

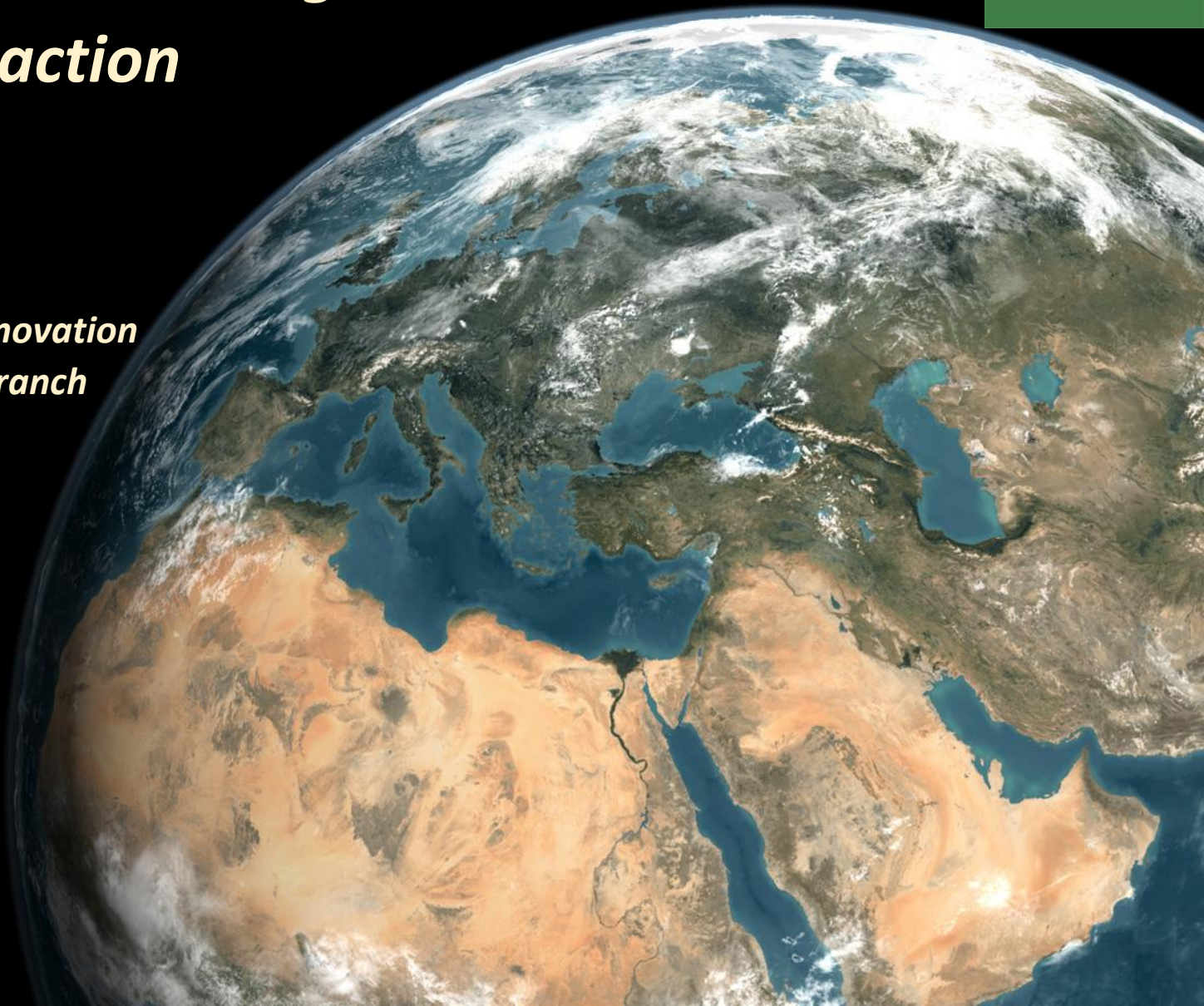
Harnessing the power of AI & frontier technologies for climate action

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Crisis Management Branch
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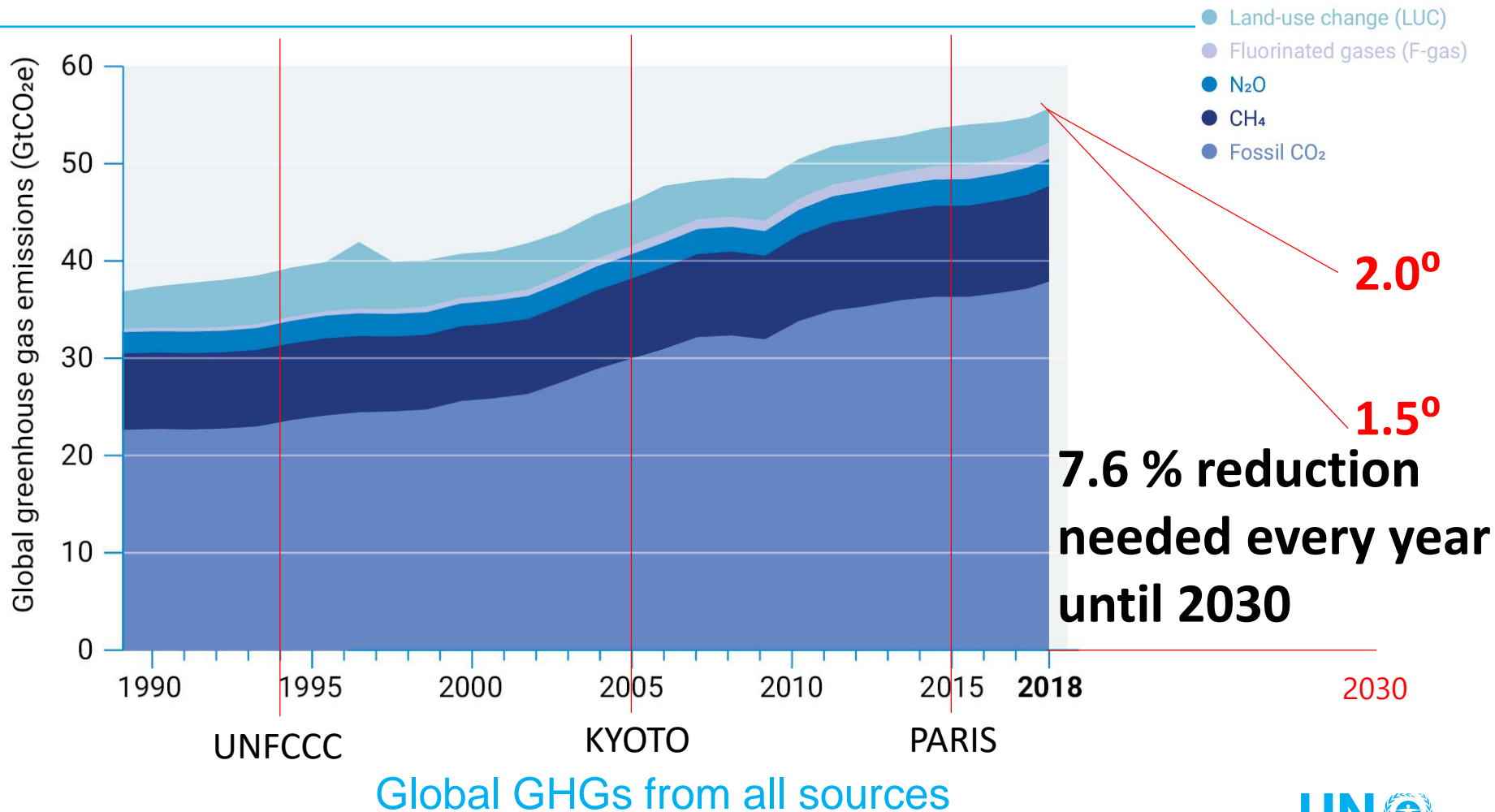


13 CLIMATE
ACTION



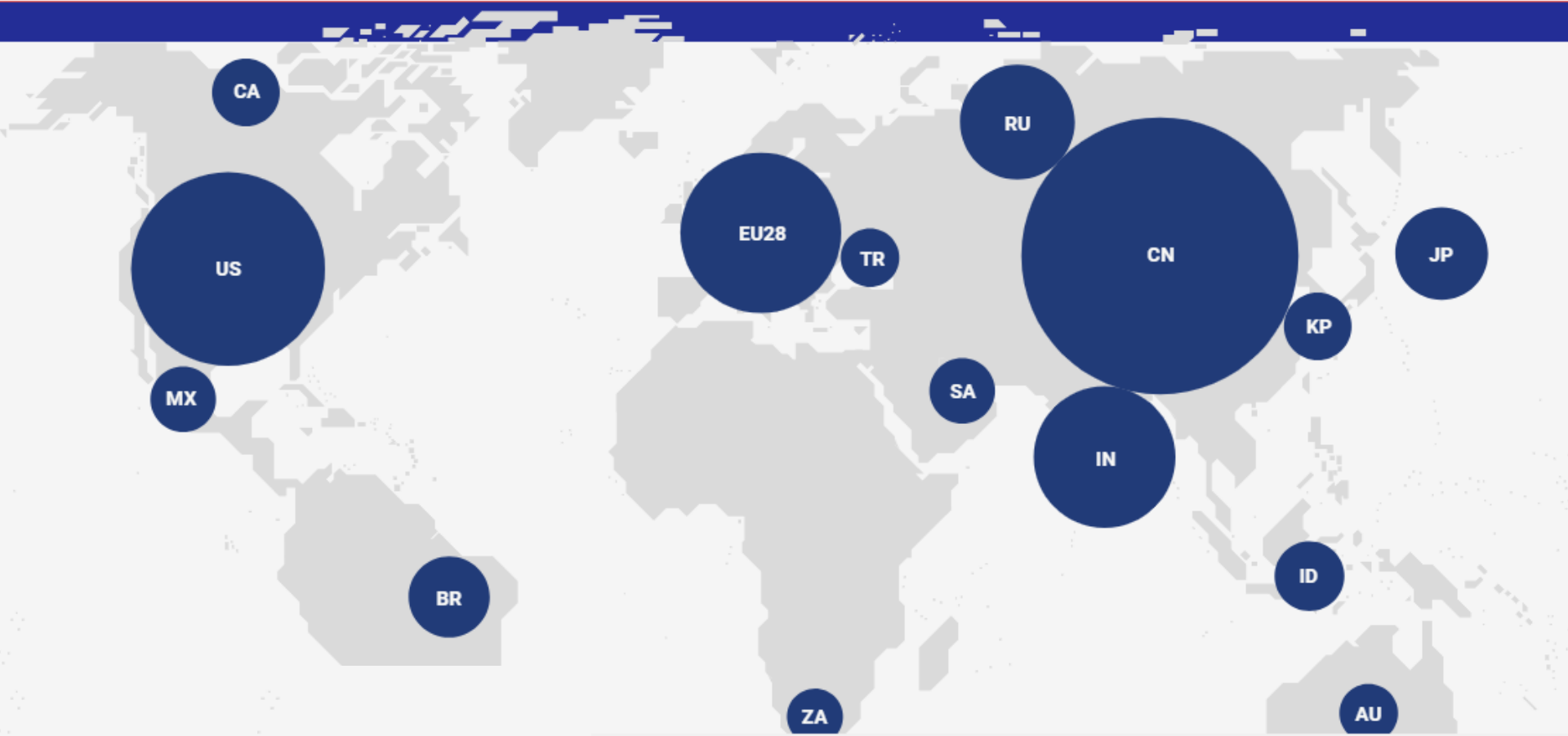
What is our climate action track record ?

