people living on this planet.

The UN Environment Global Status Report 2017 projects, that by 2060, the world is to add 230'000'000'000 m² (no typing error!) , of buildings, or an area equivalent to the entire current global building stock. (1) For the same issue, on the website of „architecture 2030“, this amount of m² which will be used up represents the equivalent of „adding an entire New York City to the planet every 34 day for the next 40 years“. (2).

Reason enough, to think hard of how we want to manage this challenge- how make cities livable- or even better- a good place worth living.

BUT- how to accomplish this- esp. in Megacities? (cities which do have a population of 10 million or more by UN's definition)

Such cities are facing huge challenges for environmental issues, infrastructure, peace, wealth and so on.

The biggest city today is Tokio, with 37,98 Million people living there. This is almost 4.75 times the number of people, living in my country, Switzerland.

Tokio is followed by Jakarta (34.54 mio) , Delhi (29.62 mio), Mumbai (23.36 mio), Manila (23.09 mio) and Shanghai (22.12 mio) (3)

In Europe, cities like Berlin, London, Moscow and Paris are considered as Megacities, because different (former independent) cities around these centers by now merged together with the Metropole.

Can a big city be sustainable? Or- with which understanding it is called „sustainable“ ? Again- and it will always stay the same - it has to be compulsory to measure the MIPS (Material Input per ServiceUnit) to decide, if sth is sustainable or not. (See SDG 12)



Once more, this SDG, too should not be addressed in studied and taught in a multidisciplinary way. Therefore reach out to their colleagues of different fields to work to

For this SDG no 11, one can connect with colleagues in

Architecture/Design	Physics	Sociol
Chemistry	Ecology/Biology	Geogra

(The order of the topics is random and has no implicatio

If you click on one of the [hyperlinked words](#), it will leac nary teaching in the text. With such a precious potpourr can introduce your students to the very much multifaclo They should be aware, that soil resources are limited. A more can't be an option.

The buildings in Cities mostly are built out of concrete. T cluding for ex. sand (calcium silicates), cement paste wi later on all mixed with water to form this famous fluid slu and molded into shape.

The production of concrete is a very dirty and dusty mat surroundings of such an industry are very much affectec

LafargeHolcim f.ex. is the global leader in building mater ter is in Rapperswil-Jona, Switzerland.

They joint the MIT Climate and Sustainability Consortiur present the building material industry.

On their website one can learn, that LafargeHolcim will r for people and the planet and they signed a „Net-Zero P



SDG no 11: Sustainable Cities and Communities

...cities and human settlements inclusive, safe, resilient and sustainable

c

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...p. in Megacities? (cities which do have a population of ...tion)

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...don, Moscow and Paris are considered as Megacities, ...ndent) cities around these centers by now merged to-

...tr- with which understanding it is called „sustainable“ ? ...same - it has to be compulsory to measure the MIPS ...to decide, if sth is sustainable or not. (See SDG 12)



Once more, this SDG, too should not be addressed in isolation, but should always be studied and taught in a multidisciplinary way. Therefore STEM-teachers are asked to reach out to their colleagues of different fields to work together:

For this SDG no 11, one can connect with colleagues in subjects like:

Architecture/Design	Physics	Sociology	Economics
Chemistry	Ecology/Biology	Geography	Psychology

(The order of the topics is random and has no implication of a ranking!)

If you click on one of the [hyperlinked words](#), it will lead you to ideas for a multidisciplinary teaching in the text. With such a precious potpourri of fields and competences, you can introduce your students to the very much multifactorial aspects of sustainable cities. They should be aware, that soil resources are limited. And that therefore, always building more can't be an option.

The buildings in Cities mostly are built out of concrete. This is a composite material including for ex. sand (calcium silicates), cement paste with aluminates and ferrite wich is later on all mixed with water to form this famous fluid slurry which can be easily poured and molded into shape.

The production of concrete is a very dirty and dusty matter. Regions and people in the surroundings of such an industry are very much affected and get seriously ill, easily. (4)

LafargeHolcim f.ex. is the global leader in building materials and solution. Its headquarter is in Rapperswil-Jona, Switzerland.

They joint the MIT Climate and Sustainability Consortium (5) as founding member to represent the building material industry.

On their website one can learn, that LafargeHolcim will reinventing how the world builds for people and the planet and they signed a „Net-Zero Pledge“ (6)



Referring back to the numbers given above as a outlook to the ... arises:

How it will be possible to have / to model sustainable city of the several SDG's?

Give it a try and explore this interesting and essential topic with every angle you can imagine.

