SDGs@DLR Initiative

How DLR research and technology contribute to the Sustainable Development Goals (SDGs)

SUSTAINABLE DEVELOPMENT GOALS

DLR

DLR's contribution
to the UN 2030 Agenda for Sustainable Development

Germany is committed to the ambitious implementation of the 2030 Agenda and the promotion of sustainable development is a fundamental goal for the Federal Government of Germany. The central driver for achieving sustainability targets is cooperation between states, civil society, and science with business practice.

The social, ecological and economic challenges arising from the 2030 Agenda cannot be overcome without science, technology, and innovation. Germany has a powerful scientific system; its capacity for innovation gives it the opportunity to make significant contributions for more sustainability – at both the national and international level.

With a wide range of activities spanning from science, engineering, and technology development to innovation as well as research and education management, the German Aerospace Center (DLR) contributes significantly to resolving the pressing challenges society is facing today. DLR's extensive research and development work in aeronautics, space, energy, transport, security, and digitalisation is integrated into national and international cooperative ventures. Interdisciplinary competencies, in combination with cutting-edge engineering research, lead to creative concepts for addressing global challenges such as economic growth, mobility, clean energy, digital transformation, security, and sustainability. DLR's portfolio ranges from fundamental to applied research and through to the transfer of research findings into innovations.

The brochure outlines DLR's approach in research and technology development to support the implementation of the 2030 Agenda at the national and international level. The SDGs@DLR initiative shall serve as the bridge and gateway between DLR's research and international cooperation and partnerships for sustainable development. It is one component of DLR's overall sustainability management.

DLR's main contributions

The DLR Strategy 2030

With its Strategy 2030, DLR has repositioned itself to create a better framework for addressing key global challenges and support social progress. The focus is on the ability to cover the entire innovation chain and harness it for the benefit of society; the foundation of new institutes in fields like more secure communication and navigation using quantum technology, energy transition, and concepts for the future mobility on land, sea and in the air, as well as the establishment of the new cross-sectoral research area of digitalisation. This compiles DLR's existing areas of expertise to offer better solutions for the economy and society. With its new approach, DLR aims to promote the consistent use of existing synergies and strengthen systematic interdisciplinary cooperation, building upon its core competencies in aeronautics, space, energy, and transport research, which have evolved over years. The strategic objective to increase DLR's commitment in responding to societal challenges is a key feature of the strategy. This objective can be achieved by supporting the implementation of the UN 2030 Agenda through science, technology and innovation.

The DLR Internationalisation Strategy 2030

The DLR Internationalisation Strategy 2030 builds on the successful international cooperation intrinsic to DLR's research and technology development as well as the international activities addressed by the DLR Project Management Agency and the German Space Agency at DLR. Four specific strategic objectives have been defined within the Internationalisation Strategy 2030:

