SOLAFRICA

SOLAR FUELS

A project to reduce
energy poverty in Ethiopia

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ESTABLISHMENT OF A COMPETENCE CENTER FOR P2X TECHNOLOGY

P2X is a key technology for the energy transition. ↗ go to infobox
For countries like Ethiopia, which have excellent framework conditions for cost-effective renewable power production, P2X represents a strategic opportunity. Unfortunately, Ethiopia is not prepared to seize this opportunity today. It lacks both know-how and awareness from policymakers and the public. Through the establishment of a competence center including a pilot plant at the Adama Science and Technology University, we are helping to improve the situation and lay a foundation for future large-scale P2X projects in Ethiopia.

KEY DATA AT A GLANCE

PROJECT PARTNERS

Support on site: Adama Science and Technology University ASTU, Department of Materials Science and Engineering
Technical Support: Institute for Energy Technology of the University of Applied Sciences Eastern Switzerland (IET OST)

PLACE OF EXECUTION

Adama Science and Technology University ASTU, Department of Materials Science and Engineering Ethiopia, Oromia Region, Adama

PROJECT DURATION

Total project: 2022 – 2027
- Planning phase (I): January 2022 - December 2022
- Fundraising Phase II: January 2023 – June 2023
- Implementation phase (II): approx. January 2023 - December 2025
- Research phase (III): approx. January 2025 - December 2027

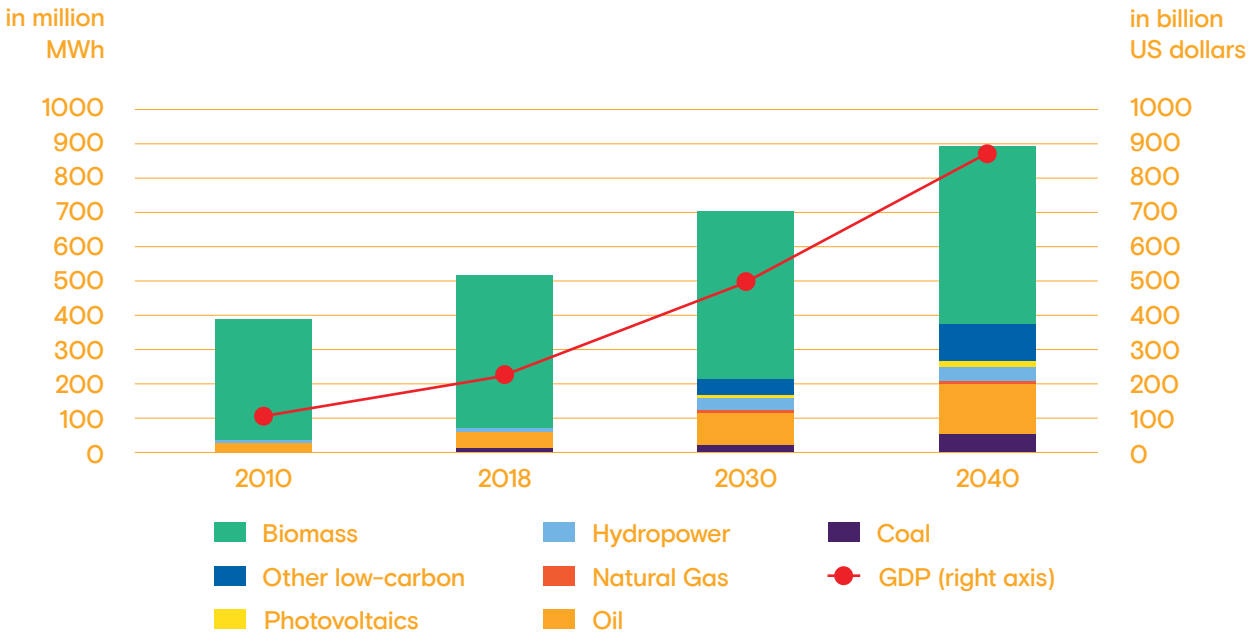
PROJECT BUDGET

- Phase I: CHF 150,000
- Phase II: CHF 2,400,000
- Phase III: CHF 350,000

KEY DATA OF PLANNED PLANT

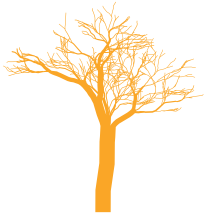
- Product: approx. 1 l methanol per hour
- Power source: Photovoltaic system with approx. 100 kWp power
- Location: ASTU Campus