- Since years, one could have been witnessing a migration of p countryside into the cities- or suburbs of cities
- Discuss the advantages and disadvantages for the peop nities, the economy, the „ecosystem city“ , for the food-...

Sources:

1. UN Environment Global Status Report 2017, https://www.worfiles/UNEP%20188_GABC_en%20%28web%29.pdf (p.8) las
2. —> automated Link listing look up!
3. —> automated Link, too (in number 3)
4. Greenpeace, <https://www.greenpeace.ch/de/medienmitteilunrecherche-umweltverschmutzung-und-krank-menschen-wegmentstaub/> last accessed 2021/04/08
5. MIT Climate & Sustainability Consortium , <https://impactclima> last accessed 2021/04/11
6. Net-Zero Pledge, <https://www.pledgetonnetzero.org/about> , las

4



3. Connecting this SDG with other SDGs

Methodological hint

Encourage your students, to present the different links and dependencies in a *Concept Map*. This is a powerful tool, not only to show how things are linked together, but it shows you, if the student can make the links and name the dependencies.

Some ideas:

- SDG 01: Poverty → big cities can be the source of poverty or poor people migrate to big cities in the hope of being able to escape poverty
- SDG 03: health → is it accessible for every body?
- SDG 04: adequate education → often a main reason for migration into cities: Are such promises true?
- SDG 06: in many cities, fresh water supply is a big issue
- SDG 07: access to clean and affordable energy: possible?
- SDG 08: how can this be guaranteed in big cities / mega cities?
- SDG 09: infrastructure versus parks and green open space? How to find a balance?
- SDG 10: are inequalities abundant in cities?
- SDG 12: Responsible consumption → how can this supervised in a city?
- SDG 13: a lot of human resources to engage for climate actions
- SDG 15: Land grabbing for enlarging the cities- violating our soil we are dependent on for constructing more buildings and infrastructure
- SDG 16: cities should contribute with institutions and organizations to this aim → enough people for an engagement.



Trying to red
be a really gc
If enterprises
just focusing
with other go
new project o

How the SDG

- SDG 01, 02
living in slum
- SDG 06: th
happen
- SDG 07: an
and clean e
keeps in mi
CO₂ footpri
- SDG 08: m
- SDG 09: th
- SDG 12: e:
Consumptic
- SDG 15: cit
destroying i



Trying to reduce man's negative impact on our planet with the help of the 17 SDG's, can be a really good idea to make positive impacts. There is a stumbling block to overcome: If enterprises, governments and individuals in their pursuit of following the SDG's are just focusing on one single or may be two SDG's, there will be a huge rebound effect with other goals. So, the crucial point really is, to have always all SDG's in mind, if a new project or idea is launched.

How the SDG 11 is affected, if one is only focusing on one of the following goals:

- **SDG 01, 02:** the bigger the cities, the more people suffering from poverty and hunger, living in slums
- **SDG 06:** the bigger the cities, the more water consumption, waste and pollution will happen
- **SDG 07:** any energy-producing unit has its own MIPS. It's not only about affordable and clean energy. It's about that we reflect our energy-consumption and that one keeps in mind, that any energy provision (renewable or not) has its own energy and CO₂ footprint; has its own MIPS.
- **SDG 08:** many workplaces - and economic growth as a whole can not be sustainable
- **SDG 09:** the more buildings, the more infrastructure, the bigger the MIPS
- **SDG 12:** especially in cities people are mostly motivated to consume! Most kind of Consumption is not sustainable
- **SDG 15:** cities are violating our land, pushing away the animals from their habitat and destroying a lot of native plants.



LafargeHolcim / Green construction / UN Sustainable Development Goals

UN Sustainable Development Goals

The UN Sustainable Development Goals (SDGs) provide a coherent, holistic and integrated framework for addressing the world's most urgent sustainability challenges and creating a better future for all. Governments are primarily responsible for prioritising and implementing actions that meet the SDGs, but achieving them also requires collaboration with business and civil society.

With ten years remaining to achieve the UN's Sustainable Development Goals, LafargeHolcim is committed to accelerating its impact across the 17 Sustainable Development Goals (SDGs) and is transparently disclosing its progress. While all the goals are relevant to LafargeHolcim, as the world's global leader in building solutions, there are 9 in which we can make an enhanced contribution through our strategy and actions on the ground. These are highlighted in the wheel below.



This goal aims at the eradication of poverty in all its forms. This includes improving the resilience of the vulnerable and poor to economic, social, and environmental shocks and disasters. The provision of essential infrastructure and services is key to lifting communities out of poverty.

Our contribution