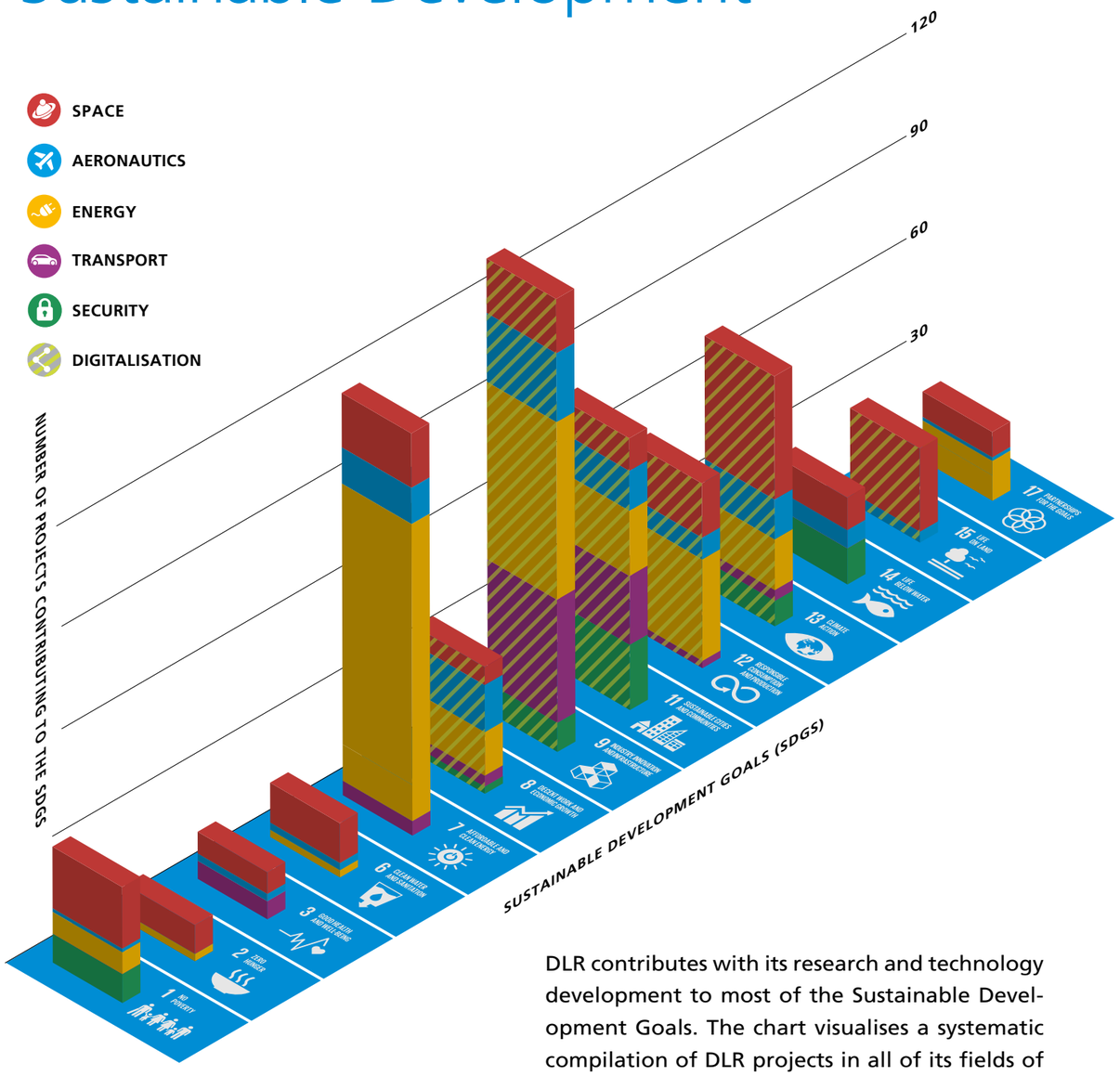
1 Scientific excellence – partnering with the very best
2 Scientific excellence – increasing internationality
3 Implementing the UN 2030 Agenda for Sustainable Development
4 Partnering with industry

DLR is implementing the comprehensive 'SDGs@DLR' initiative to support these objectives.

At the heart of the 2030 Agenda for Sustainable Development, adopted by all United Nations member states in 2015, are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries in a global partnership.

Transforming our world

The 2030 Agenda for Sustainable Development



DLR contributes with its research and technology development to most of the Sustainable Development Goals. The chart visualises a systematic compilation of DLR projects in all of its fields of research and technology which started between 2013 and 2019. The contribution of each project was attributed to the targets of the SDGs.

SDGs@DLR

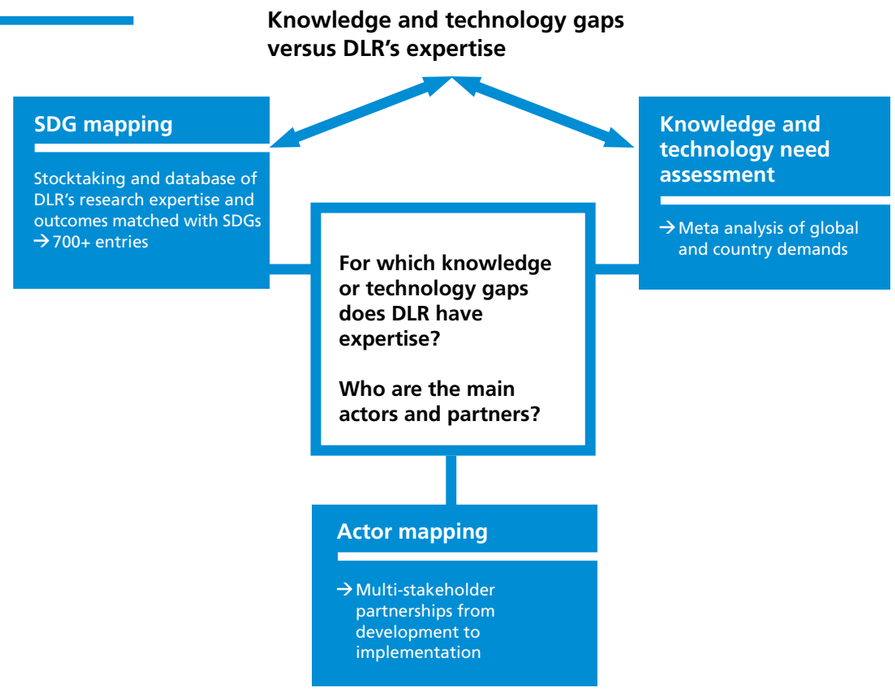
Science, technology, and innovation are some of the key elements to achieve the SDG targets and to implement the 2030 Agenda for Sustainable Development.

