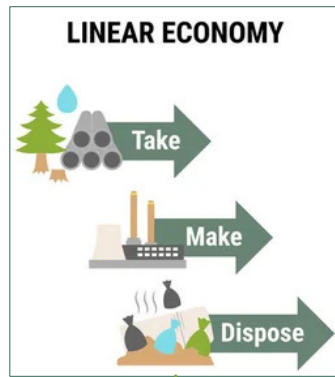


## INTRODUCTION



The ongoing global warming poses nowadays a significant risk, potentially leading to **critical "turning points"** with irreversible effects on global climate, humans and ecosystems.

In order to address this climate crisis, it is necessary to **shift towards a climate-neutral economy**, following the principles of the circular economy to "reduce, reuse and recycle", thus move away from the conventional approach of "make, use and dispose".

Focusing more on energy resources, the **transition from a fossil-fuel reliant economy to a decarbonized one** that explicitly utilizes renewable resources (RES) becomes imperative.

Following the relevant EU and national legislations and directives, **Greece has developed an action plan to enhance the use of RES and to promote energy savings by 2030.**

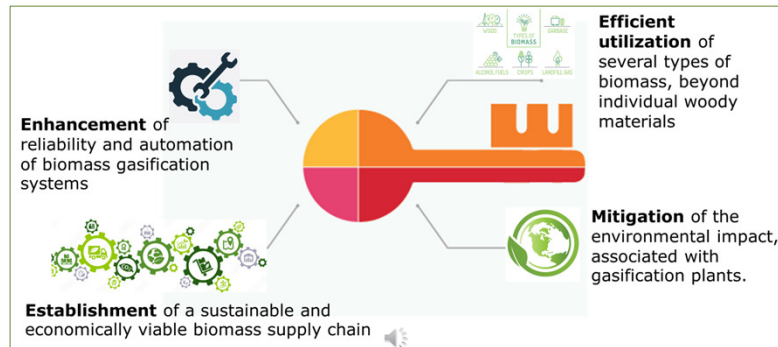
**Among others, the major goals of this action plan are to:**

- ❖ Implement biomass **projects up to 250 MW** capacity in total,
- ❖ Produce final energy from biomass equal to **0.27-0.41 Mtoe**,
- ❖ Strengthen the available **district heating installations**, especially those using RES, and
- ❖ Exploit the biomass that is produced from **agricultural and agri-food industries**.



## OBJECTIVES AND KEY FACTORS

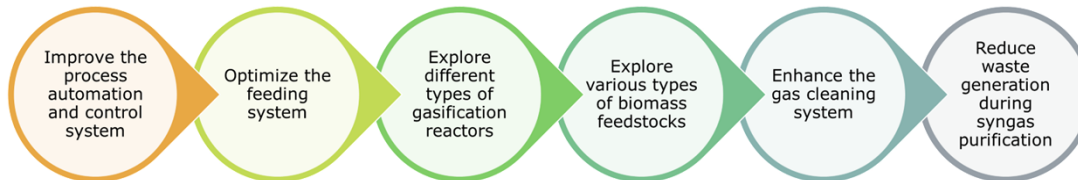
- Produce synthesis gas (syngas) at an average rate of 105 Nm<sup>3</sup>/hr by utilizing **70 kg/hr of biomass**.
- First gasification system **entirely designed and constructed in Greece**.
- Focus on biomass, agricultural residues and other agricultural by-products.



- ❌ Implementation of licensed biomass gasification plants → **significantly low level**.
- ❌ **Lack** of fully automated systems
- ❌ Unresolved environmental issues **regarding tar and wastewater management**
- ❌ **Seasonal availability and unstable procurement costs**
- ❌ **Economic viability and continuous operation** of gasification units.

## SCOPE

Within the scope of the i-GAS project, ENGAIA S.A. aims to further enhance the efficiency of its pilot gasification system.



**ENGAIA S.A.** has the ambition to **commercially exploit the project's outcomes**, both in terms of products and knowledge, for the development and construction of biomass gasification plants, initially in Greece and eventually worldwide.

Ongoing efforts of ENGAIA S.A. to **improve the efficiency** and in general **intensify the gasification system under development**

- ❖ **Advanced process simulation techniques** were employed to determine the optimal values of operational parameters for **different biomass feedstocks and streamline operations**, to **reduce human intervention**, and to **maximize electricity generation**.
- ❖ The **feeding system** was specifically **optimized** by carefully analyzing the characteristics of **different biomass feedstocks**, ensuring a **consistent and efficient supply**.
- ❖ Particle size, moisture content and feeding rate, which directly affect gasification efficiency, were quantitatively considered.

To enhance the **economic viability** of the gasification unit by utilizing a wider range of biomass feedstocks, a **fluidized bed gasifier** was selected **over the initial downdraft gasifier**.

**This reactor design is expected to:**

1. Maximize efficiency,
2. Ensure optimal biomass-to-syngas conversion, and
3. Reduce tar production.

Finally, initial steps have already been taken towards optimal **ash management and waste generation reduction and treatment**.

**ENGAIA S.A.** by successfully commercializing their enhanced gasification system, aims to significantly contribute to the adoption of sustainable and carbon-neutral energy solutions, leveraging biomass as a renewable energy resource for a greener future.

**The pilot gasification unit comprises various components, including**



- PLC automation panel, speed controllers and PCs
- Compressed air circuit
- Feeding hopper and biomass conveyor
- Downdraft gasifier
- Automatic ash extraction system
- Gas purification filter
- Gas cooling exchanger and liquid waste extraction
- Dual fuel (syngas/bioliquids) generator
- Cyclone

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