The role of emerging digital technologies for climate change mitigation and adaptation

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WIPO GREEN

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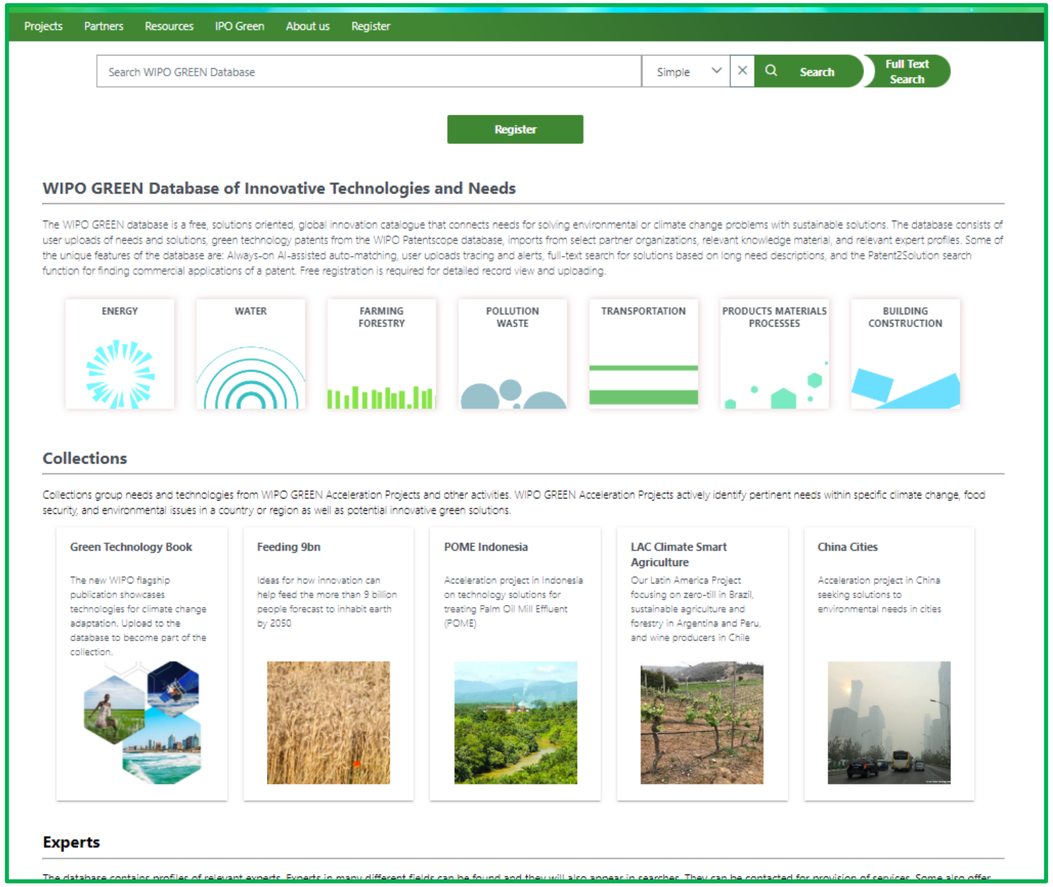
WIPO: UN agency for innovation, creativity and intellectual property (IP). Supports a just global IP system through 23 international treaties

WIPO GREEN: green technology matchmaking platform. Connects those seeking technologies, with green technology providers and solutions for global challenges

WIPO GREEN Database a central tool



- Free UN-based database
- Open access to 3,900 technologies and 129,000 patent descriptions
- Identification of potential partners, suppliers or licensees for green innovation: access to contact details
- Source of information on green technology trends and developments through the database’s resources and publications

Green Technology Book:
A catalogue of more than 600 climate technologies

1st edition: climate adaptation technologies
2nd edition: climate mitigation technologies
3rd edition: energy technologies

607 solutions and counting – ranging from local and indigenous people's techniques to advanced and digital climate technologies

2.3 million page views
1.2 million unique visitors
40,000 downloads of pdf

Highlights climate technologies for: agriculture & forestry, cities, industry, water & coastal zones

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Emerging digital technologies play an important role

- The Green Technology Book, *Mitigation Edition,* refers to “digital” or “digitalization” 156 times
  - In addition: nearly 100 references to “robotics”, “AI”, “ICT” or “machine learning”
  - 38% of mapped technologies integrate one or more of these elements

- Digital component in climate-related patents:*
  - 20% of climate-related patents have a digital component
  - 60% of climate-related trademarks

- Few, but interesting, references in countries Nationally Determined Contributions:**
  - ICT: 17 of 197 – majority in Africa
  - AI: 6 of 197

* Amoroso S., et al. (2021). World corporate top R&D investors: Paving the way for climate neutrality – A joint JRC and OECD report.