DLR contributes to these elements with excellent research and technological development in the fields of space, aeronautics, energy, transport, as well as in the cross-cutting areas of security and digitalisation.

The main DLR contribution can be summarised in these fields:

1 Disruptive technology advancements, knowledge, and innovation
2 Understanding Earth and the solar system
3 Monitoring and evaluation of progress and impacts on sustainability

This is reflected in the 'SDGs@DLR' initiative. It matches DLR's extensive research and technology development and its outcomes with the knowledge and technology demands of the 2030 Agenda and the key actors it needs to work with in order to reach the desired impacts. It is a systematic gathering of DLR's research expertise and outcomes with relevance to the SDGs. The initiative shall serve as bridge and gateway between DLR research and international cooperation for sustainable development.



01 **Aviation** research

Future air traffic will be climate-neutral, quiet, safe, and efficient. It connects people and markets.

DLR is developing solutions for innovative technology and processes. Thanks to its know-how of the entire aviation system, **DLR is presenting well-founded proposals for the next but one generation of aircraft.** Its aeronautics research aims at the SDGs: to avoid pollutant emissions from aircraft, to develop unmanned aerial systems, and to consistently digitalise aviation.

Unmanned aerial systems

Unmanned helicopter superARTIS takes off to deliver aid supplies. Credit: DLR (CC-BY 3.0)

Unmanned aircraft systems are already used today for many different applications. For example, to supply poorly connected areas with urgent supplies or in disaster relief. The implementation of autonomous unmanned air vehicles creates a number of new challenges for research, manufacturers, operators, and legislators. In addition to technical aspects, their integration into the airspace brings up complex procedural and legal issues that need to be investigated. **Because of its unique research portfolio, DLR is a major enabler of unmanned aircraft systems. Its interdisciplinary research is combined and tested in the Test Center for Unmanned Aerial Systems in Cochstedt.**

02 **Space** research

DLR is the largest space research institution in Europe. It contributes towards addressing societal challenges such as global change, secure communications, health and demographic change.

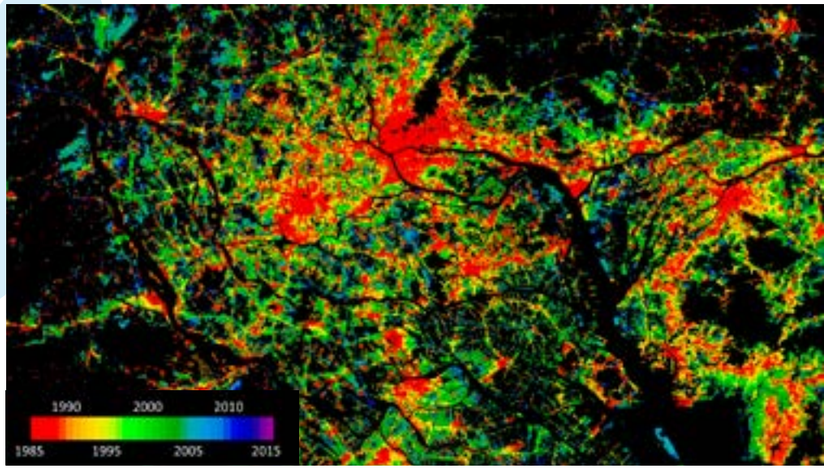
The activities cover all areas of space technology and its applications. The Space Research and Technology programme comprises **Earth observation, communication, navigation, quantum technology, space exploration, research under space conditions, space transportation, robotics, and space system technology.**

Space technologies and applications contribute to single SDGs in various ways and may also be instrumental in monitoring their implementation.

