

Universidad del
Rosario

Australia-Colombia Clean Energy and Sustainability

Symposium

Driving the Future:

**Colombian Universities at the Forefront of
Energy Transition and Disruptive Innovation**

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Dean School of Engineering, Science and Technology



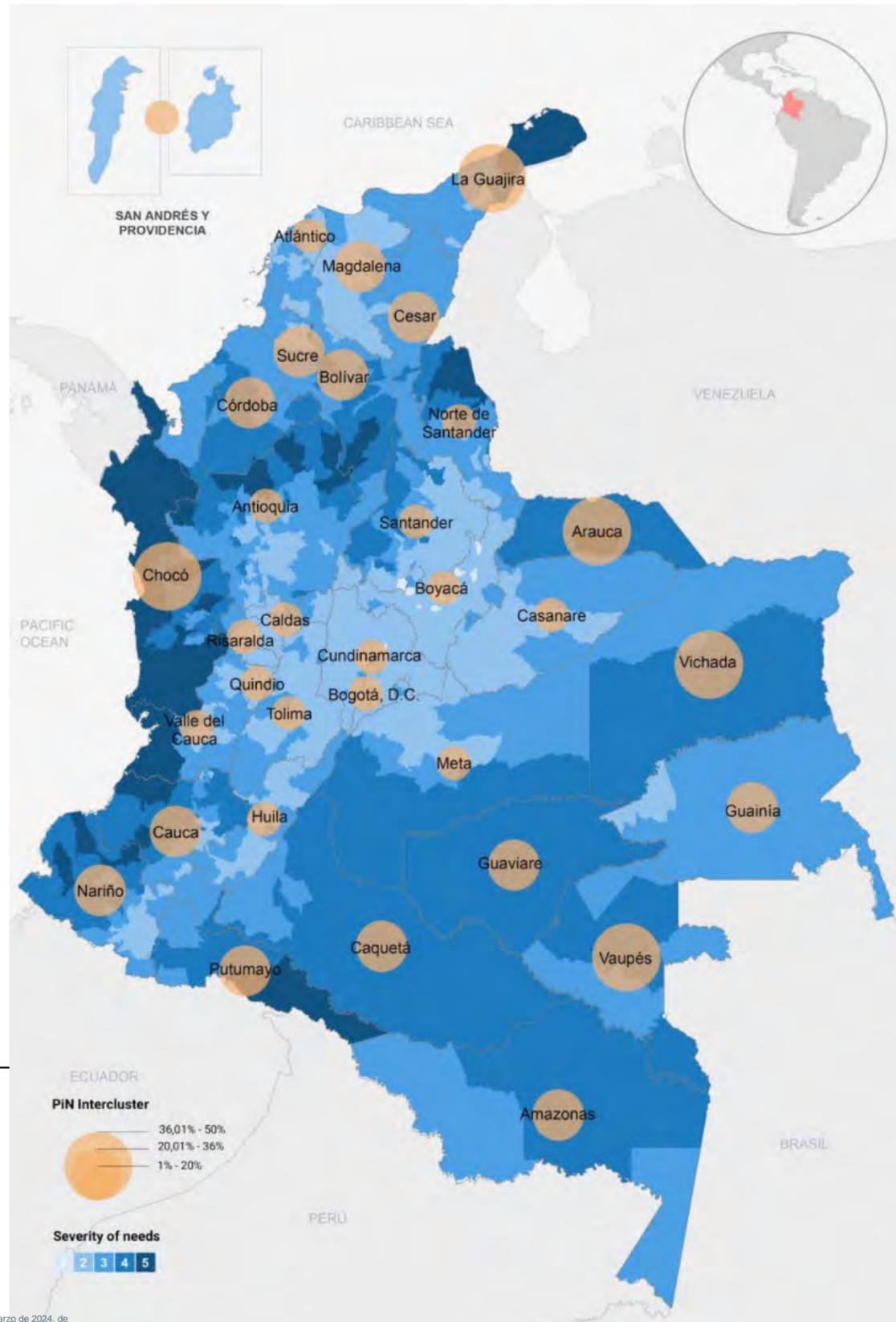
Colombia Overview



Colombia's Gross Domestic Product (GDP) is currently experiencing a notable upswing, indicating a robust path of economic recovery.

Colombia - Gross domestic product (GDP) per capita 2028. (s/f). Statista. Recuperado el 18 de marzo de 2024, de <https://www.statista.com/statistics/369116/gross-domestic-product-gdp-per-capita-in-colombia/>





The **severity of needs** in territories, measured on a scale from 1 to 5, allows for a quantitative assessment of the urgency and gravity of needs across different geographical areas. This scale is defined as follows:

- **Minimal:** Indicates that needs are very low or practically nonexistent. The population has access to the necessary basic resources and services for their well-being and development.
- **Low:** Shows that there are some needs, but they are of minor importance. Resources and services are available, but improvements or additions might be needed in certain areas.
- **Moderate:** Demonstrates that needs are evident and significantly affect the population. Interventions are required to improve the quality of life and access to basic services.
- **High:** Indicates that needs are critical and urgent. There is a significant lack of access to essential resources and services, and the population faces serious difficulties in meeting their basic needs.
- **Extreme:** Points out that needs are extremely severe and urgent, with a critical situation that requires immediate intervention. The population is in a high vulnerability condition, with very limited or no access to basic services and resources, and at risk of suffering severe consequences without immediate support.

This scale enables decision-makers, humanitarian organizations, and governmental entities to prioritize and allocate resources efficiently to address the most pressing needs first.





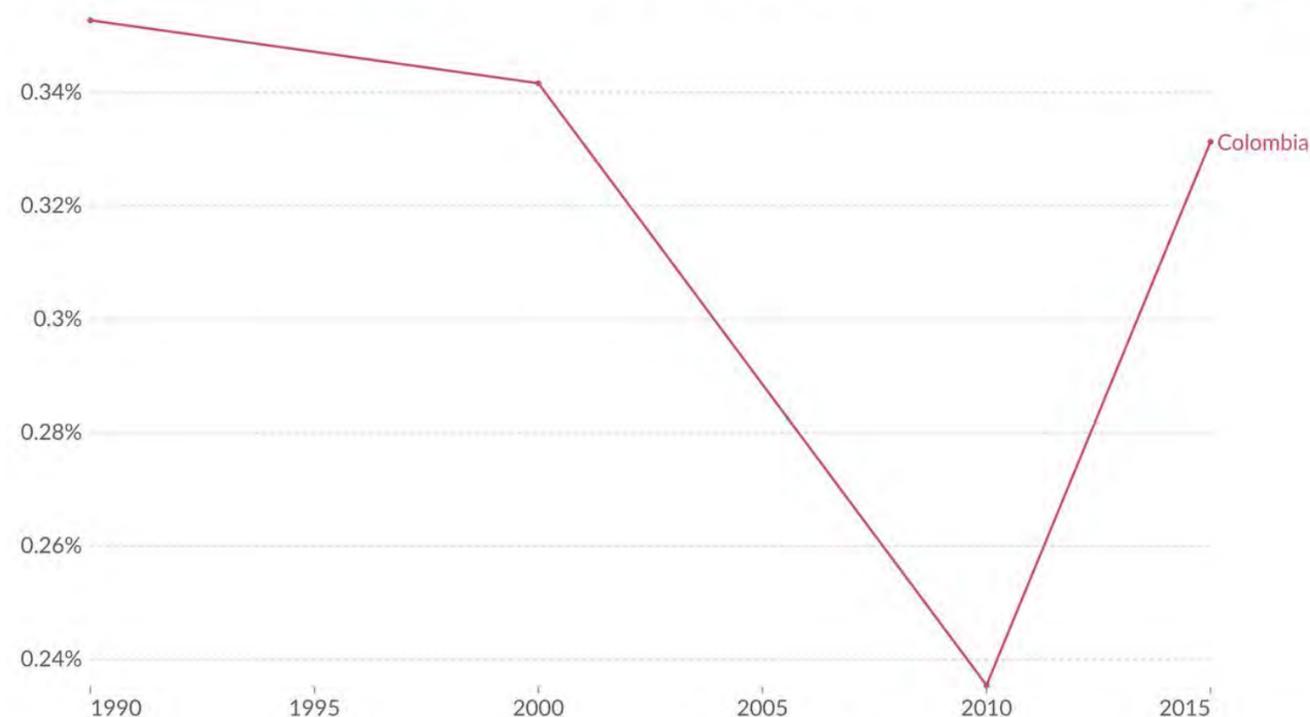
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Colombia Overview



Annual deforestation as a share of forest area

Our World in Data



Data source: UN Food and Agriculture Organization (FAO). Forest Resources Assessment.