Global greenhouse gases have risen 1.5 per cent per year in the last decade and continue to increase.



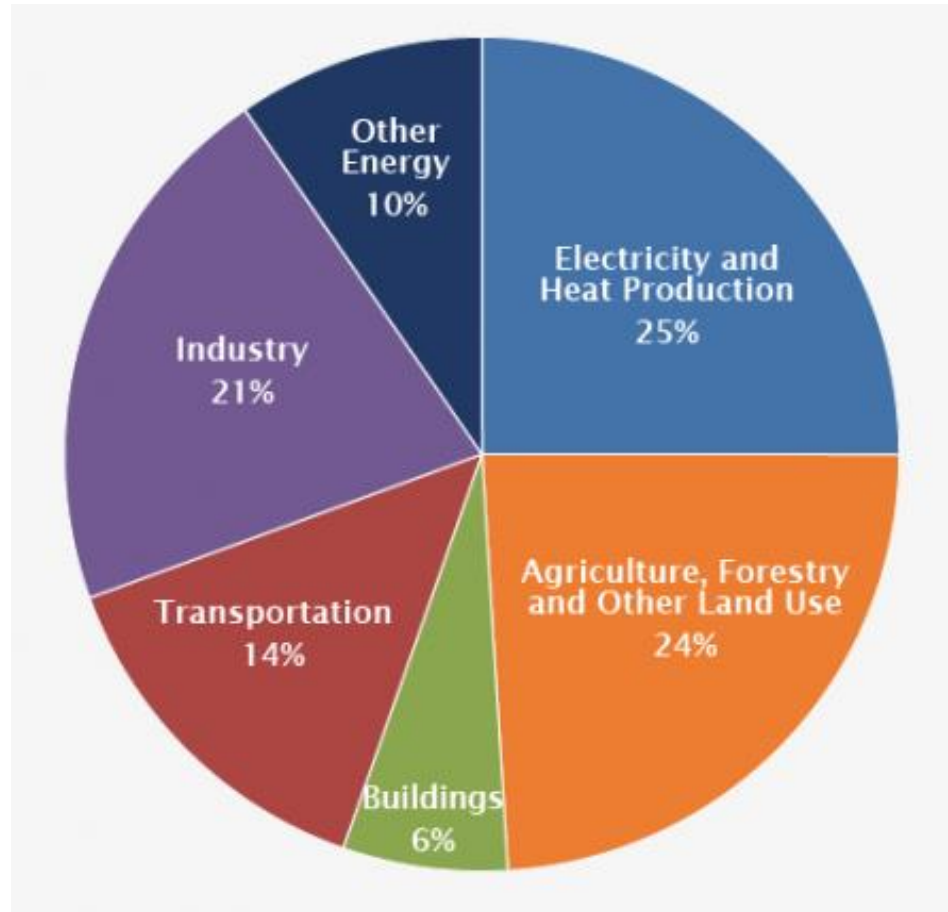
Where to target ?

The G20 (a group of 19 countries, plus the EU) account for 78% of all emissions.



What to target ?

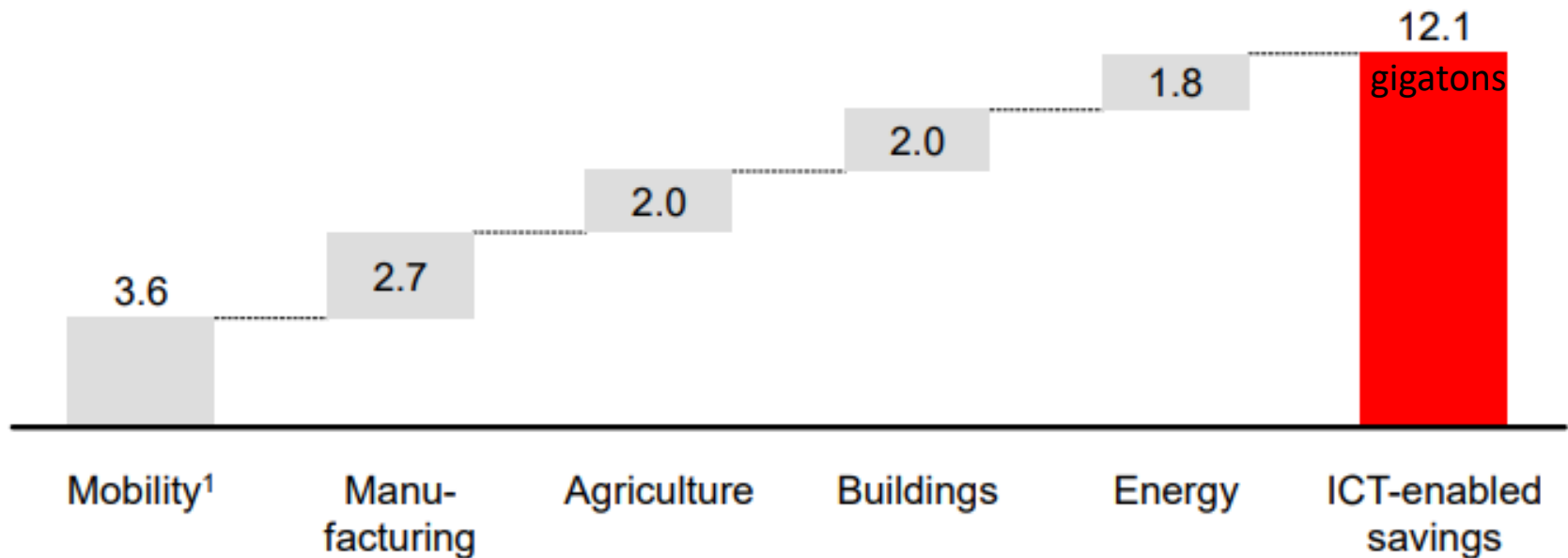
Five sectors make up more than 80% of greenhouse gas emissions.



How to disrupt business as usual ?

ICT can enable a 20% reduction of global CO_{2e} emissions by 2030 based on 2015 emission levels

Figure 1: CO_{2e} abatement potential by sector (2030)

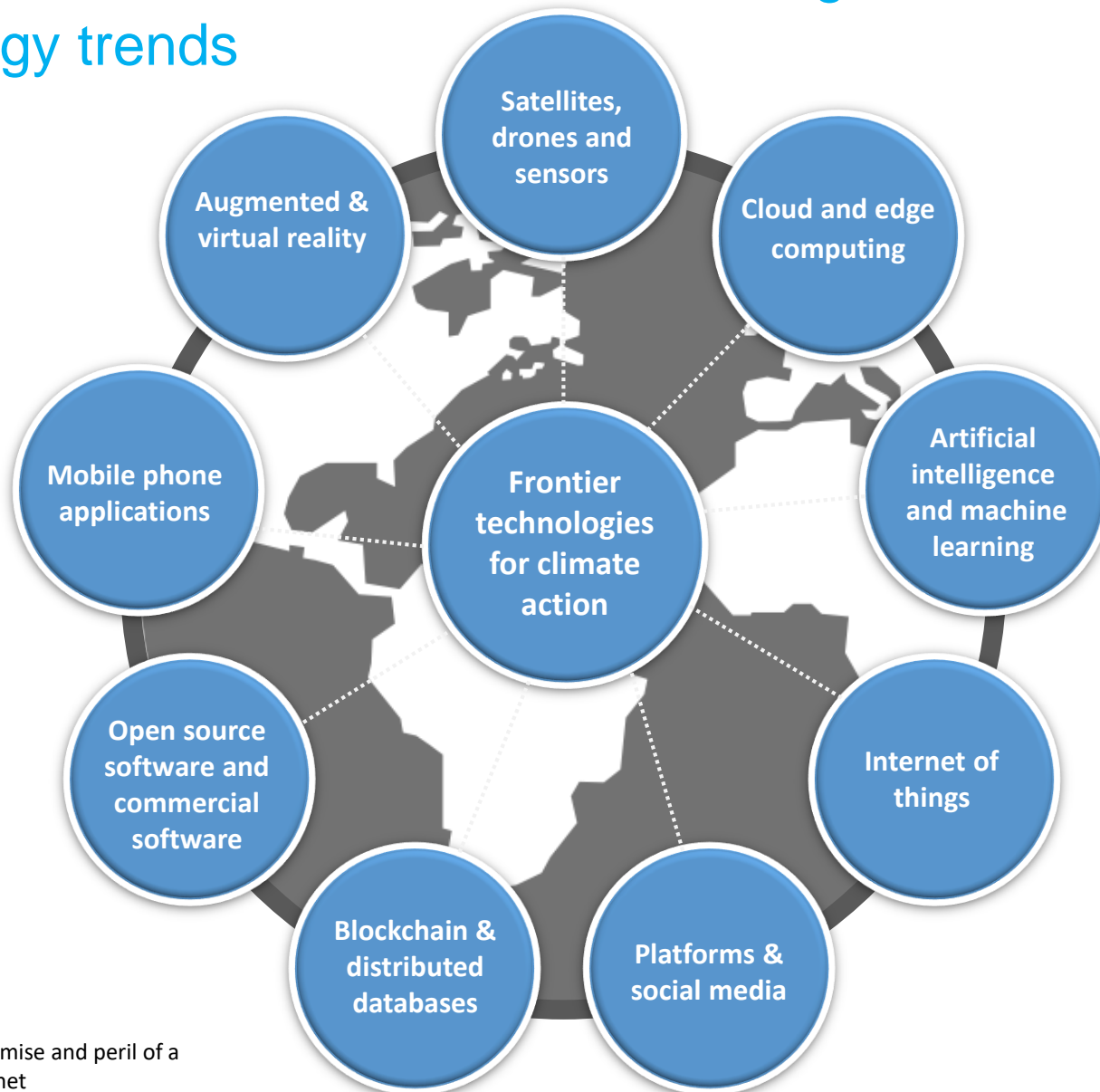


¹ Mobility solutions consider ICT-enabled improvements to private and commercial mobility and additionally consider the reduced need to travel from various sectors, including health, learning, commerce, etc.