** Climatewatchdata.org

Adaptation: monitoring impact and strengthening resilience

Agriculture and forestry a key sector of opportunity

Monitoring and EWS	Emerging technologies help us monitor drought, floods, crop and soil health, vegetation cover, pest attacks and weather patterns.
Crop insurance	Advanced historical and real-time data collection and analysis enables climate risk assessments and subsequent crop insurance

Agriculture and forestry: Monitoring and early warning systems

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3. Agriculture and forestry / Early warning systems, modelling and monitoring / Proven technologies

Crop monitoring using artificial intelligence, machine learning and machine vision

is a precision agriculture company that provides monitoring and prediction of agricultural variables. The platform uses vehicle-based machine vision, artificial intelligence and machine learning technology to capture data and digitize processes normally carried out manually in the agricultural industry. This enables faster decision-making based on quantitative information about factors such as yield, irrigation and fertilization. Data can be entered into an app which then processes the relevant data to provide crop maps, harvest estimations and so on.

- Contracting type: Service
- Technology level: High
- Country of origin: Chile
- Availability: Worldwide

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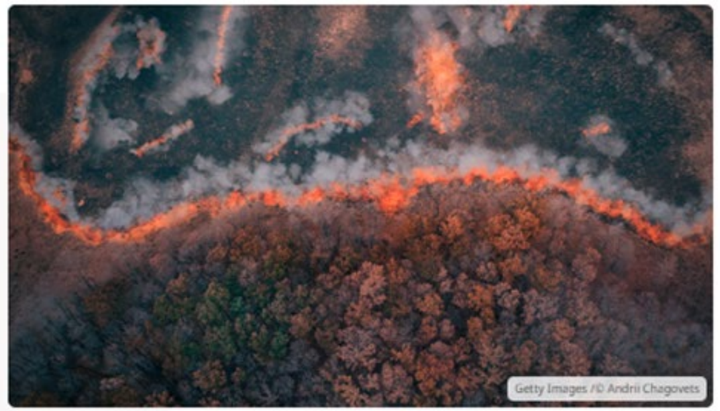
3. Agriculture and forestry / Forest and ecosystem management / Frontier technologies

Wildfire monitoring using artificial intelligence



is a company using artificial intelligence (AI) and image analyses to detect fire based on data from satellites, drones and land cameras. Satellite imagery is analyzed every 10 minutes to identify where new wildfires have started. The company has trained AI models to identify wildfires using aerial imagery with a high accuracy. Special cameras installed on satellites or aircraft capture videos that are then analyzed by the AI model to detect fire activity. Based on this information, alerts are then sent to decision-makers for them to take appropriate action.

- Contracting type: Services
- Technology level: High
- Country of origin: United States
- Availability: Worldwide

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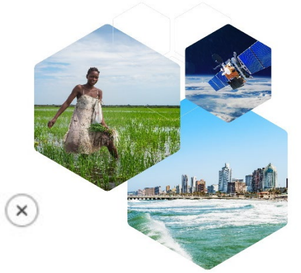
3. Agriculture and forestry / Livestock / Proven technologies

Smart tags for livestock monitoring

has developed so-called "smart tags." Attached to the ears of animals, these tags continuously monitor all aspects of animal behavior, health and welfare, including ambient temperature. For example, they detect and monitor signs of heat stress in cattle. A tag can run 10 years or more without a change of battery and all data is transmitted directly via a constellation of low earth orbit (LEO) satellites. Data can be collected without the need for any other infrastructure. Once received via satellite, all data is transferred and stored securely in the company's cloud-based data platform. This enables users to share data with third parties. Tags can be linked to existing herd or farm management software so that the data can be combined, analyzed and visualized

- Contracting type: For sale
- Technology level: High
- Country of origin: United States
- Availability: Worldwide

Agriculture: Resource optimization



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3. Agriculture and forestry / Farming technologies / Frontier technologies

Self-driving tractors

This technology makes more efficient use of farm inputs and labor to improve crop productivity. offers autonomous technologies for a wide range of applications. Through its open hardware and software platform, turns existing farm equipment into customized, autonomous field solutions through retrofit kits. These kits can be retrofitted to most equipment since many tractor models use the same steering, acceleration and control systems. An intelligent control system is connected to a cloud robotics platform. This allows farmers to dictate assignments such as feeding, harvesting, seeding and weeding from a mobile phone app. GPS technology is used to ensure accuracy.

- Contracting type: For sale
- Technology level: High
- Country of origin: Canada
- Availability: Canada

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3. Agriculture and forestry / Irrigation / Horizon technologies

Robotic irrigation systems

Artificial intelligence (AI)-based and automated solutions could increase water efficiency in the irrigation sector. In one example, researchers at the have explored robotic irrigation solutions for precision application of water grape vines. As infrared sensing and drones for remote monitoring of plant status are already available, researchers looked at ways to exploit that information. This included attaching small, cheap plastic emitters to individual irrigation lines. These were then controlled by devices operated by field workers or mounted on mobile robots. The devices signalled to the emitters when to adjust the amount of water received by each vine. The robots travel along rows of crops adjusting irrigation flows according to data provided by sensors, thus watering each vine according to need.