ENERGY POVERTY IN ETHIOPIA

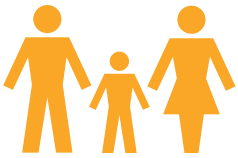


Development of primary energy consumption in Ethiopia according to IEA "stated policies" scenario

In Ethiopia, a large part of the rural population is affected by energy poverty. Biomass, among other firewood, is often the only affordable and available source of energy. The consequences are dramatic for both humans and the environment:



- Decreasing forest area
- Forest ecosystem loss
- CO_2 emissions as a result of overexploitation
- Increasing drought periods
- Soil erosion



- Respiratory and circulatory diseases, developmental disorders
- Large, increasing collection effort
- Equality barrier for women (women are usually responsible for collectin the biomass and for cooking)

EXAMPLE OF USE

The overexploitation of Ethiopia's forests can only be stopped if the population gets access to suitable alternatives. Fuels produced locally from solar power using P2X can be precisely this alternative in the future. Thanks to particularly favorable framework conditions, continuous improvements of the technology and the sale of CO_2 certificates (the substitution of biomass with solar fuels allows in certain parts of Ethiopia the avoidance of more than 1 ton of CO_2 per person per year), P2X could soon become competitive in Ethiopia. In the long term, an export of solar fuels would also be a possibility (e.g. to Switzerland).

P2X AS A KEY TECHNOLOGY FOR THE GLOBAL ENERGY TRANSITION

One central challenge of the energy transition is to bring the supply of renewable energies into line with the demand. Power-to-X (P2X) does precisely this by producing storable and transportable fuels from renewable energy. When photovoltaics are used as a source of electricity, they are commonly referred to as solar fuels. There is consensus that P2X is a key technology for decoupling the global economy from fossil fuels.

INITIAL SITUATION - COOKING WITH FIREWOOD

Timber growth

+300 kg
per person and year
≈ -500 kg of CO_2

Timber harvest

-900 kg
per person and year
≈ 1,500 kg of CO_2

Characteristics of cooking with wood

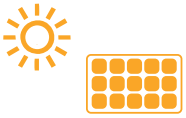
- No monetary costs
- High non-monetary costs (collection effort, health damage and loss of ecosystems)
- Net biomass decrease of approx. 600 kg per person and year
- Net CO_2 emissions of approx. 1,000 kg per person and year

SOLUTION - COOKING WITH THE SOLAR FUEL METHANOL

Timber growth

+300 kg
per person and year
≈ -500 kg of CO_2

Photovoltaic



1.87 MWh
per person and year
≈ 50 kg of CO_2

Power-to-Methanol

160 kg Methanol
per person and year
≈ 50 kg of CO_2

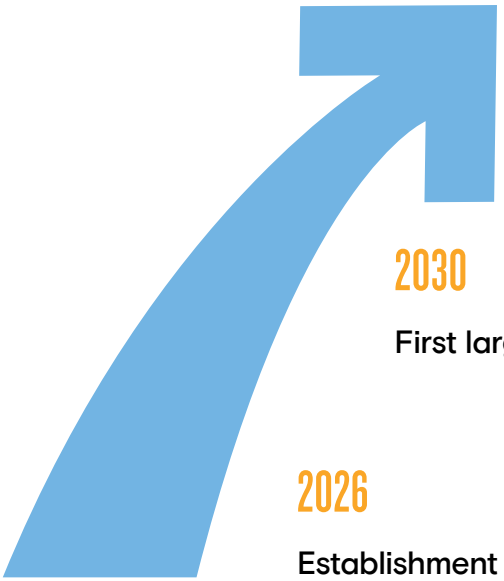
Characteristics of cooking with methanol