Source: WRI, IPCC, World Bank, GeSI, Accenture analysis & CO₂ models

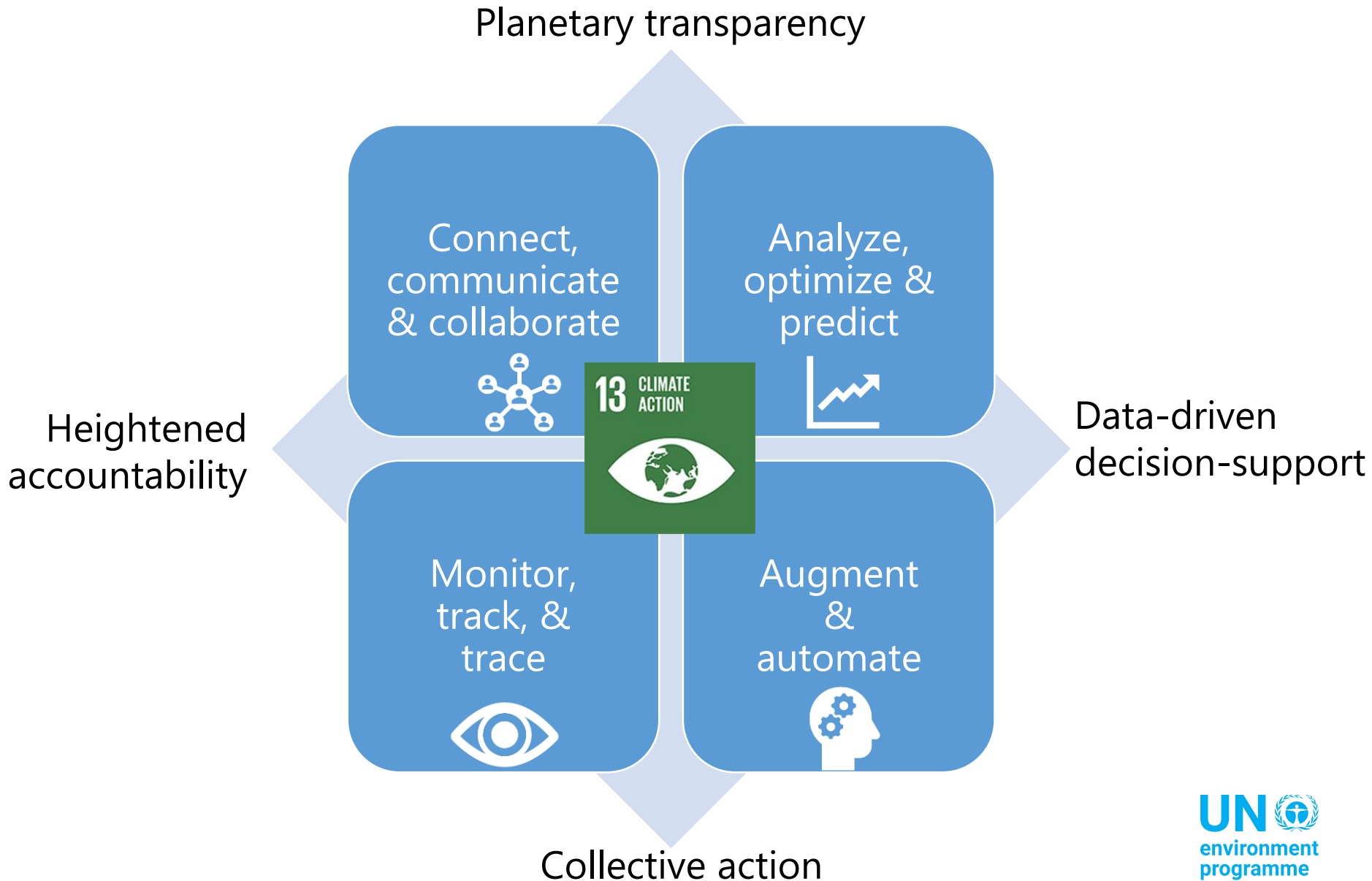
Which technologies to use ?

Not only about AI – but about the convergence of nine technology trends



How can frontier technologies disrupt business as usual?

Useful to consider 4 main categories and 4 main outcomes



CONNECT, COMMUNICATE & COLLABORATE: Massive potential for digital nudging and microtargeting to influence individual consumption behavior through AI, mobile apps and social media

A photograph showing a person's hands holding a blue smartphone. The person is wearing a white long-sleeved shirt. The background is a market stall with various fruits, including oranges and apples, in baskets. The lighting is bright, suggesting an outdoor market environment.

5 billion unique mobile phones
4.4 billion with internet access
2.5 billion smart phones
2.4 billion Facebook accounts
500 million citizen science contributions
2.3 trillion market capitalization of GAFA

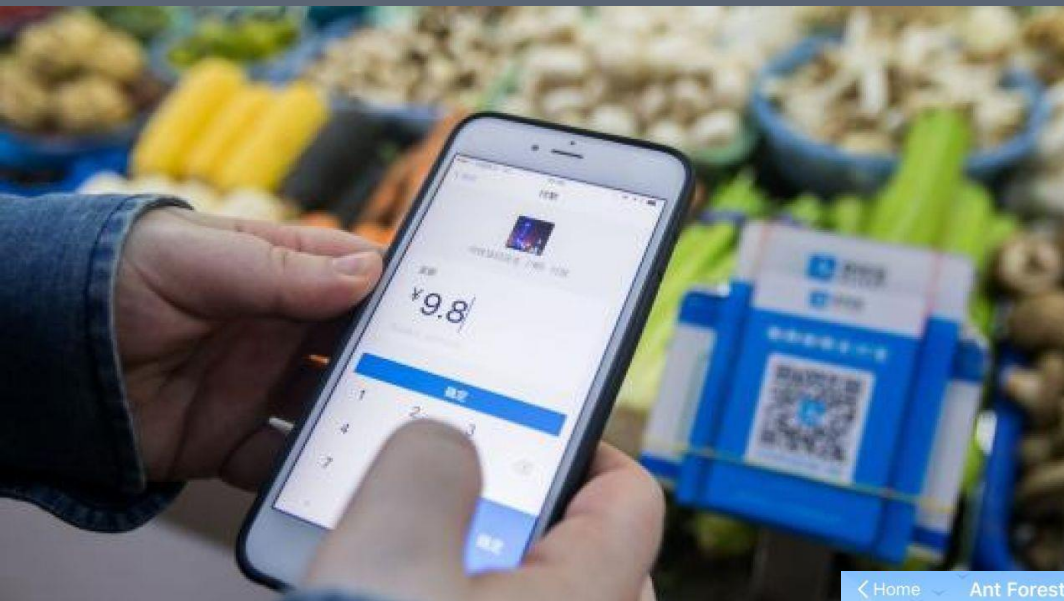
Inner Planet – assessing consumption patterns



Co-creating an app to seamlessly calculate your carbon usage and visualize the world you are making.

Making a **'fitbit for the environment'**

Ant Forest – gamification for low carbon consumption



Alipay annual active users:
700 million
1.7 trillion in funds flow through

Idea to create an app within the Alipay ecosystem to gamify low carbon behaviors and reward energy points that can be used to plant trees. Hope was to engage **a few million** people.

By mid 2019, **over 500 million people** had joined Ant Forest's initiative.



Ant Forest

This has resulted in over 122 million trees being planted in Gansu Province, Inner Mongolia Autonomous Region reducing carbon emissions by over 6 million tons.



Universal Sustainability Education & Reward System (USERS) compares carbon and environmental footprints of products

EMPOWERING CITIZENS TO ACT SUSTAINABLY

To help consumers and procurement to find the most sustainable, healthy and optimal but affordable products we developed an augmented reality IT system which guides consumers at the point of sale or at home.

Green products and companies will win, "Business as Usual" lose. Here you see the APP prototype. In a university research it has proven to be able to double sustainable consumption.



Should digital platforms be required to contribute towards our sustainability and climate-action aspirations ?

Hard wire ? Opt out ? Opt in ?

Product sustainability information

Green product advertising

Detection of fake news



MONITOR, TRACK & TRACE: conduct real-time observations at a planetary-scale of green house gas emissions, supply chains and climate impacts