World Settlement Footprint (WSF)

Earth observation can be used to assist in the implementation of the SDGs. Global mapping and monitoring of urban areas is of utmost importance to support the implementation of strategies for sustainable development of urban and rural settlements.

With remote sensing, we can **monitor the dynamics of urbanisation by mapping the settlement extents over time.** At DLR, we recently launched the World Settlement Footprint (WSF), a novel suite of open and free high spatial resolution global products supporting a comprehensive analysis of urbanisation and, in turn, monitoring of related SDGs (e.g., 11.3.1).



Yearly urban development of the Pearl River Delta region (China) from 1985 (red colour) to 2015 (blue colour)

03 **Energy** research

The energy system of the future must be ecological, economical, socially accepted, and energy supply should be secure. DLR's energy research is supporting this goal by developing components and systems for supplying dispatchable, sustainable energy for transport, industry, and households.

To do so, research topics follow three different but closely interlinked paths: firstly, to deliver power and heat, it is necessary to **combine technologies to harvest fluctuating renewable energies with those to store power or heat** for times with low availability of solar radiation and wind; secondly, **renewable energy can be used to produce chemical energy (synthetic fuels),** which can then be converted into power and heat as requested and can also be used directly for mobility; thirdly, **all components in the energy system need to be part of a smart overall energy system management** using digital technologies, ensuring optimised systems operation and sector integration. DLR's research also includes energy systems analysis, required for creating and understanding the future energy system.

SUN-to-LIQUID

The transition from fossil to renewable fuels is one of the most urgent challenges of our time. The SUN-to-LIQUID approach, which is funded by the EU and Switzerland, uses concentrated solar energy to synthesise liquid hydrocarbon fuels from H_2O and CO_2. This reversal of combustion is accomplished via a high-temperature thermochemical cycle. It is based on metal oxide redox reactions which convert H_2O and CO_2 into energy-rich synthesis gas (syngas), a mixture of mainly H_2 and CO. Subsequently, a Fischer-Tropsch unit processes the synthesis gas on site into solar kerosene. Its technological demonstration can have important implications for the defossilisation of longhaul transport, aviation, and shipping.

Solar plant SUN-to-LIQUID in Móstoles
© ARTTIC / Christophe Ramage

04 **Transport** research

Mobility is indispensable for any society. Powerful, emission-free, reliable, safe, and secure transport links and networks are a necessary prerequisite in order to satisfy the needs of private individuals, economic entities, and other institutions.

Protecting the climate through reducing greenhouse gas emissions remains the biggest challenge for the transport sector. Hence, the transport sector needs transformation to continue ensuring reliable and affordable mobility for people as well as for the transport of goods in a balance of interests between the environment, society, and the economy. In this field of tension, DLR seeks sustainable solutions through concerted research in various disciplines. **A unique characteristic of DLR lies in the interaction of knowledge about mobility and transport as the application domain with the methodological knowledge from information technology, traffic sciences, and engineering.**

Alternative powertrains

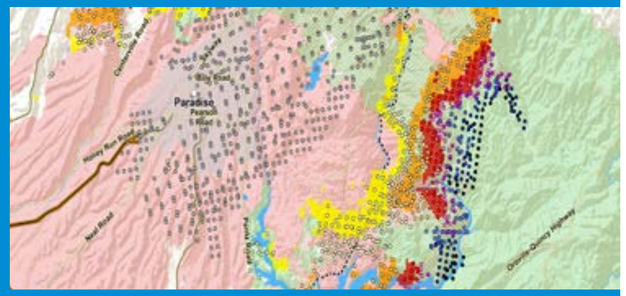
E-Mobility and, in particular, green hydrogen are climate-friendly alternatives where petrol, diesel, kerosene or heavy oil are used today. At the same time, green hydrogen offers the usual comfort of long ranges and fast refuelling. **DLR is developing powerful fuel cells for mobile use, new types of hydrogen tanks, as well as their integration into new vehicle concepts for road, rail,** and especially all kinds of heavy-duty vehicles. DLR experts are analysing their market and deployment potential with respect to different mobility concepts. DLR's Safe Light Regional Vehicle (SLRV) concept vehicle will have a highly efficient hydrogen drive and is expected to make its first laps as a prototype in autumn 2020.