Note: The UN FAO publish forest data as the annual average on 10- or 5-year timescales. The following year allocation applies: "1990" is the annual average from 1990 to 2000; "2000" for 2000 to 2010; "2010" for 2010 to 2015; and "2015" for 2015 to 2020.

OurWorldInData.org/forests-and-deforestation | CC BY

PEOPLE IN NEED DISAGGREGATED DATA

Women
4.184.408

Men
4.122.720

Elderly
1.132.949

Girls
1.219.045

Boys
1.274.312

People with disabilities
243.838

REFUGEES AND MIGRANTS*

Women
1.915.425

Girls
905.051

Men
1.493.454

Boys
942.880



*Refugees and migrants from Venezuela, Colombian returnees, and their host communities

Colombia persists in confronting enduring humanitarian challenges caused by conflict and climate change-induced disasters, which have a significant impact on communities.

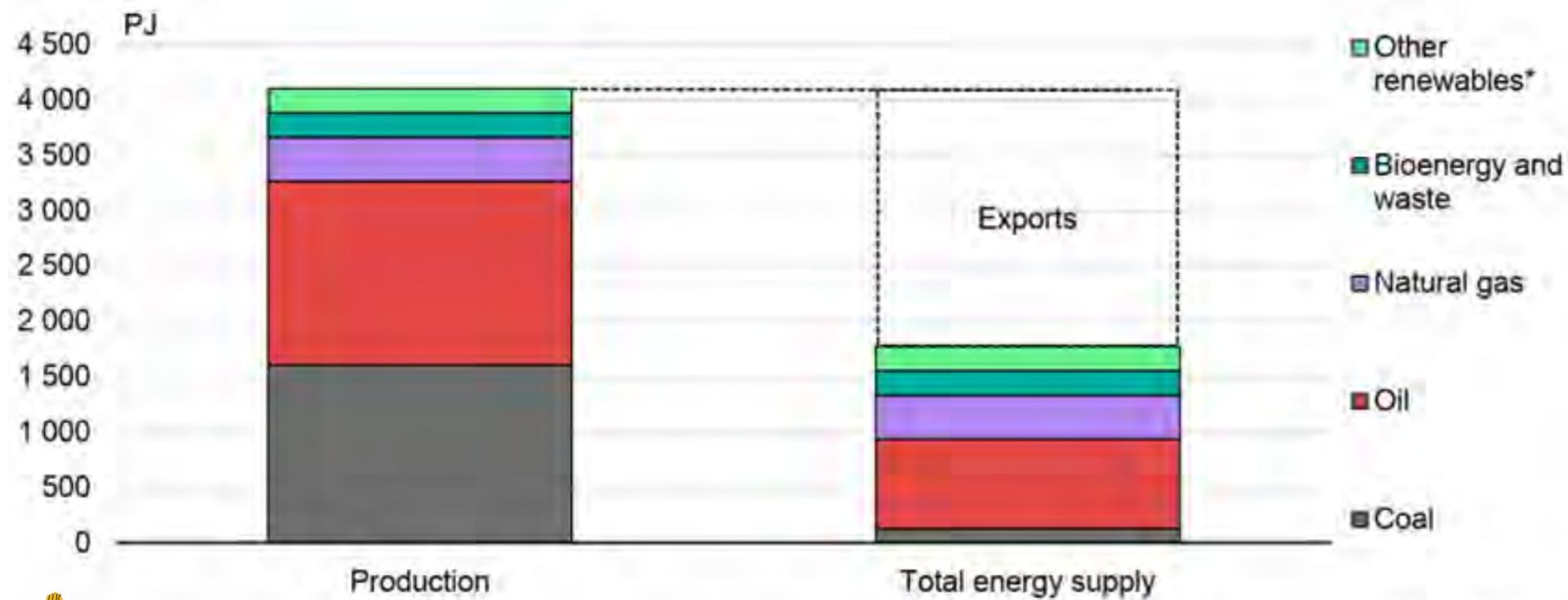
Colombia - Gross domestic product (GDP) per capita 2028. (s/f). Statista. Recuperado el 18 de marzo de 2024, de <https://www.statista.com/statistics/369116/gross-domestic-product-gdp-per-capita-in-colombia/>

Colombia. (s/f). Unocha.org. Recuperado el 18 de marzo de 2024, de https://www.unocha.org/colombia?_gl=1*_pxoeh*_ga*MTg2MjAzODk4MS4xNzEwNjA2NzUx*_ga_E60ZNX2F68*MTcxMDYwNjc1MS4xLjEuMTcxMDYwNzYzMC42MC4wLjA