Satellites: 5,000

Sensors: 16 billion

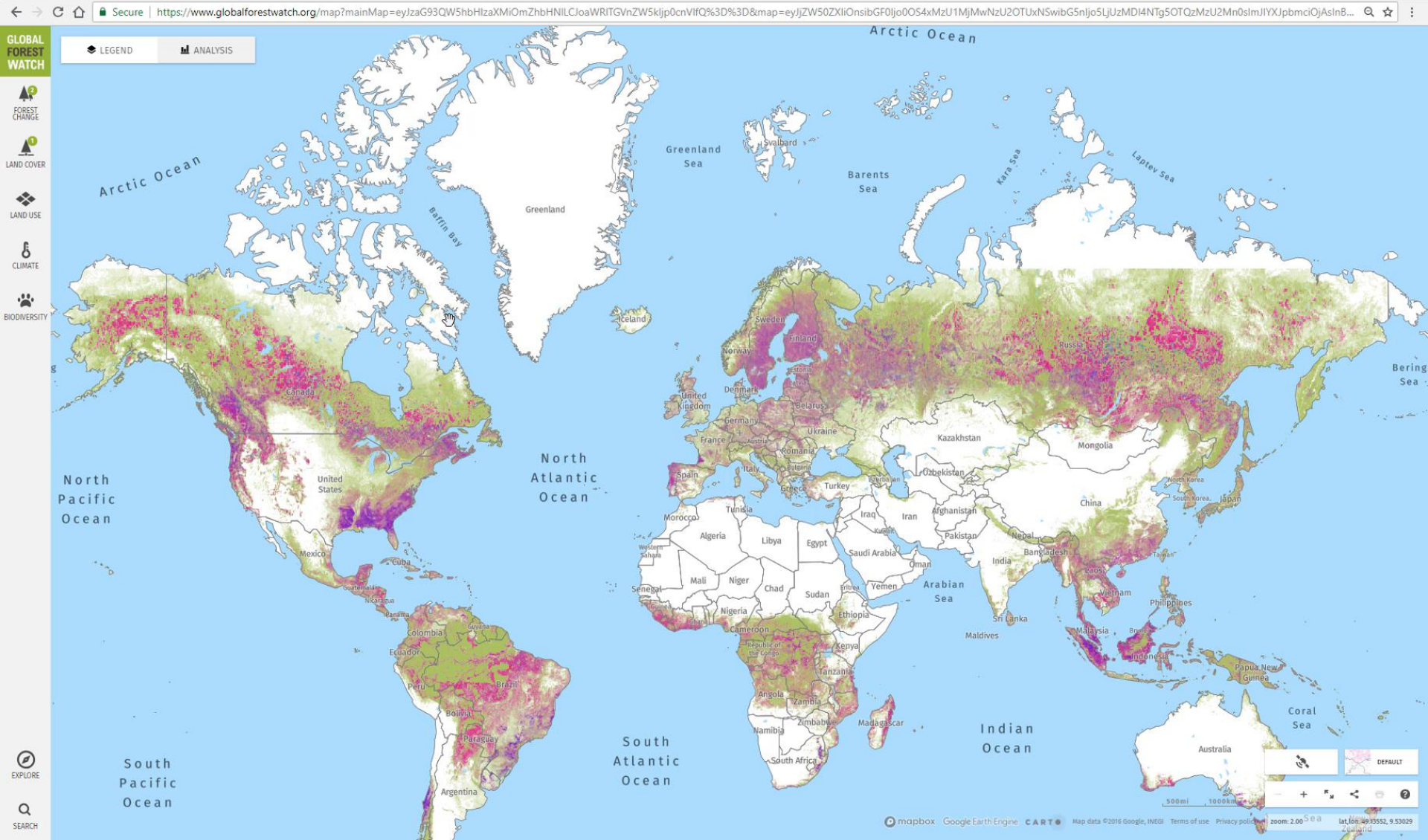
IoT: 42 billion by 2025

IP addresses: 3.4×10^{38}

Mobile location data

Blockchain

Global forest watch tracks tree loss and gain



<https://www.globalforestwatch.org/>

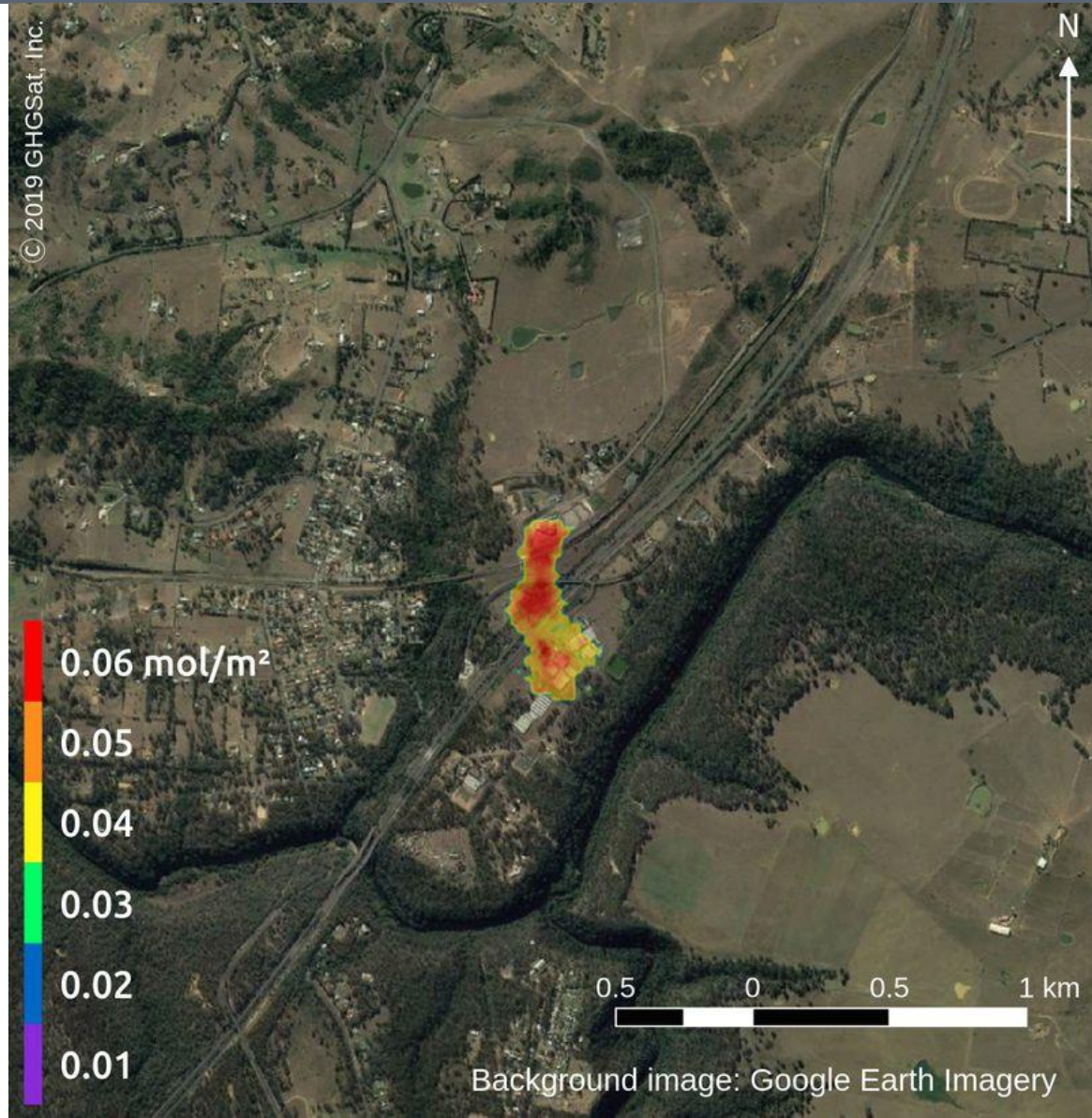
Wave of new satellites for monitoring global emissions

Satellites for Climate Action:

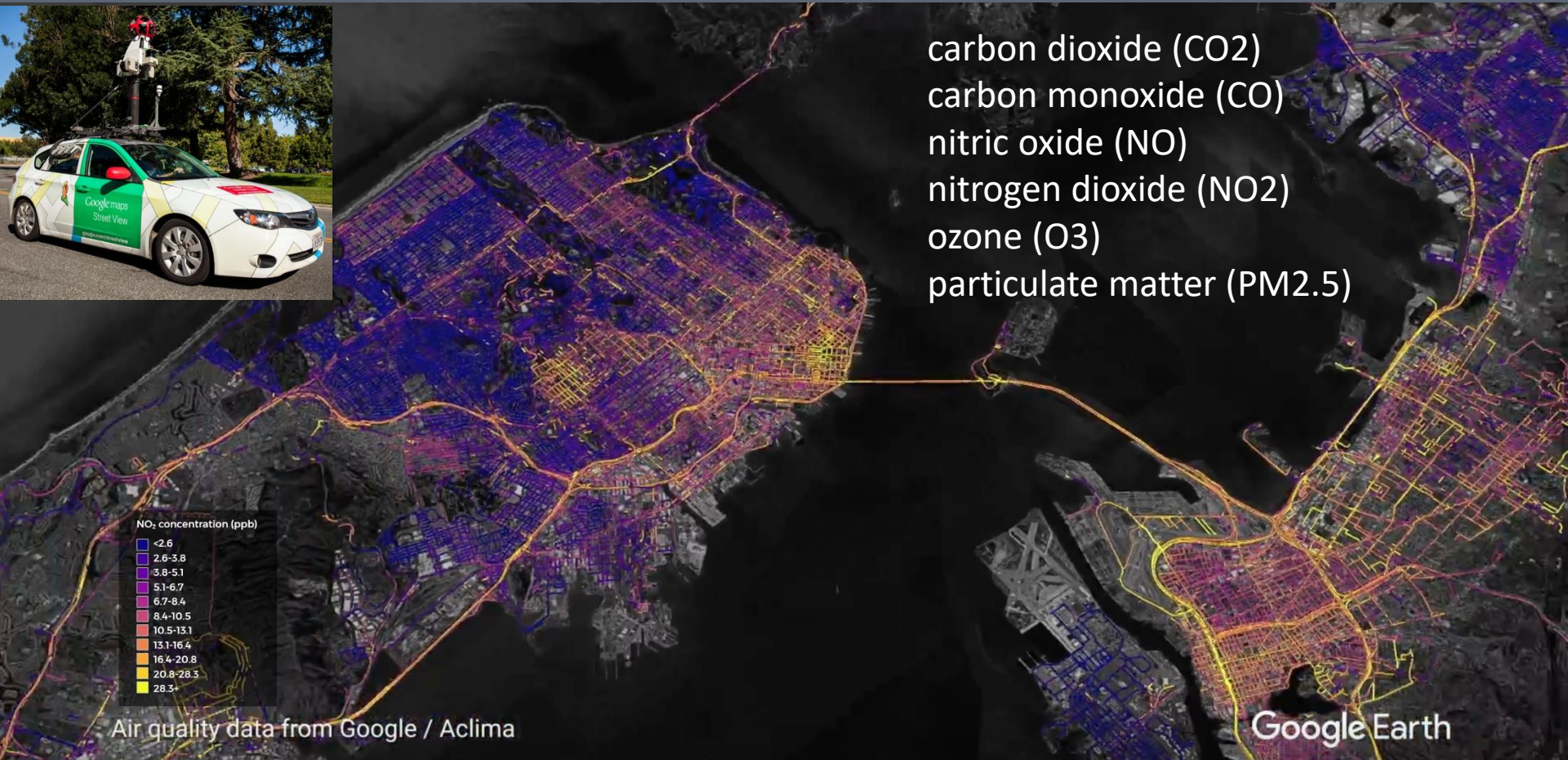
New initiative that will use satellite data to inform and accelerate climate protection. Collaboration by UN, Planet Labs, California Governor and Michael Bloomberg.

ESA to launch in 2025:

3 sentinel 7s for Carbon Dioxide
—
3 day repeat period
Critical tool for the 2028 Paris review

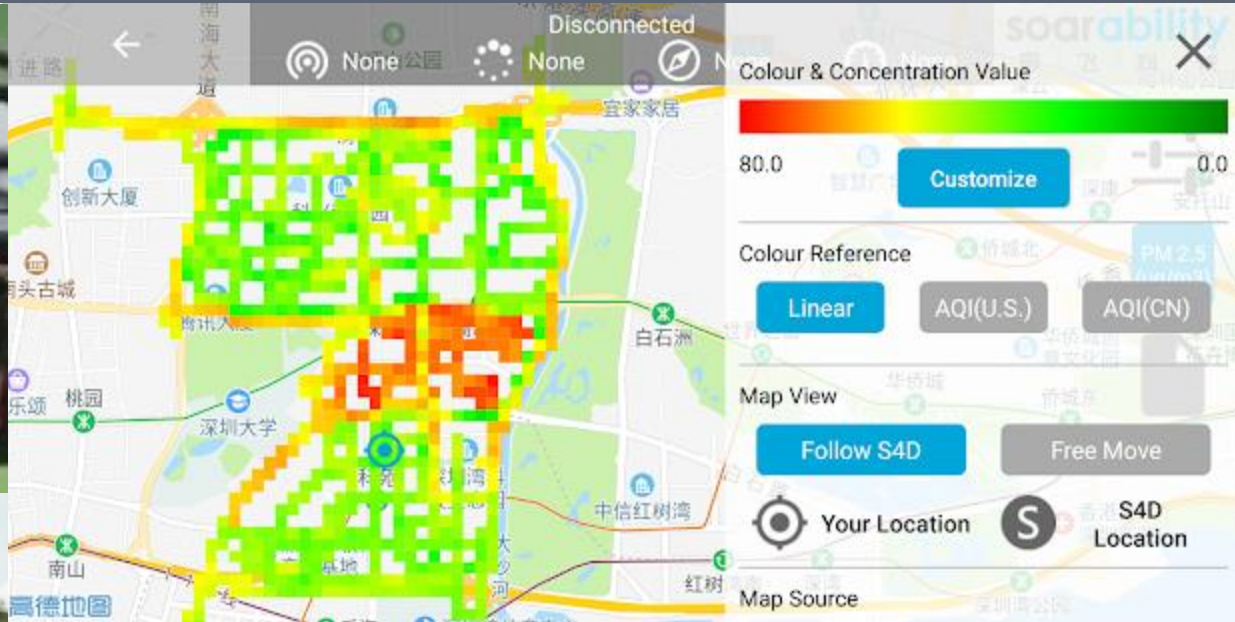


Aclima offers block by block mapping of air quality






Google and environmental sensor company Aclima have announced plans to scale and integrate Aclima's mobile sensing platform into Google's global fleet of Street View vehicles. This would allow hyper local mapping of emissions.