- Contracting type: Research collaboration
- Technology level: High
- Country of origin: United States
- Availability: N/A

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3. Agriculture and forestry / Early warning systems, modelling and monitoring / Proven technologies

Wireless sensor networks for management of agricultural resources

is a device designed for remote data capture and transmission in precision agricultural applications. The device allows the creation of wireless sensor networks to monitor, predict and optimize the management of agricultural resources in real time due to their cloud connection. These networks give greater control to farms, enabling them to manage disease, regulate the application of plant protection products, make efficient use of water in irrigation and optimize resource use in general. is compatible with various types of sensors, such as meteorological (temperature, humidity, pressure, rain, solar radiation), gas (H_2S, CO, CO_2, SO_2) or agricultural (leaf moisture, soil pH, dendrometers and so on). Through solar-powered wireless sensors connected to the cloud, the farm knows the real-time status of a wide range of variables involved in agriculture. By connecting to the service through computer, mobile phone or tablet, a farmer can take immediate crop productivity decisions.

- Contracting type: For sale
- Technology level: High
- Country of origin: Chile
- Availability: Worldwide

Mitigation: addressing GHG emissions

Industry a key sector of opportunity: digitalization of industrial processes could produce energy savings of up to 30 percent*

Resource-efficient manufacturing	producing lightweight parts, customizing production to reduce process waste, streamlining manufacturing processes, predictive maintenance, digital material passports for enhanced reuse and recycling, optimized material flows and supply chains etc.
Energy-efficient manufacturing	smart grid integration, energy management systems and optimization, temperature monitoring etc.

- *IEA (2019)

Industry 4.0: manufacturing industry (steel and cement)

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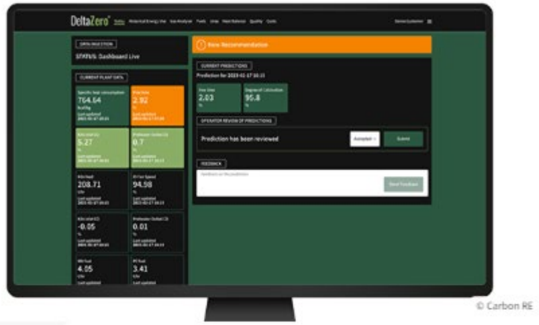
4. Industry / Industry 4.0 / Frontier

AI platform for control room operators: optimizing steel and cement energy usage



a software platform that uses artificial intelligence (AI) to optimize steel and cement production processes. Analysis of real-time sensor data generates a high-resolution digital twin of the plant. This twin enables AI "agents" to learn process control through deep reinforcement learning – an AI area that has witnessed a significant breakthrough in recent years. Software then provides operators with clear, actionable recommendations for the various process stages and parameters. According to the company, up to 10 percent energy savings and 20 percent emission reductions can be achieved, while also keeping equipment within a safe operating space and controlling NO_x emission limits.

- Contracting type: For collaboration
- Technology level: High
- Country of origin: United Kingdom
- Availability: N/A

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4. Industry / Industry 4.0 / Frontier

AI-based cement plant predictive maintenance

supplies artificial intelligence-based predictive maintenance solutions for the cement sector. A specially developed algorithm, supported by sensors, helps predict plant failure. The technology simultaneously monitors the entire plant for anomalies, improving operational efficiency and reducing maintenance needs. Installation of the application takes approximately three months.

- Contracting type: For sale/service
- Technology level: High
- Country of origin: Greece
- Availability: Worldwide

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4. Industry / Industry 4.0 / Proven technologies

Automated control system for electric arc furnaces

has developed an automated control system for steelmaking electric arc furnaces. The company's SmartFurnace™ technology is centered around artificial intelligence. Its different modules enable key parameters to be measured and controlled, including temperature, off-gas, slag level, arc stability, as well as gas, oxygen and carbon status. Laser technology and off-gas sensors allow best operating points and energy saving to be quickly identified. The system can also control the rate at which steel is input through continuous feeding systems so as to maintain optimal temperature.

- Contracting type: For sale/service
- Technology level: High
- Country of origin: Mexico
- Availability: Worldwide

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Database collection – Industry 4.0

Industry 4.0

The next industrial revolution, Industry 4.0, is here with promises of smarter, more resource efficient production processes, and GHG emission reductions.

Proven | Frontier | Horizon

AI platform for cont...

Carbon Re

Digital twin in the ...

Ansys/Tata Steel

Drones, cloud comput...

Sund & Bælt

ML and Software as a...

Petuum Inc.

Optimized Electric A...

AMI Automation

Simens Insights Hub ...

Siemens AG

Augmented reality fo...

Microsoft Corporatio...

AI-based predictive ...

CemAI

Real-time optimizers...

TITAN Cement Group

Each chapter of the Green Technology Book is linked to a growing collection of technologies in the WIPO GREEN Database. Organizations and technology providers are welcome to create a profile and add their solutions as well as technology needs to these database collections.

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Green Technology Book
Solutions for climate change mitigation

Thank you
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