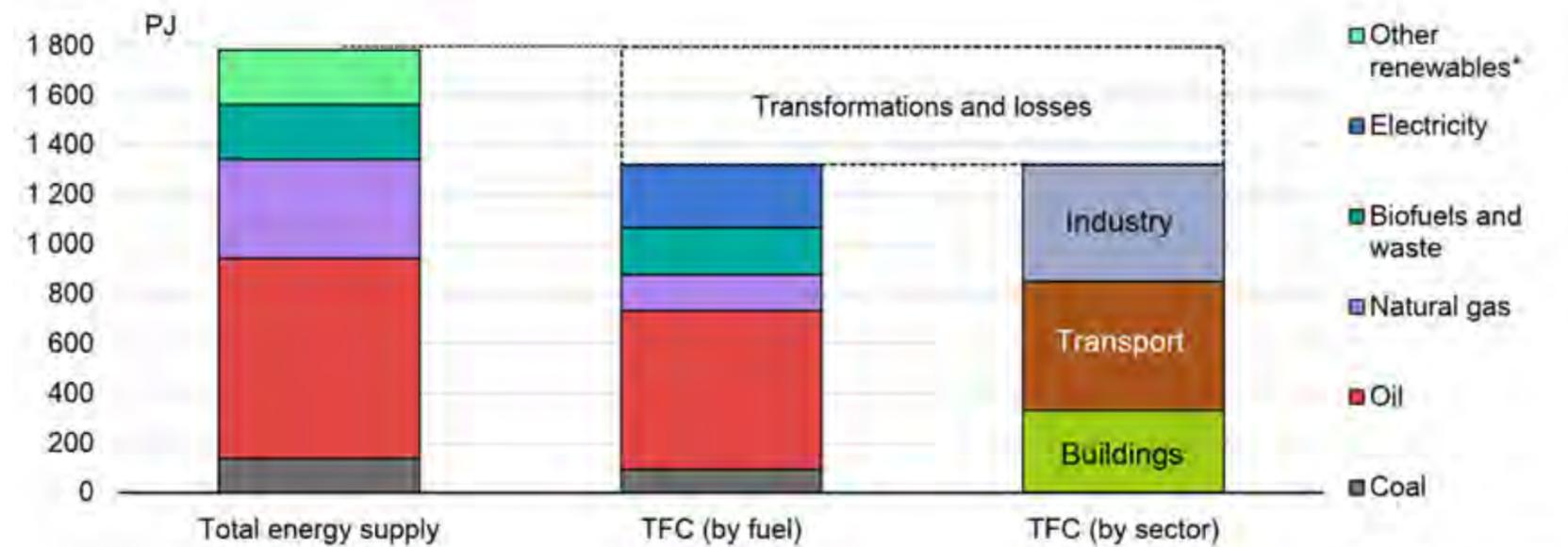
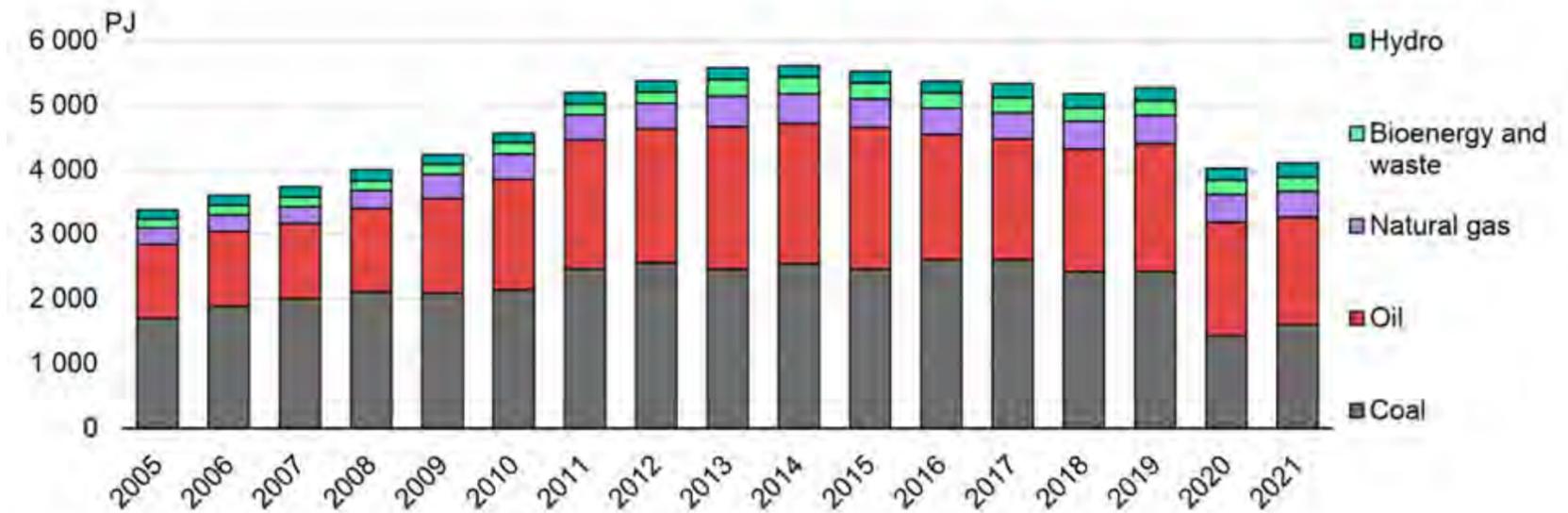
Colombia is an oil and coal net exporting country.
In 2021, Colombia exported 59% of its domestic energy production



Colombia Overview



- **Fossil fuels accounted for 89% of total energy supply (TES).**
- **TES also consists of significant shares of renewable energy sources, mostly bioenergy and waste (16%) as well as hydro (13%) and a small share of solar and wind (0.1%).**



IEA, CC BY 4.0

IEA, Colombia 2023: Energy Policy Review,
2023



Just Energy Transition



DECENT JOBS AND WORKER PROTECTION

- 1 Design transitions to maximise the creation of decent jobs
- 2 Develop tailored government support for communities and workers as well as a focus on skills and training
- 3 Use social dialogue, robust stakeholder engagement and policy co-ordination to deliver better outcomes

SOCIAL AND ECONOMIC DEVELOPMENT

- 4 Ensure that policies enhance social and economic development, and improve quality of life for all
- 5 Prioritise universal clean energy access and the elimination of energy poverty
- 6 Maintain and enhance energy security, affordability and resilience

EQUITY, SOCIAL INCLUSION AND FAIRNESS

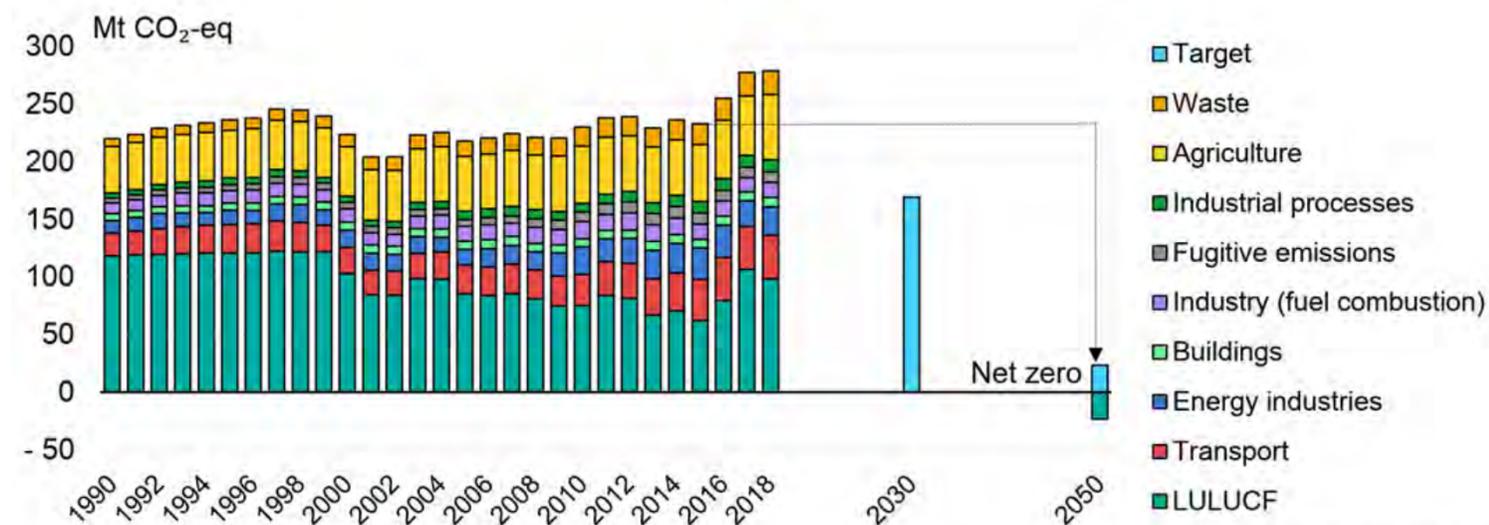
- 7 Incorporate gender, equality and social inclusion considerations in all policies
- 8 Ensure fair distribution of clean energy benefits and avoid the risk of disproportionate negative impacts on vulnerable populations
- 9 Integrate the voices of younger generations in decision making

PEOPLE AS ACTIVE PARTICIPANTS

- 10 Involve the public through participation and communication
- 11 Use insights from behavioural science to design effective behaviour change policies
- 12 Enhance impact through international collaboration and exchange of best practice



ECOLOGY
— Think green —



IEA. CC BY 4.0.

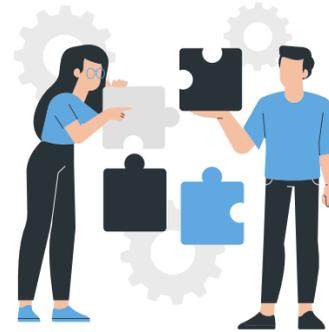
IEA. CC BY 4.0.

Source: IEA (2021).



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How to approach it?