DLR Safe Light Regional Vehicle (SLRV) concept vehicle

05 **Security** research

Civil security research focuses on the research and development of solutions to protect citizens and critical infrastructure from damage caused by natural disasters and major accidents, threats posed by terrorism, and organised crime. These solutions contribute to improving the security of citizens and thus their quality of life and to strengthening the civil security economy.

Detecting natural disasters and supporting humanitarian aid



Active fires around the town of Paradise, California, in the massive fire in November 2018. This information supports fire fighters but also contributes to the assessment of disaster losses and impacts. Map produced by ZKI, © DLR 2018

In the event of disasters such as earthquakes, floods or oil spills, **Earth observation satellites can deliver an instant overview.** Satellite images provide information on the extent of a disaster or crisis; they indicate where relief action is most urgently needed, and support response teams on the ground. **Satellite-based remote sensing is used to generate digital maps of the Earth's surface as well as to assist with daily weather forecasting, thus, for instance, securing air and shipping traffic.**

At DLR's Center for Satellite Based Crisis Information (ZKI), Earth observation data such as satellite or aerial imagery as well as geo data is acquired and analysed in order to generate up-to-date situational awareness information before, during or after a disaster situation or in case of major events. All crisis information is produced according to the ZKI users' requirements. Users like the Red Cross or civil protection agencies receive customised information products to help and support crisis response operations in challenging situations.**The close interlocking between research, development, and service is an enormous strength of the ZKI.**

06 **Digitalisation** research

Digitalisation is one of the primary fields of innovation. Big data, artificial intelligence, and internet connectivity already shape our daily life and will become key factors for sustainable development.

DLR defines and contributes to four crucial topics:

For **Digitalisation in the Economy**, DLR conducts research ranging from the highly automated factory of the future to laser-based optical data transmission. Our work on **Intelligent Mobility** covers various aspects of an automated, networked, and electrically powered transport system: effective planning, self-organised cooperation, and organisational principles.

Big and Smart Data challenges such as storage and processing are addressed by developing highly performant algorithms and artificial intelligence methodologies, and furthermore, in the light of the increasing importance of security of communication and navigation links, DLR draws on its **Cyber Security** expertise to help defend cyberattacks.

Global connectivity via satellite

Digital inclusion decisively supports the UN Sustainable Development Goals. It is significantly increased by providing access to modern information and communication technologies as well as to ubiquitous and affordable internet, even in the least developed countries. **Therefore, DLR is working on innovative technologies for Very High Throughput (VHT) geostationary satellites**, which provide a wide coverage area and have the potential to close existing gaps in broadband internet access – not only in Germany and Europe, but on a global scale. To enable a more efficient use of satellite resources, optical feeder links which are capable of transporting several terabits per second, are a key enabling technology and thus a focal area of work at DLR.

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Prospects

As a research organisation, DLR is striving to increase its commitment in responding to societal challenges and to contribute to the implementation of the UN 2030 Agenda for Sustainable Development through science-based solutions and policy advice.

Through the SDGs@DLR initiative, DLR will contribute to shaping selected projects and initiatives with the aim to support the implementation of the UN's 2030 Agenda accomplishing the Sustainable Development Goals (SDGs) through science, technology, and innovation.

We can only achieve the goals through partnerships and cooperation. DLR will therefore deepen and widen cooperation with science, the private sector, international organisations, and the United Nations along with government entities and civil society. Strong partnerships are needed to work together on the whole chain from research to implementation. Therefore, we partner with key actors in development cooperation like Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), and UN organisations like the UN Development Programme (UNDP), the World Food Programme (WFP), and the UN Office for Outer Space Affairs (UNOOSA), which we support by bringing in our expertise to contribute to sustainable development.

Science, technology, and innovation need to be integrated into national and regional development planning and activities. Strong partnerships between research and development actors will enable desired impacts for sustainable development.

About DLR

DLR is the Federal Republic of Germany's research centre for aeronautics and space. We conduct research and development activities in the fields of aeronautics, space, energy, transport, security and digitalisation. The German Space Agency at DLR plans and implements the national space programme on behalf of the federal government. Two DLR project management agencies oversee funding programmes and support knowledge transfer.

Climate, mobility and technology are changing globally. DLR uses the expertise of its 55 research institutes and facilities to develop solutions to these challenges. Our 10,000 employees share a mission – to explore Earth and space and develop technologies for a sustainable future. In doing so, DLR contributes to strengthening Germany's position as a prime location for research and industry.

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