Soarability uses AI to power a fleet of autonomous drones to conduct hyper-local air pollution monitoring

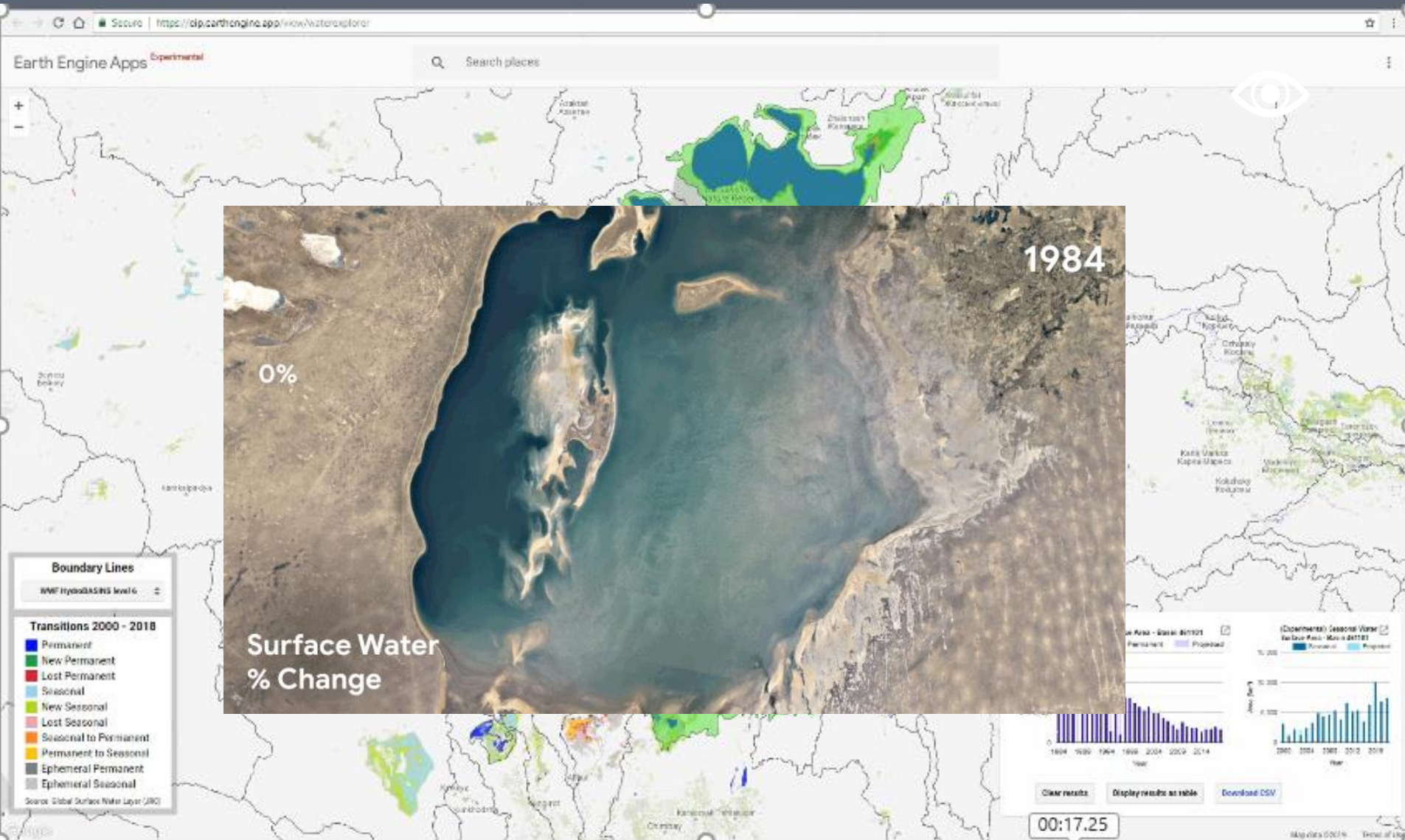


Potential blockchain applications for enabling traceability & trust for carbon markets, climate finance, & clean energy

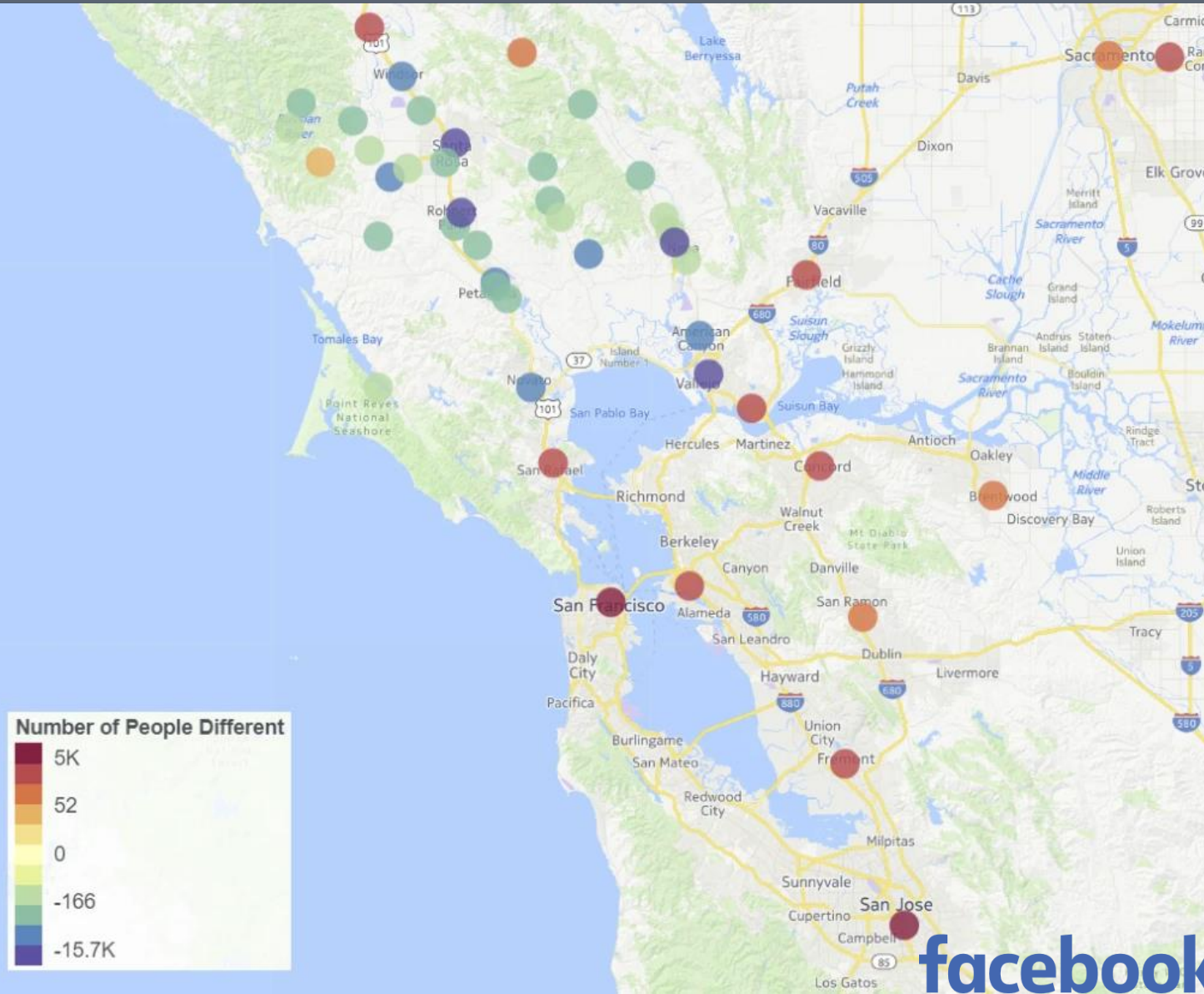
BLOCKCHAIN SOLUTIONS

	APPLICATION	POTENTIAL ADVANTAGES
	Carbon markets: Enabling mechanism for trading and accounting of mitigation outcomes.	<ul style="list-style-type: none">• Immutable audit trail of the creation and transfer of mitigation outcomes;• Facilitated trading with various granularity levels and units;• Lower transaction and management costs and increased transaction speed;• Traceability of emissions reductions and certificates trades across countries.
	Climate finance: Facilitating and enabling of climate-smart investments through traceability of financial flows.	<ul style="list-style-type: none">• Enhanced accountability through traceability of capital flows;• Facilitation of earmarked and results-based financing;• Enabling of automated micro-payments to reduce micro-payments for loan repayment;• Reduced management and transaction costs.
	Clean energy: Enabling prosumer business models for decentralized energy systems.	<ul style="list-style-type: none">• Enabling of peer-to-peer energy transactions;• Better energy prices for both consumer and producer;• Traceability and certification of renewable energy production;• Facilitated addition of energy generation incentives (e.g. tokens).

Global surface water explorer tracks surface water extent



Facebook offers disaster mapping based on mobile phone location data



Number of people in each city in the week of December 4, 2017, approximately two months after the fires started

ANALYZE, OPTIMIZE & PREDICT: Integrate multiple datasets to extract insights on climate risks and to drive efficiency in emission reductions

Big data: 40 zettabytes
Cloud and edge computing
Data fusion
Data science
Increasing spatial and temporal resolution



Google is integrating big data sets and using machine learning to assess the solar potential of homes



1,841 hours of usable sunlight per year
Based on day-to-day analysis of weather patterns



1,885 sq feet available for solar panels
Based on 3D modeling of your roof and nearby trees

\$14,000 savings

Estimated net savings for your roof over 20 years

Wrong building? Click another roof to view details.



How Project Sunroof Works

Your own personalized solar savings estimator, powered by Google Earth imagery.



1

Search for your home

We use Google Earth imagery to analyze your roof shape and local weather patterns to create a personalized solar plan.



2

Personalize your solar analysis

Adjust your electric bill to fine-tune your savings estimate and the recommended number of solar panels for your home.



3

Compare finance options

Compare loan, lease, and purchase options for your solar panels based on your results.

Fine-tune your information to find out how much you could save.

YOUR AVERAGE MONTHLY ELECTRIC BILL

We use your bill to estimate how much electricity you use based on typical utility rates in your area.

\$90

YOUR RECOMMENDED SOLAR INSTALLATION SIZE

This size will cover about 98% of your electricity usage. Solar installations are sized in kilowatts (kW).

2.8 kW
(194 ft²)

YOUR POTENTIAL ENVIRONMENTAL IMPACT

Estimated annual environmental impact of the recommended solar installation size.

Carbon dioxide 2.1 metric tons = Passenger cars 0.5 taken off the road for 1 yr = Tree seedlings 54.8 grown for 10 yrs

[SEE TOTAL SOLAR POTENTIAL FOR THIS ZIP CODE](#)

LEARN HOW TO FINANCE YOUR SOLAR PANELS

BUY

LEASE / PPA

LOAN

Pay up front, largest lifetime savings. You pay the full cost up front and own the solar system without any additional payments over time. As the outright owner, you may claim any local, state, or federal incentives.