UR Programs (EICT)



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5 UNDERGRADUATES

Applied Math and Computer Science
Electronic Engineering
Data and Market Analytics

Energy Systems Engineering
Industrial Engineering

1 PHD

Engineering, Science and Technology

7 MASTER PROGRAMS

Applied Math and Computer Science
Renewable Energies
Engineering, Science and Technology



Universidad del Rosario | URSTEAM

Business Analytics Smart and sustainable cities Materials Design and Innovation Strategic information management and digital innovation

Research as a Formative Process: Born from the Student Body

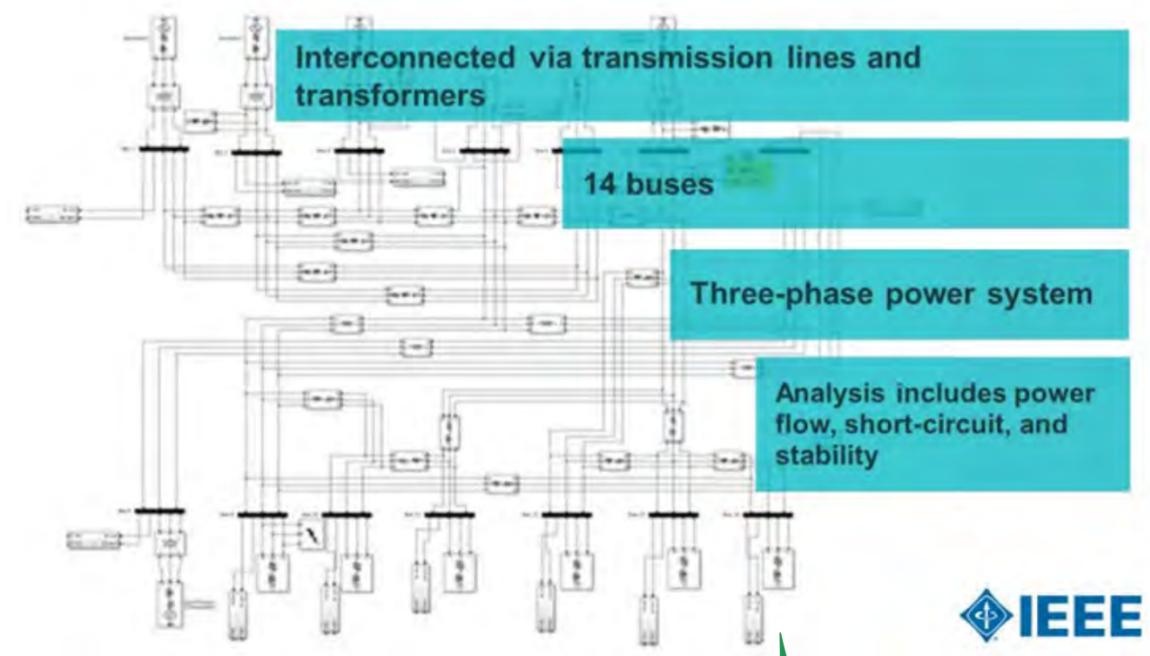
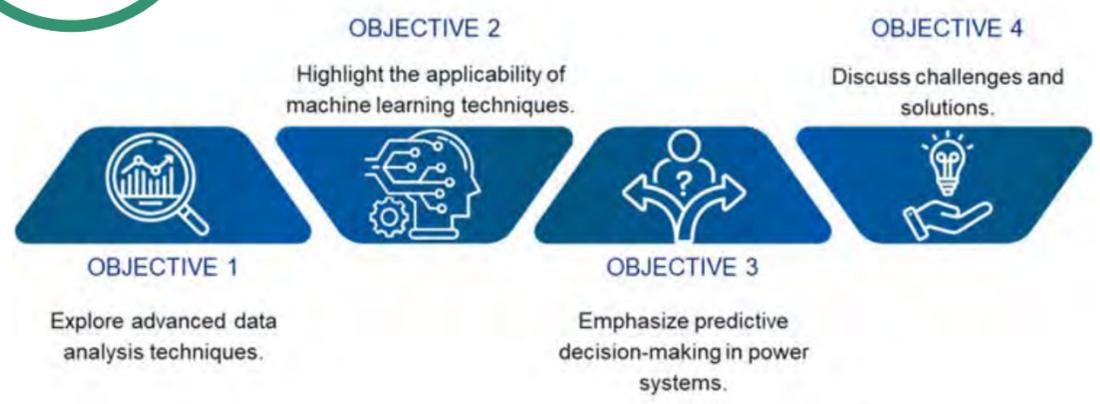
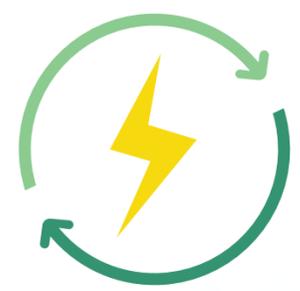
- Research output at the school in 2023 doubled compared to the year 2022.
- 98% of this output is ranked within quartiles 1 and 2.
- Establishment of 11 research groups.
- Formative research integrated into the curriculum.
- Creation of an international research internship as a graduation option.
- In a university "by and for" students, research in our school originates from the student body!



Undergraduate Research



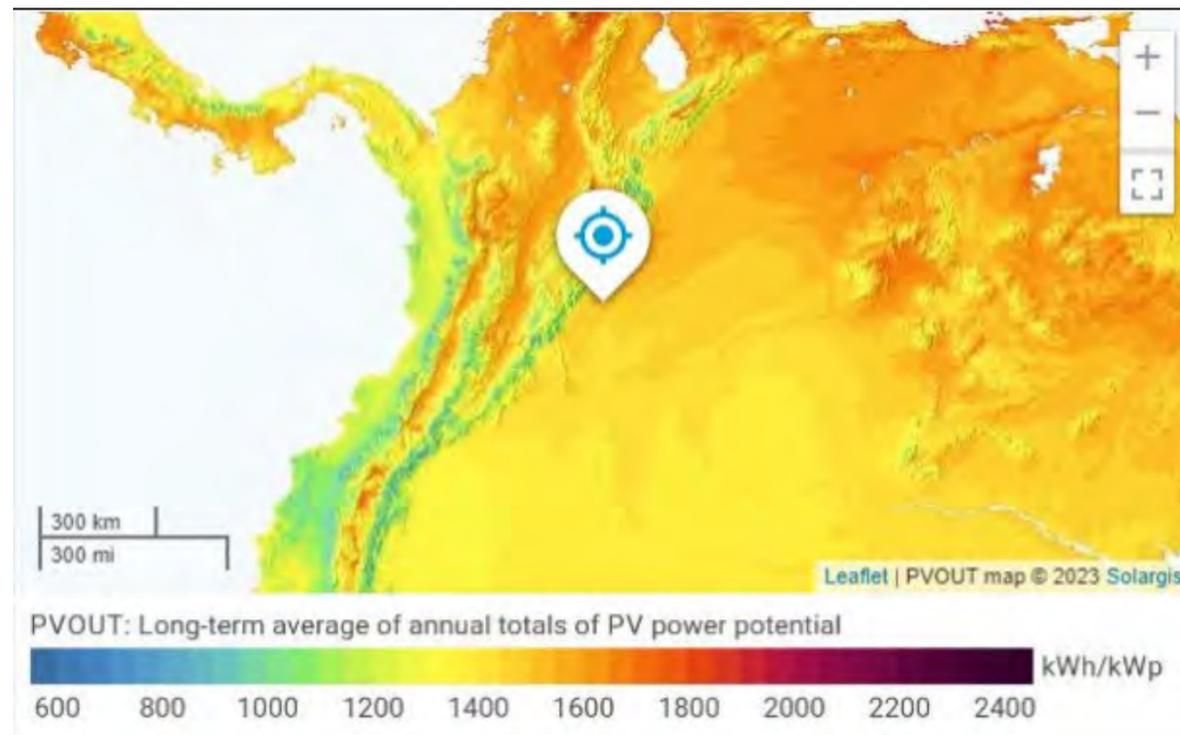
Machine Learning for Smart Energy Systems