- High production costs ≈ €150 per person per year (Estimate for the year 2030)
- Low non-monetary costs (low procurement costs, no damage to health and protection of ecosystems)
- Avoided CO_2 emissions of approx. 1400 kg per person and year compared to cooking with wood
- Based on an estimated CO_2 price of 100 €/t the net cost is reduced to €10 per person per year

OUR APPROACH

We are bringing applied P2X research to the Horn of Africa for the first time, specifically to the Adama Science Technology University, through:

- **Knowledge transfer** regarding P2X technology
- **Establishment of a competence center** incl. research and demonstration plant
- **Training** of local experts as part of an international research program
- **Development** of model concepts for large-scale implementations in Ethiopia
- **Announcements** in the form of public tours of the demonstration and research facility
- **Lobbying** for suitable regulatory framework conditions



2040

Large-scale deployment of P2X

2030

First large-scale implementation(s)

2026

Establishment of the competence center for P2X

IMPACT

With the creation of the competence center for P2X at Adama Science and Technology University, we want to make a significant contribution to the sustainable development of Ethiopia. The project is helping to achieve the following United Nations' Sustainable Development Goals (SDGs) in Ethiopia:

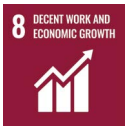
Improved health, since methanol burns without residue and no health hazards occur as a result of the fumes

Through the P2X Centre of Excellence, knowledge transfer, knowledge building and quality education will be advanced in Ethiopia

Reduce barriers to gender equality, as mostly women are affected by collection efforts

Reducing energy poverty in rural Ethiopia using renewable energy

Creation of local jobs in an industry with a high future potential



Awareness raising in politics, business and population regarding the P2X related opportunities

Combating the overexploitation of biomass resources and its consequential damage to the environment

P2X offers great opportunities particularly for Ethiopia, considering its favourable natural conditions. With our project, we are laying the foundation to prepare Ethiopia in the best possible way to take advantage of this opportunity and thus make an important contribution to combating energy poverty, climate change and the overexploitation of forests.

PROJECT ORGANIZATION

The project management consists of three project partners: the Adama Science and Technology University ASTU, the Institute for Energy Technology of the University of Applied Sciences Eastern Switzerland (IET OST) and Solafrica, with Solafrica being the lead partner.

MARTIN THEILER

Martin Theiler is responsible for project management and has overall responsibility for the project. He has many years of experience as a project developer and project manager for public infrastructure projects and holds an MSc in Environmental Sciences from ETH Zurich. At **Solafrica**, he is also responsible for managing an advocacy project to improve the solar industry in Ethiopia.

DR. DINSEFA MENSUR

The **Adama Science and Technology University ASTU** is an emerging university focusing on applied research in materials science and engineering and is dedicated to providing concrete solutions to pressing societal problems in close collaboration with the private sector. ASTU is represented in the project by Dr. Dinsefa Mensur, professor and head of the Department of Materials Science and Engineering.

SALVATORE ORICCHIO

The **Institute of Energy Technology at the University of Applied Sciences Eastern Switzerland (IET OST)** recognized the relevance of P2X at an early stage and has many years of experience in the conception, planning and realization of P2X plants. The institute has been operating a demonstration plant for the production of renewable methane since 2014 among other things. Salvatore Oricchio, project manager and research associate in the field of P2X, is responsible for the work of the IET OST within the framework of the project.

SOLAFRICA – THE ORGANIZATION

Solafrica is an independent Swiss non-profit organization that promotes solar energy. Through education, social entrepreneurship and the construction of non-profit solar plants, Solafrica spreads the use of solar energy mostly in Africa. Thus, the Swiss non-profit organization enables social development that does not come at the expense of the climate.

Solafrica carries the Zewo-label, is a member of the climate alliance and aligns its projects with the United Nations agenda 2030 for sustainable development.

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