\$10,000

UPFRONT COST AFTER INCENTIVES

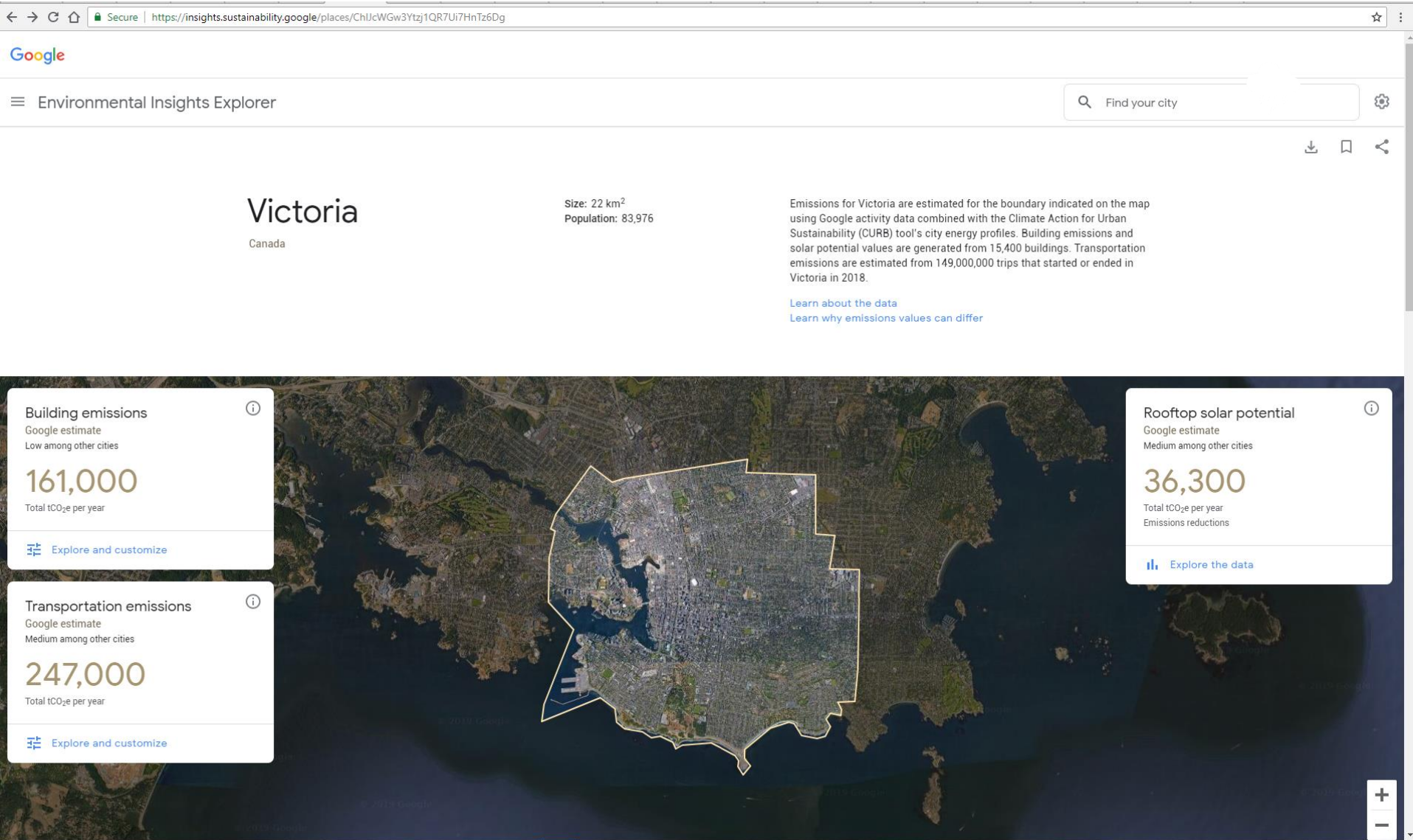
\$24,000

20-YEAR BENEFITS

\$14,000

TOTAL 20-YEAR SAVINGS

These analysis can be scaled to the size of cities and also merged with climate projections



These analysis can be scaled to the size of cities and also merged with climate projections

Secure | <https://insights.sustainability.google/places/ChIJcWgw3Ytzj1QR7Ui7HnTz6Dg/solar>

Google

Environmental Insights Explorer

Victoria > Rooftop solar potential

Find your city

20 year climate projections

From NASA Earth Exchange

Temperature

15 day increase in hot days projected

Precipitation

3 day decrease in wet days projected

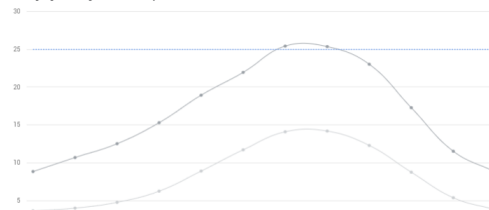
Cold days

1 day decrease in cold days projected

The projected future days of heat will be similar to present day in Klagenfurt, Austria

Projected average temperatures °C in 2037

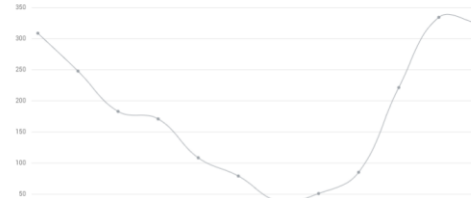
● Avg. high ● Avg. low ● Hot days threshold



The projected wet days will be similar to present day in Porto Alegre, Brazil

Projected monthly amount of precipitation (mm) in 2037

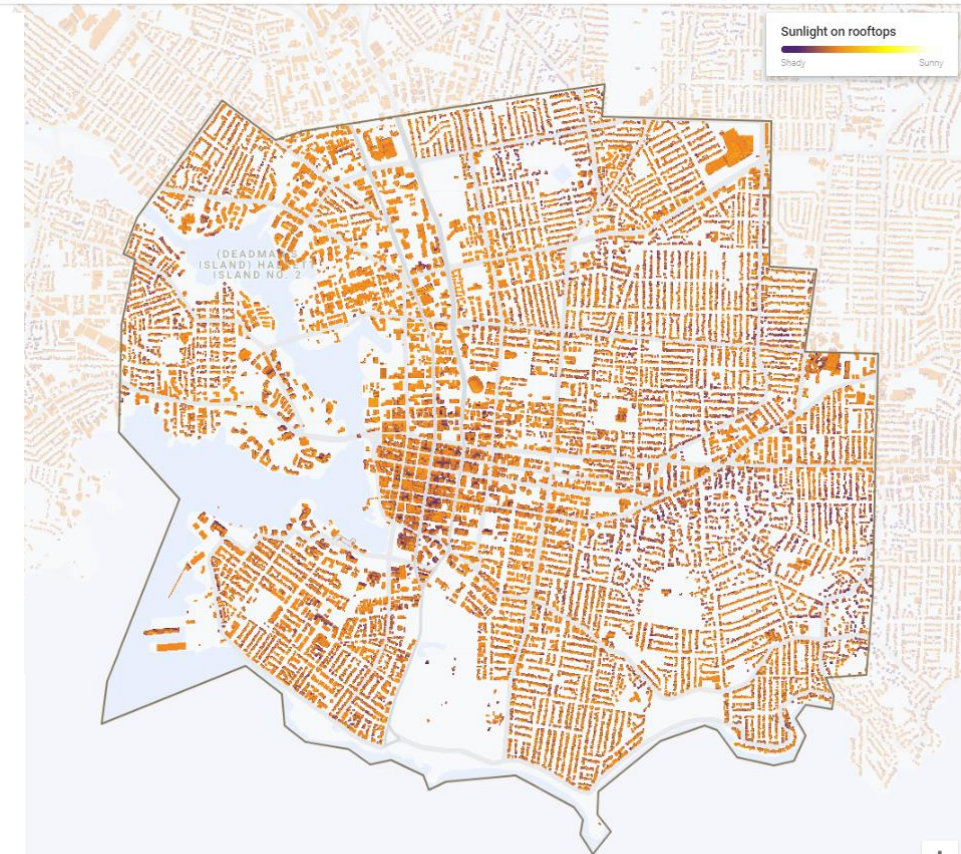
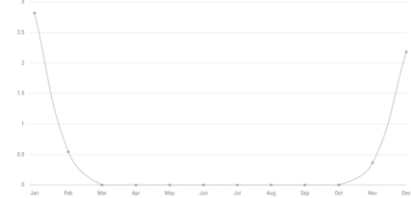
● Precipitation ● Wet days threshold



The projected cold days will be similar to present day in King County, United States

Projected monthly cold days in 2037

● Cold days



Google

Map data ©2019 Google Terms of use Report a map error

Microsoft AI for Earth – 50 million dollar investment to find AI-powered solutions to environmental problems



AI for Earth

AI for Earth puts Microsoft cloud and AI tools in the hands of those working to solve global environmental challenges.

▶ Play AI for Earth video

Areas of focus

AI for Earth awards grants to projects that use artificial intelligence to address four critical areas that are vital for building a sustainable future.

[Learn about AI for Earth grants >](#)



Climate

The changing climate threatens human health, infrastructure, and natural systems. AI can give people more accurate climate predictions to help reduce the potential impacts.



Agriculture

By 2050, farmers must produce more food, on less arable land, and with less environmental impact to feed the world's increasing population. AI can help people monitor the health of farms in real time.



Biodiversity

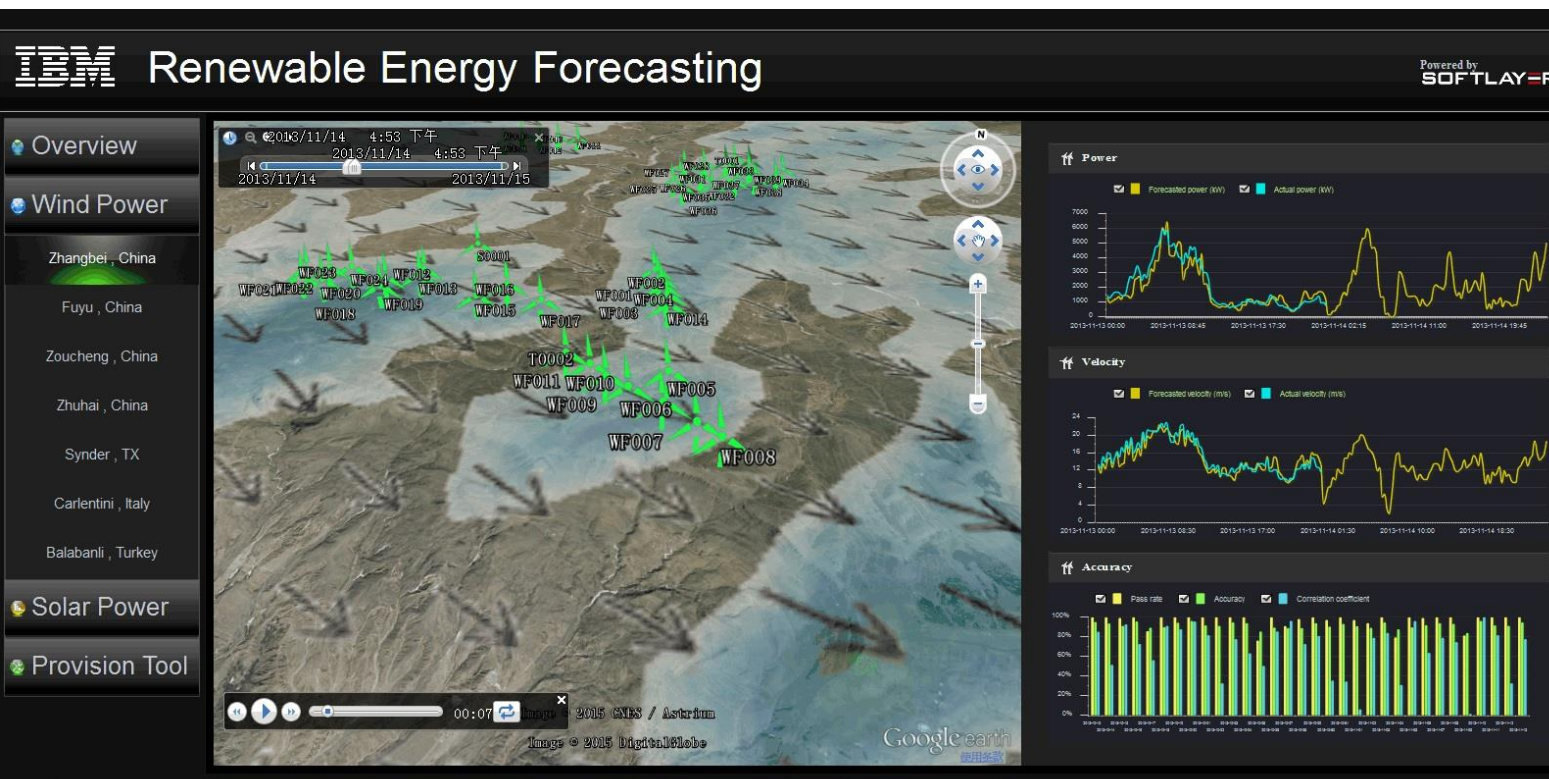
Species are going extinct at an alarming rate. AI can help people accelerate the discovery, monitoring, and protection of biodiversity across our planet.



Water

In the next two decades, demand for fresh water is predicted to dramatically outpace supply. AI can help people model Earth's water supply to help us conserve and protect fresh water.

IBM's Green Horizon's program is improving the accuracy of solar energy forecasting



Solar energy forecasting system that is up to 30% more accurate than the next-best conventional system.