**Ana María Garzón, Víctor Siacha,
Natalia Laiton and Sabina Moreno**

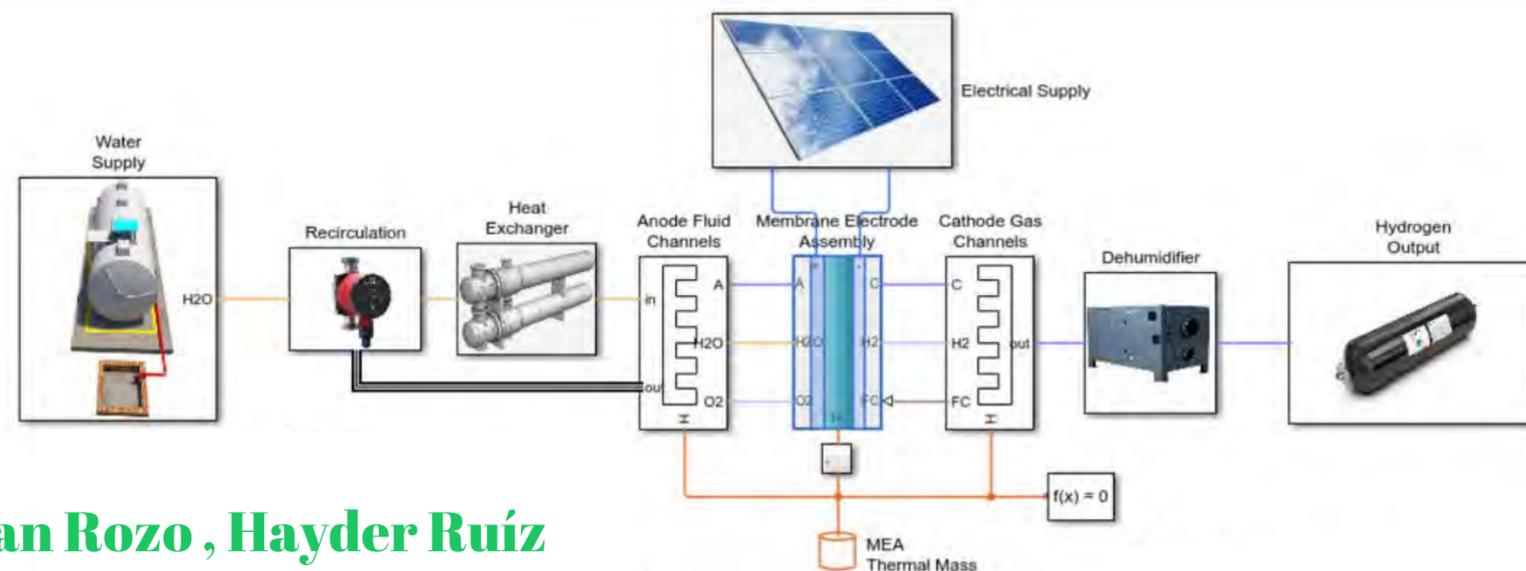


Modeling of a pilot system for green H₂ generation through electrolysis of wastewater, using PV solar energy



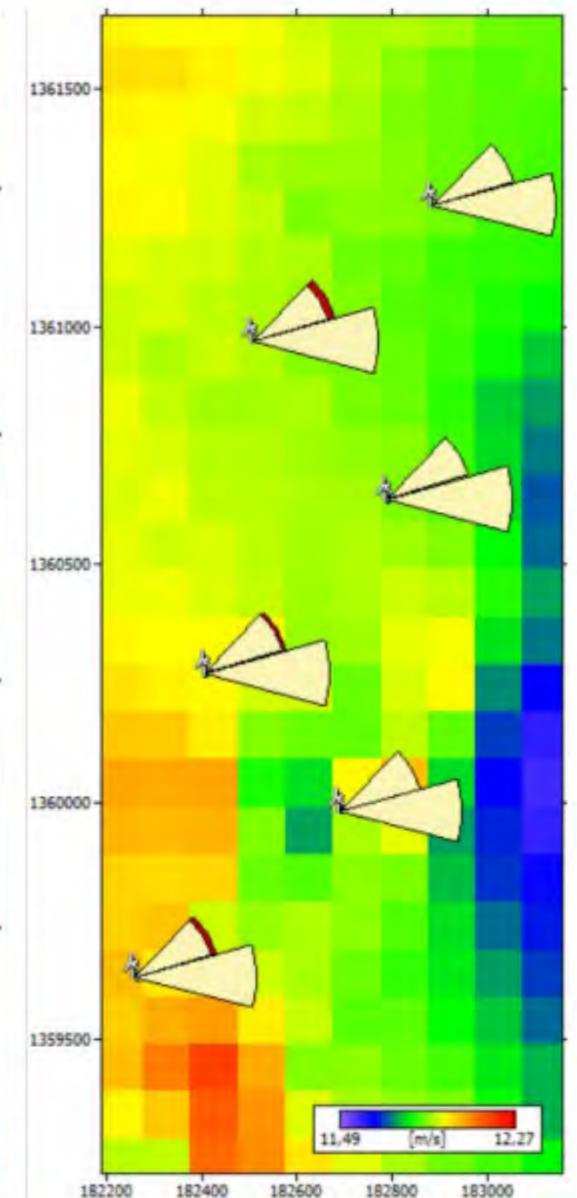
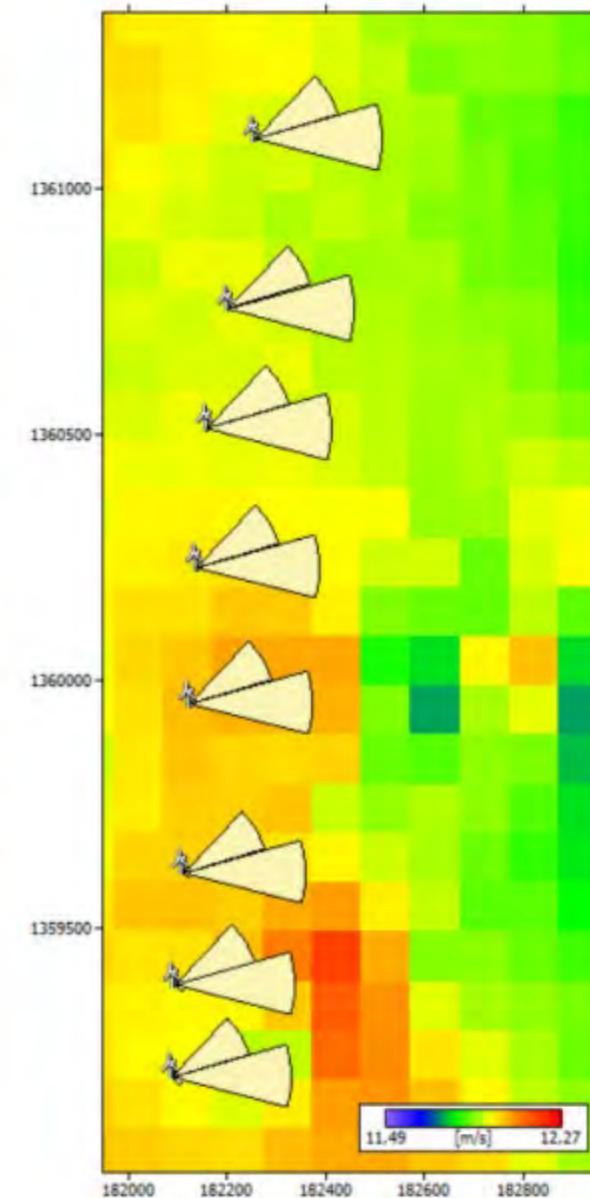
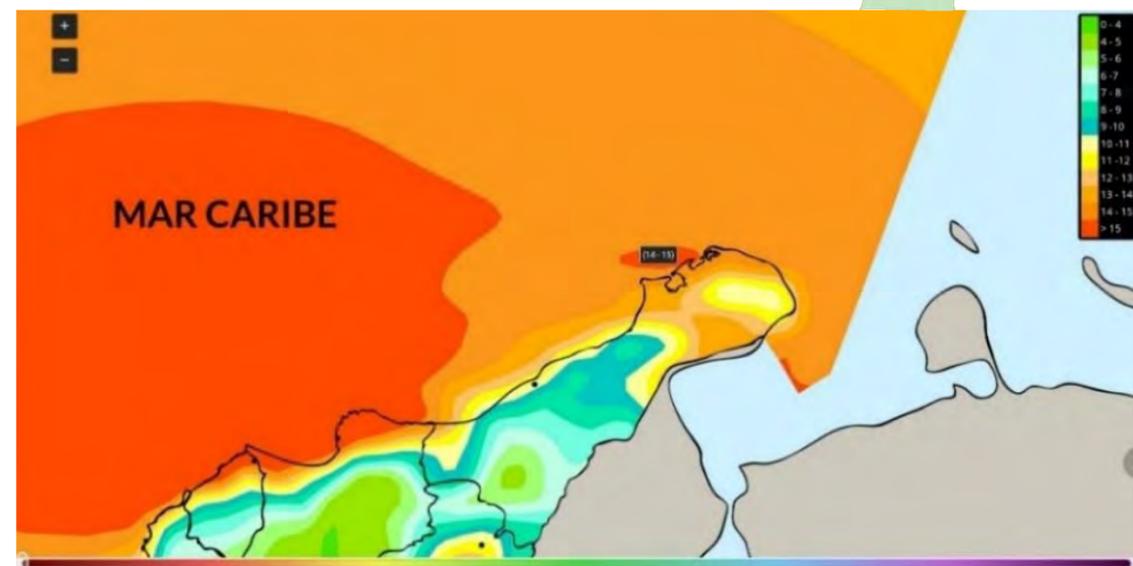
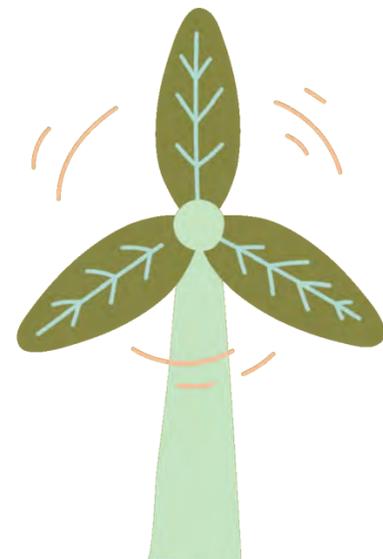
This project has a strong environmental - aim where modelling is the key to counteract the contamination problems throughout two main perspectives:

- **Industrial wastewater reutilization, from oil/gas fields.**
- **Viability of green hydrogen as energetical vector, which is currently obtained through unconventional methods.**



Design of a community project for wind energy generation for the sustainable development of the Wayuu territory

- Aiming to design a community-centric wind farm for national grid electricity supply.
- Technical, economic, and social feasibility of a wind energy project involving community participation in Wayuu territories of Upper and Middle Guajira.



Graduate Research-Renewable Energy Master

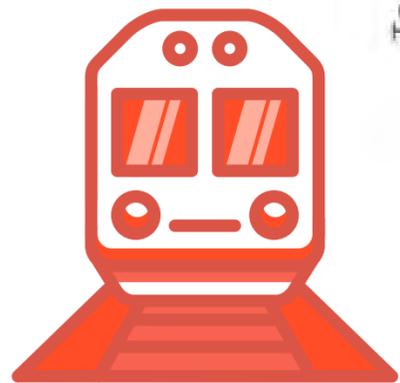
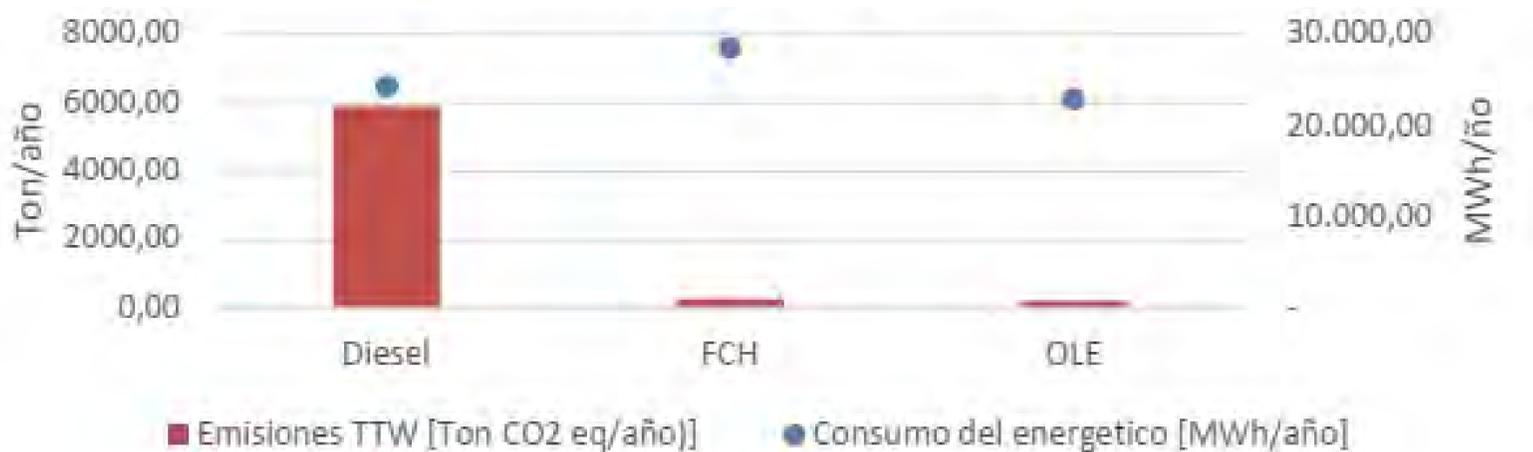
Pre-feasibility study for the propulsion of a train with green hydrogen in Colombia



- **Pre-feasibility study of hydrogen-powered freight rail transport from Non-Conventional Renewable Energy Sources - NCRE.**

- **Feasibility of implementing a technological change to reduce GHG emissions while maintaining competitiveness parameters.**

CO₂ Emissions



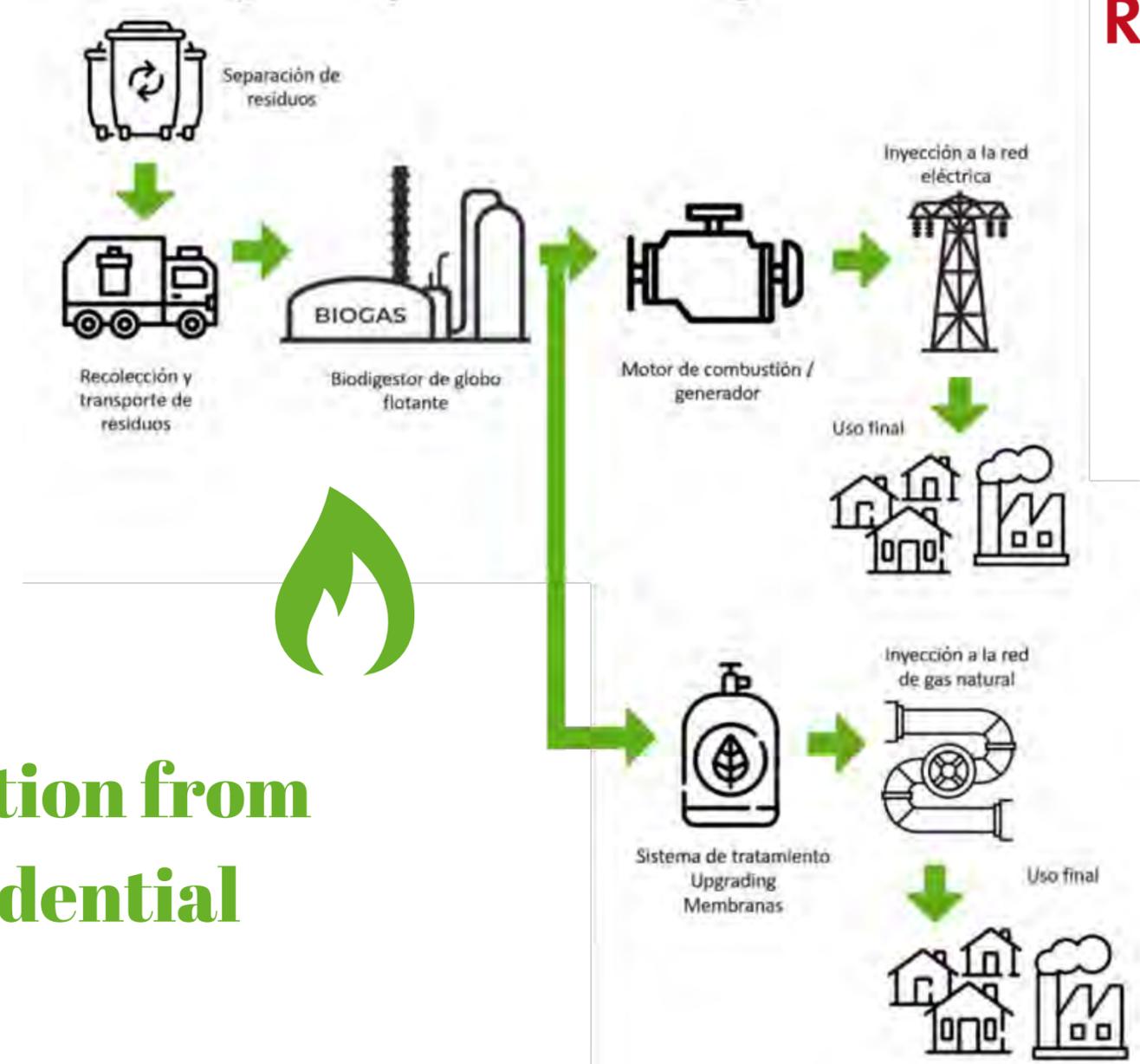
Andres Tautiva Mancera

Graduate Research-Renewable Energy Master

Diana Polanía, Faber Isaza, Yuly Pérez

- Includes the analysis of the demand for electricity and NG, based on the characterization of Municipal Solid Waste (MSW).
- Design of two generation models for electricity and gas, evaluating the different biodigester technologies

Prefeasibility of electricity and gas generation from the digestion of the organic fraction of residential waste in the municipality of Simijaca