Deep learning techniques to blend:

- ✓ domain data
- ✓ information from sensor networks
- ✓ local weather stations
- ✓ cloud motion physics derived from sky cameras and satellite observations,
- ✓ multiple weather prediction models

AUGEMENT & AUTOMATE: Extend human capabilities, empathy and understanding of potential climate impacts and SMART solutions

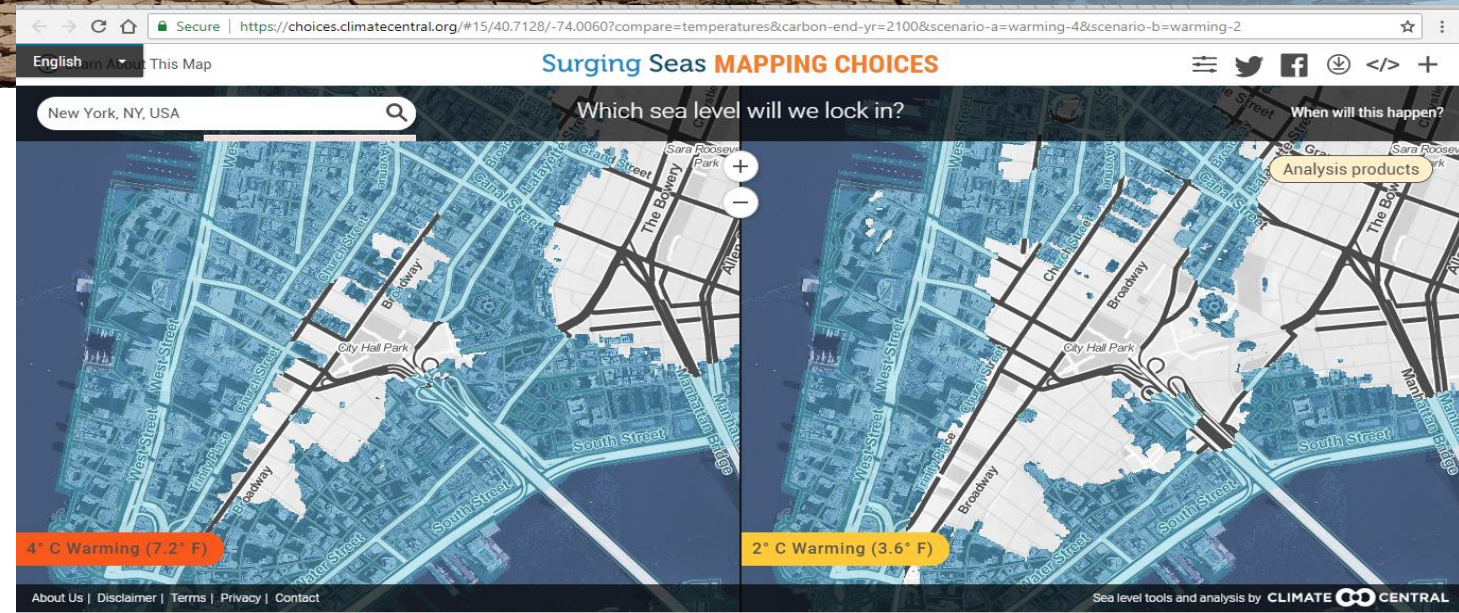


The power of extended reality to shape our concern about the future

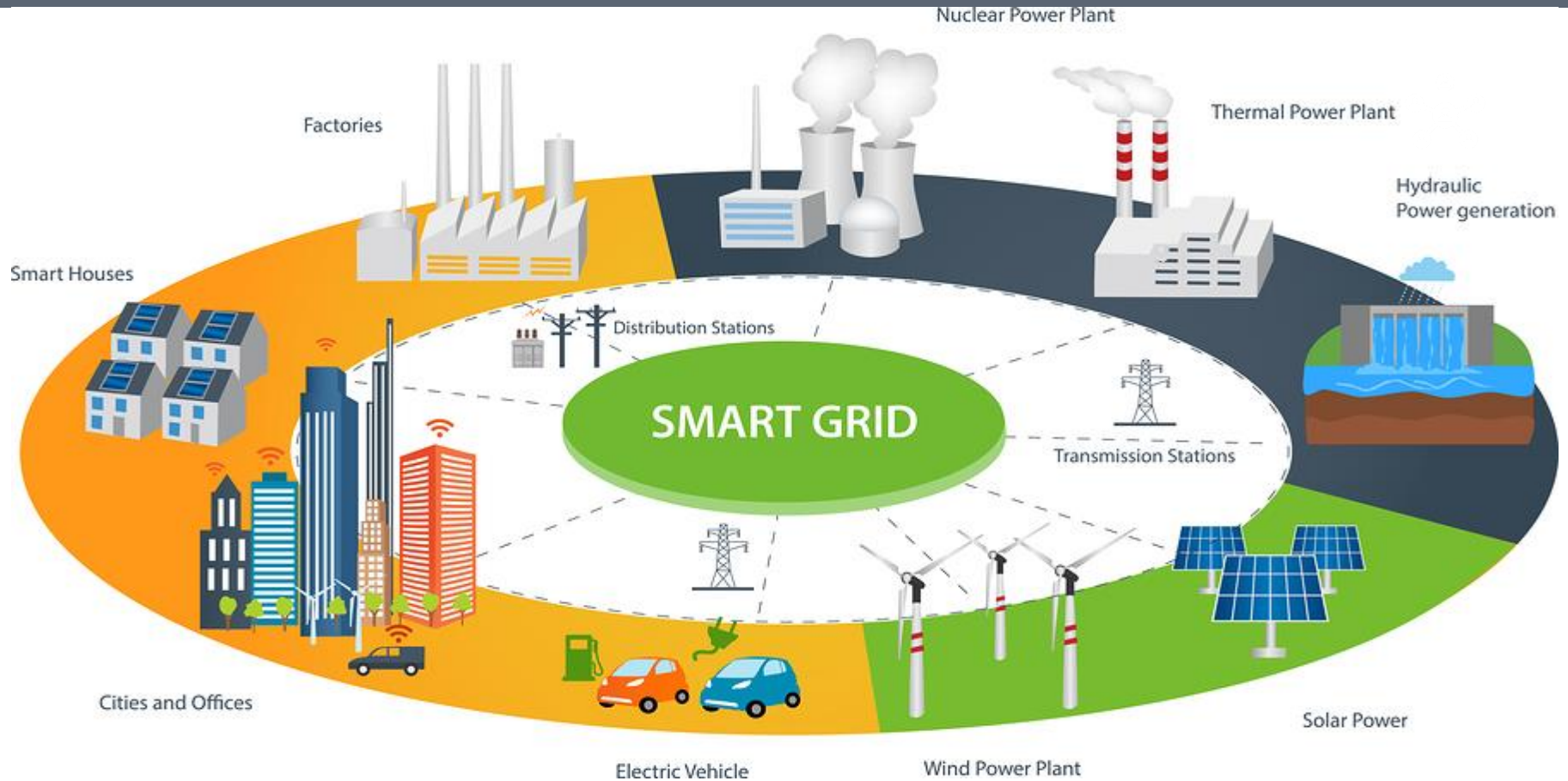
Efforts underway to visualize the impacts of different climate change impacts & scenarios:



Virtualized and down-scaled projections of drought, heat waves, sea-level rise and extreme precipitation



SMART grids, cities, agriculture, transport, for automated optimization and decision-making



Energy production could be reduced by 20% - a saving of 6.3 billion MWh - as a result of better demand management and the integration of renewables.

Smart Agriculture could boost yields by 30%, avoid 20% of food waste, reduce water needs by 250 trillion liters and abate 2.0Gt CO_{2e}

Precision Agriculture Technologies

GUIDANCE TECHNOLOGIES

- Machine Guidance
- Controlled Traffic Farming
- Driver Assistance

SENSING TECHNOLOGIES

- Soil Mapping
- Canopy Sensing
- Soil Moisture Sensing

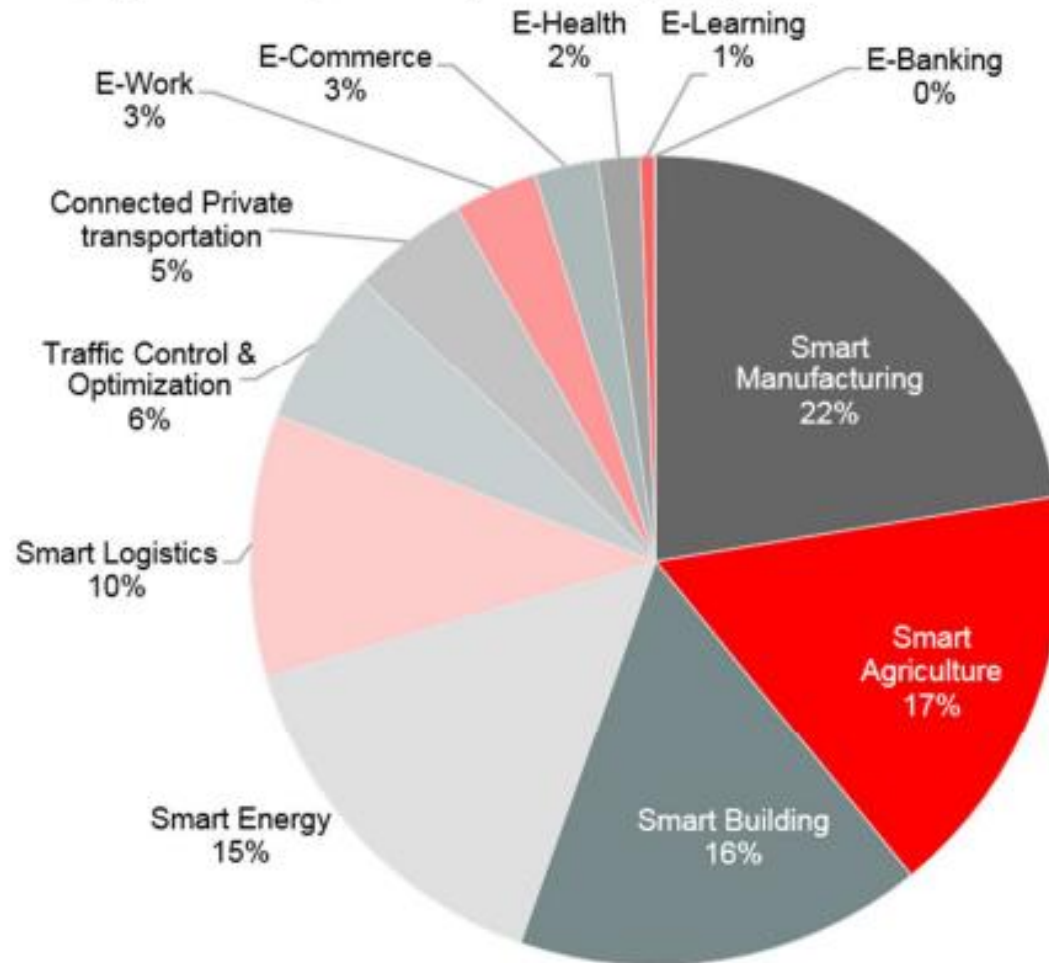
REACTING TECHNOLOGIES

- Irrigation
- Weeding
- Variable Rate Technologies (Seeding, Nutrients, Pesticides)



80% of CO_{2e} abatement potential from five SMART applications

Figure 6: Environment - CO_{2e} abatement potential by use case (2030)



What are the barriers to overcome ?