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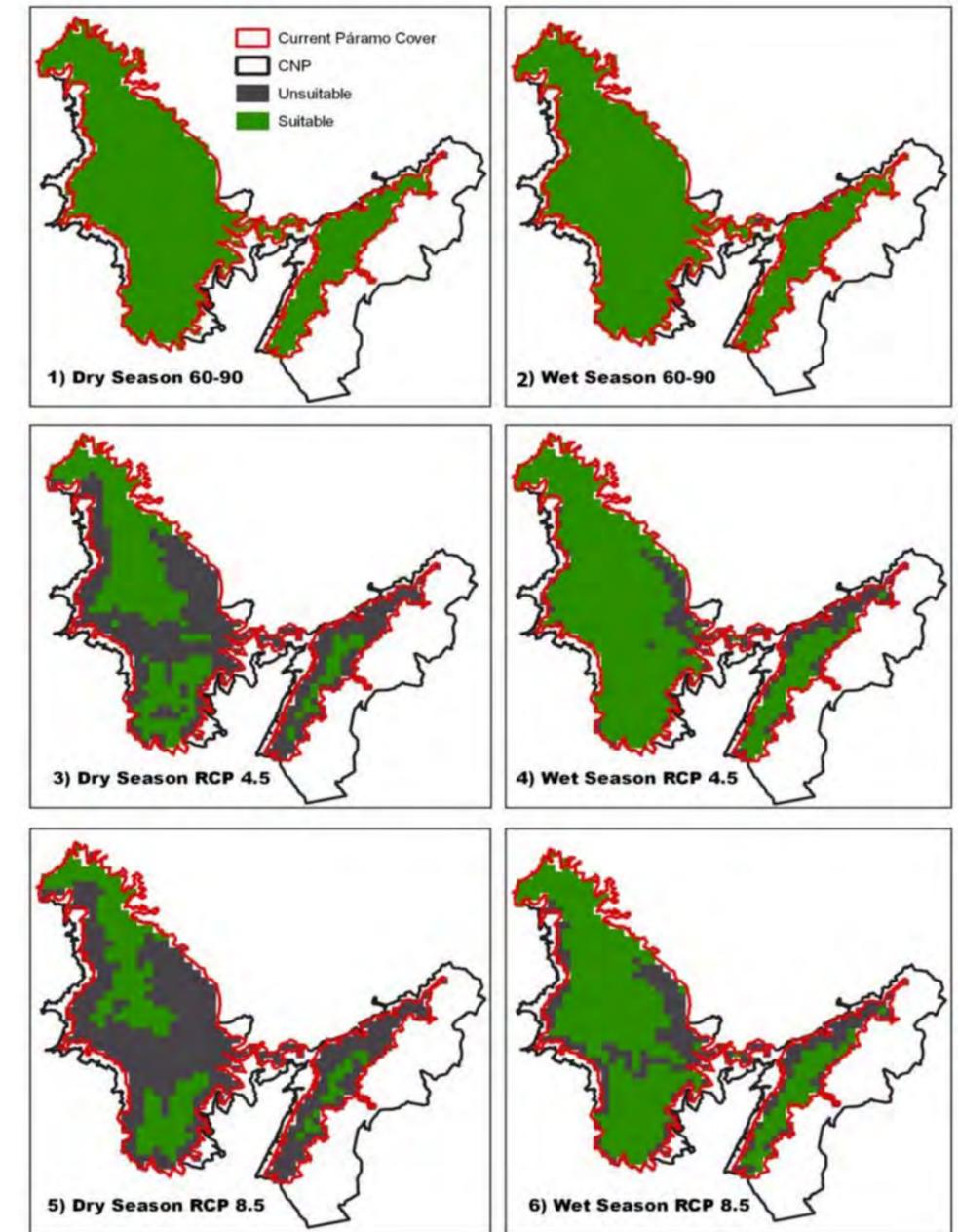
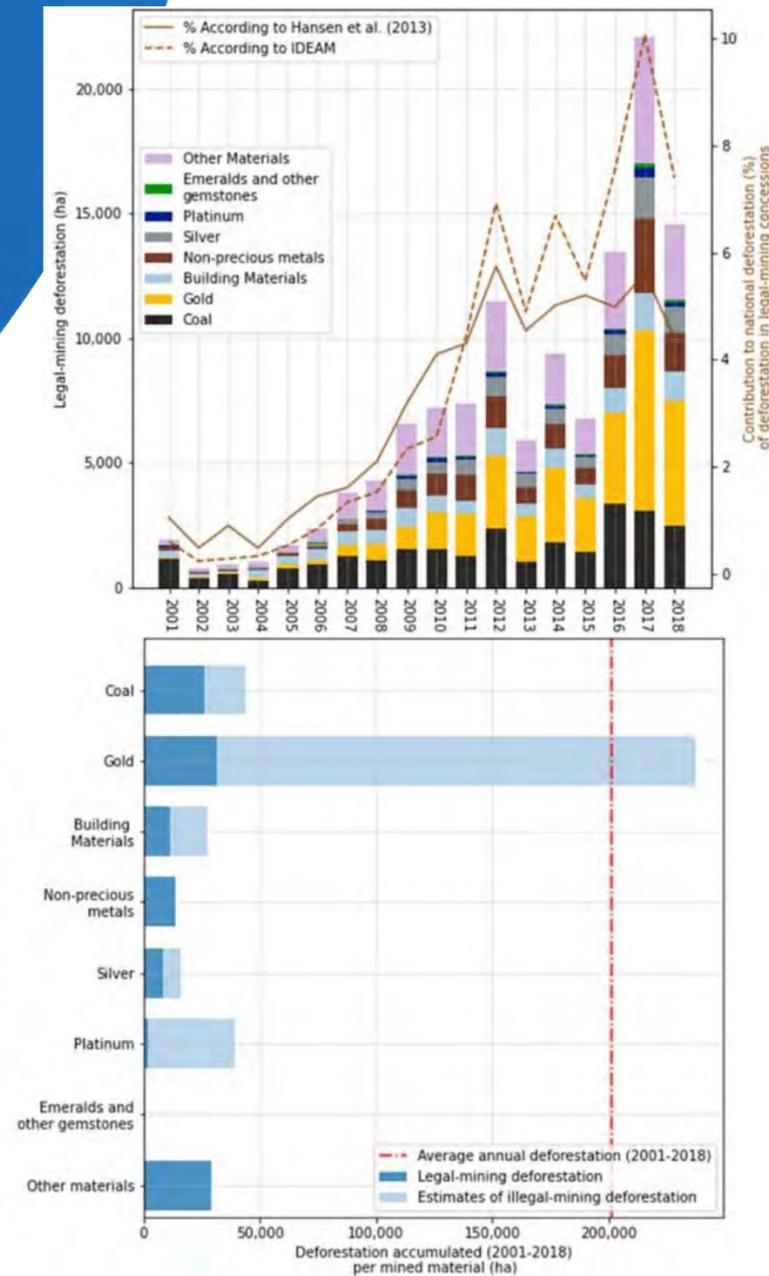
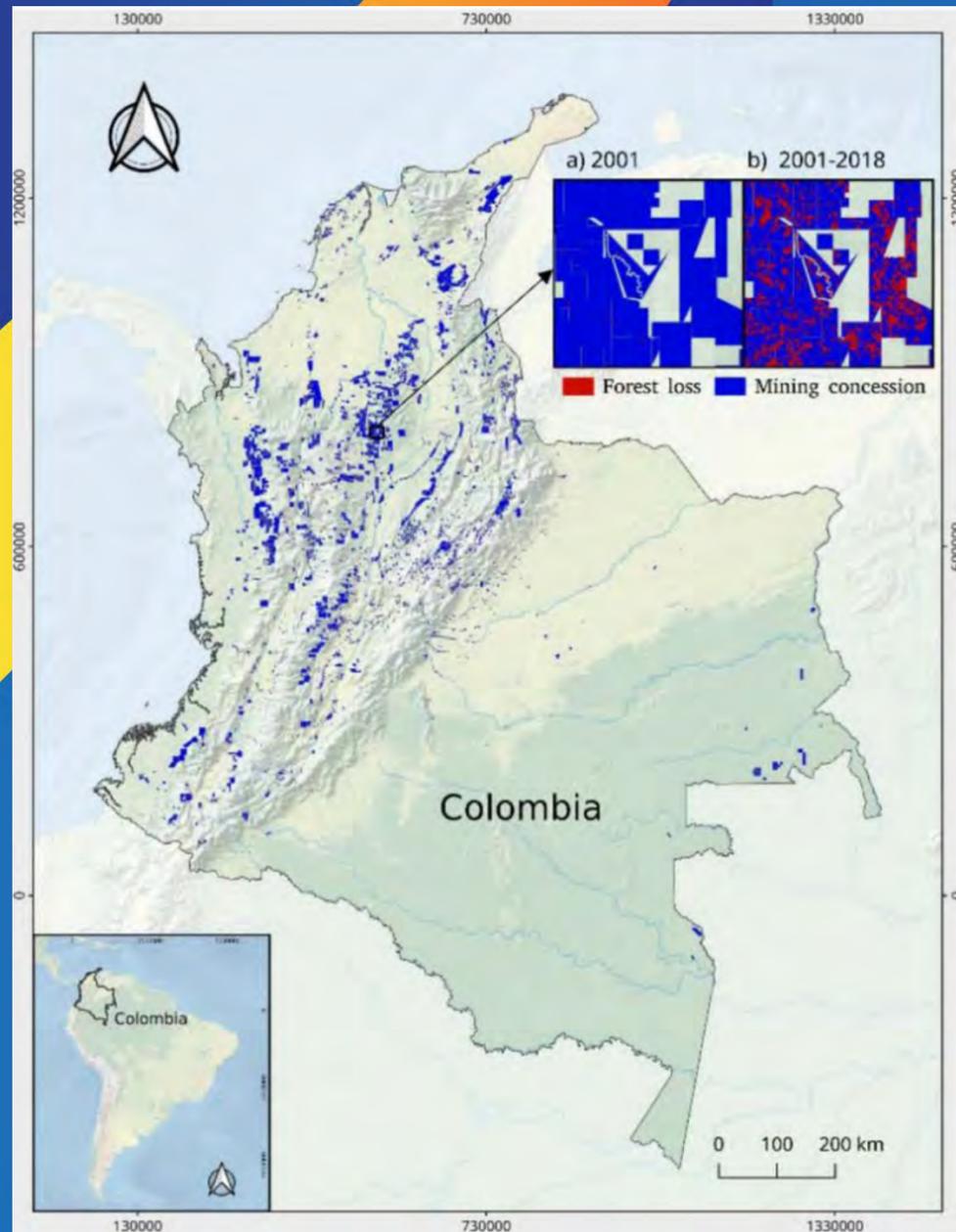


Growing mining contribution to Colombian deforestation

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Future Climate Change Renders Unsuitable Conditions for Paramo Ecosystems in Colombia

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Baltic Sea Centre, Stockholm University, 10691 Stockholm, Sweden

What's missing?

Goals

-  1: No Poverty
-  2: Zero Hunger
-  3: Good Health and Well-Being
-  4: Quality Education
-  5: Gender Equality
-  6: Clean Water and Sanitation
-  7: Affordable and Clean Energy
-  8: Decent Work and Economic Growth
-  9: Industry, Innovation and Infrastructure
-  10: Reduced Inequality
-  11: Sustainable Cities and Communities
-  12: Responsible Consumption and Production
-  13: Climate Action
-  14: Life Below Water
-  15: Life On Land
-  16: Peace, Justice and Strong Institutions
-  17: Partnerships for the Goals



Current level: bars shows current level of achievement on each available target. The longer the bar, the shorter the distance still to be traveled to reach the 2030 target. Colors refers to the Goals.

Trend assessment: the outer ring describes the trend using stoplight colours to measure progress towards the target

-  Target is achieved or on track to being achieved
-  No progress or moving away from the SDG target
-  Progress has been made, but is insufficient
-  No (or insufficient) data





Partnerships

**Inclusive
governance**

**Policy
Integration**

**Data collection
and monitoring**

**Infraestructure
Development**

**Sustainability and clean energy
challenges know no borders, but
neither do the opportunities for
collaboration.**





Thank you
Gracias



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