Enabling policies, standards and partnerships

Digital ecosystem for the planet

- Disclosure of emissions data
- Data sharing and licensing
- Provenance and inter-operability
- Global standards for the digital ecosystem
- Concerns about data & algorithm quality
- High fragmentation / limited strategic collaboration
- Dominated by few large players

13 CLIMATE ACTION



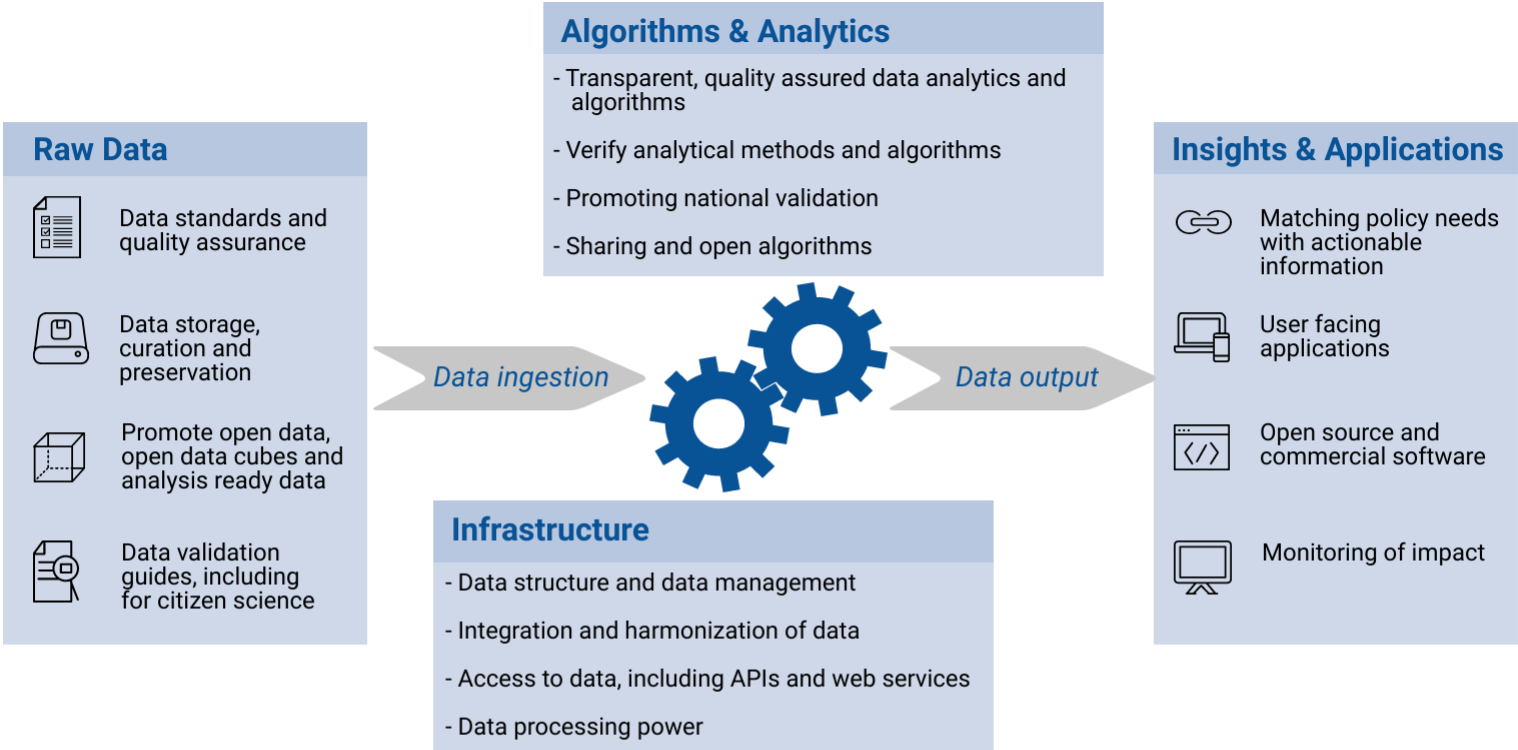
Financial

- Need for new business models
- Incentives for public-private partnerships & investments
- Potential for capital flight
- Pay to play potential

Governance issues

- Information and capacity asymmetries
- Safeguards, privacy and data security
- Consent, Opt in / Opt out
- Environmental footprint
- Sustainability & climate requirements
- Ethical frameworks

How to foster public-private collaboration to build a digital ecosystem for the planet that generates essential insights for climate action ?



Source:
The promise and peril of a digital ecosystem for the planet (UNEP, 2019)

In the next 10 years we must reduce emissions by 50%,
7.6% per year on average. Business as usual is NOT working.
Only frontier technologies move at this speed and scale.



We must move
our approach to
climate action
from an analog to
a digital world
powered by AI.

The future is ours
to shape.

EXTRA SLIDES

Impact functions

Impact functions definitions

Impact sub-functions

Connect & Communicate

Connecting people to each other and to critical information/ the internet.

- Public awareness messages
- Targeted content
- Digital marketplaces and business models
- Digital payments and finance

Monitor & Track

The real-time, extensive observation of the world and its natural and man-made systems.

- The environment
- Populations, people and activities
- Organisations and supply chains
- Individual assets and rights

Analyse, Optimise & Predict

The development of insights from data, and the use of those insights to drive process efficiency and infer the future.

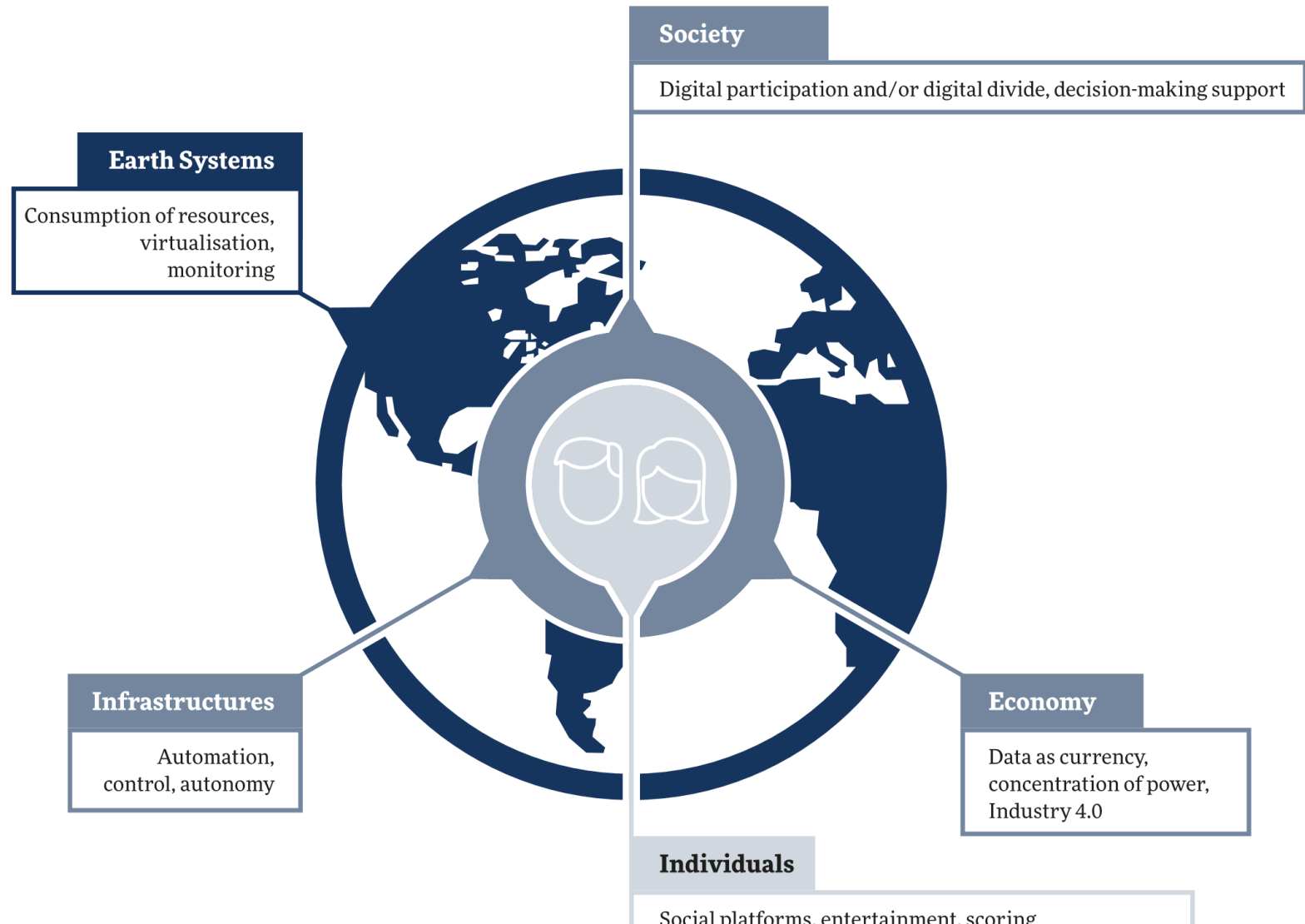
- Process optimisation
- Socio-ecological analysis and targeting
- Rapid data analysis for innovation
- Future state prediction

Augment & Automate

Provision of an “active bridge” between digital and physical, from simulation through augmentation to the creation of autonomous systems.

- Immersive experiences to aid decision making
- Augmented humans
- Autonomous processes and machines

These frontier technologies are having a profound disruptive influence on the 5 main systems that underpin transformation



Applications of ICT for climate action

1. Automated detection and monitoring

- Emissions
- Renewable energy potential
- Climate-related hazards



2. Risk assessments and impact modeling

- Security: hazards, conflict, migration, geopolitics
- Species / ecosystem distribution
- Insurance



3. Predictive analytics, forecasting and scenarios (what if) for decision-support

- Solar / clouds
- Temperature
- Agriculture
- Water
- Air quality



4. Optimization of energy and materials use

- SMART cities, agriculture, electrical grids/load management, thermostats
- Product design
- Supply chains on carbon intensity
- Oil and gas reserves



5. Consumer awareness and behavior nudging

- Calculation of carbon footprint
- Peak load periods



6. Quality control / assurance

- Blockchain
- Stopping fake news / fake data
- Hackers and gaming the system



An array of big data sources

Satellites



4,987 Satellites in orbit in 2019¹²
5,700 generated scenes per day (open source)
Landsat archive **32 years** - over **5 million scenes**¹³
Entire terrestrial surface imaged every day

Sensors



15.4 billion sensors in 2015
75 billion by 2025¹⁴

Internet of Things



IoT creates **40 zettabytes of data** per year¹⁵

Mobile phones



5 billion unique phones offering opportunities for geocoded data collection as well as daily movements¹⁶

Mobile apps



3 million unique apps¹⁷

Internet access



Over **4.4 billion people**, **57.3%** of population¹⁸

Digital platforms



Every minute of the day in 2018:
Youtube users watch **4,333,560 videos**
Amazon ships **1,111 packages**
Uber users take **1,389 rides**¹⁹

Censuses and surveys



More than **7 billion people** are covered by censuses every 10 years²⁰

Citizen science



500 million records on eBird²¹
58 million records on Artportalen²²
16 million records on iNaturalist²³

Publications and doc



Over **2.2 million scientific articles** on science and engineering²⁴
Over **50,000 corporate sustainability reports**²⁵

Administrative data



Governments, utility companies, and other services providers maintain data related to **registration, transaction and record keeping**²⁶

Finance data



Financial databases cover **189 countries** to date²⁷