Greece – China Bilateral Cooperation
Ministry of Science and Technology (MOST) of the People's Republic of China &
General Secretariat of Research and Technology (GSRT) of the Hellenic Republic

Project SYNAGRON

Integrated management and exploitation of multi-dispersed agricultural residues – application to energy production

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Project Coordinator
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Project / Funding

- *Greece: Funded under European Regional Development Fund (ERDF) and National Resources (GSRT)*

- *China: Funded under Ministry of Science and Technology of the People's Republic of China*

Start: 14/10/2019,
Duration: 3 years

Partners

Greece:

- University of Patras (UP), Department of Environmental Engineering (*Coordinator*)
- University of Western Macedonia (UOWM), Chemical Engineering Department
- SIRMET S.A.

China:

- Beijing University of Chemical Technology (BUCT)
- Beijing United Pioneer Environmental Engineering Co. Ltd (BUPEE)
- Nanjing Benran Environmental Technology Co. Ltd (BENRAN)

Other:

- Khalifa University of Science and Technology (KUST), United Arab Emirates

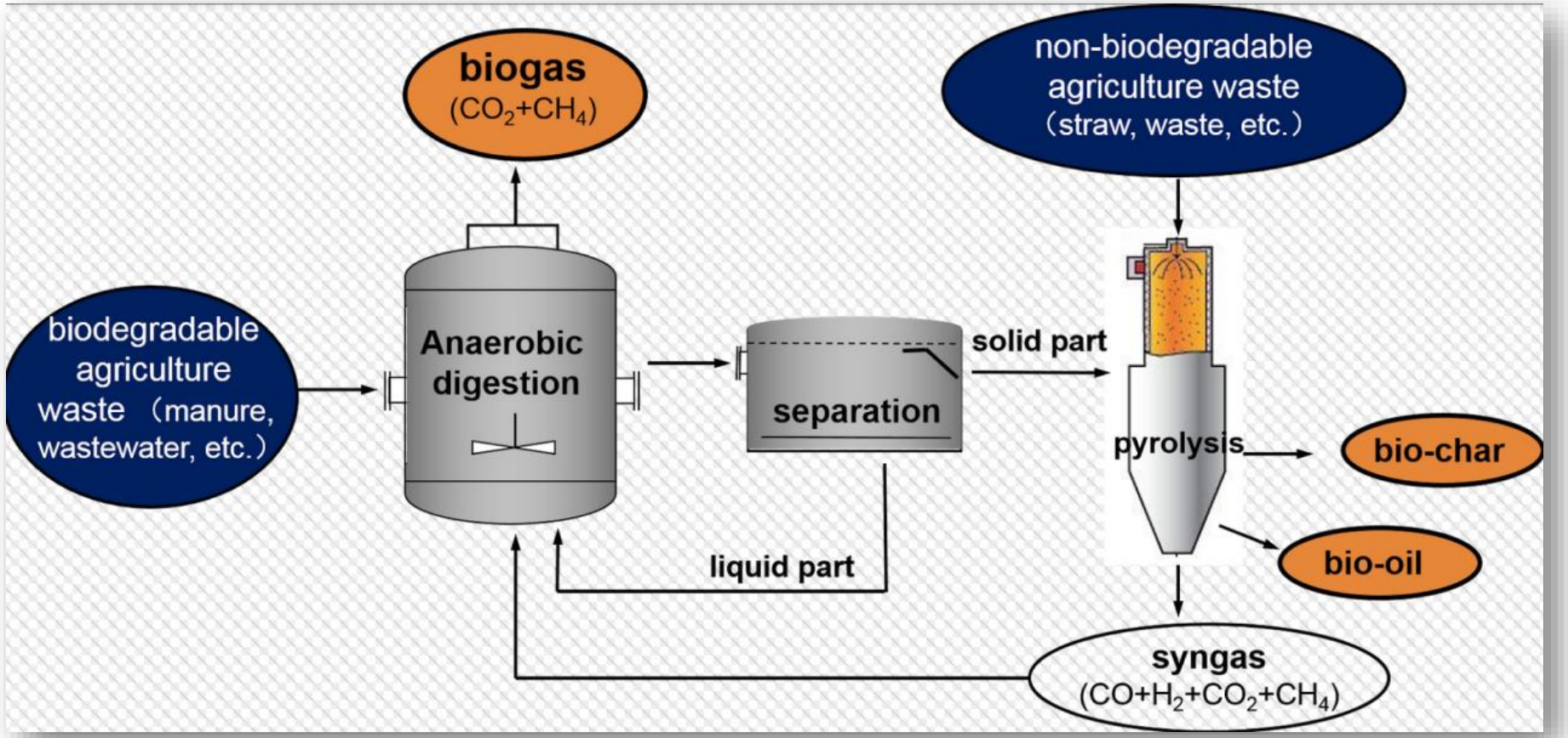
These are burnt releasing about 2.7 millions of CO_2 greenhouse gas emissions in the atmosphere.

Alternatively, 6.6 TWh of thermal energy could be produced annually *or* 2.3 TWh of electrical energy covering almost **4.8% of the total country's energy needs.**

Main Objective of SYNAGRON

Pave the way for the environmentally friendly useful exploitation of the residues of the Chinese and Greek agricultural sectors for the generation of high value bio-products and/or energy.

- This is to be accomplished by designing and developing **an innovative pyrolysis (Py) - anaerobic digestion (AD) processing plant for the conversion of agricultural wastes initially into useful bio-products**, such as bio-char, bio-oil, syngas and biogas, and then into hydrogen and/or electrical energy.



The proposed processing plant for the conversion of both biodegradable and non-biodegradable agricultural residues into useful bio-products and/or hydrogen feeding SOFCs for energy production

SYNAGRON Work Packages

Work Package 1

- Market Uptake

Start date	M1	End date	M18	Total person months	24
Participant	GR: **UP**, SIRMET, UOWM, CN: **BUCT**				

Tasks
T1.1 Survey of the most promising agricultural residues (UP, SIRMET, UOWM, BUCT)
T1.2 Market analysis for bio-char, bio-oil, biogas and hydrogen (UP, SIRMET, BUCT)
Deliverables
D1.1 *Report on the most promising agricultural residues in China & Greece* ***(M18)***
D1.2 *Report on market analysis in the two countries* ***(M18)***

Work Package 2

- Biodegradable waste fermentation for biogas production

Start date	M1	End date	M24	Total person months	31
Participant	GR: **UP**, SIRMET, UOWM, CN: **BUCT**, BUPEE, BENRAN				

Tasks
T2.1 Experimental investigation of the anaerobic digestion process using various biodegradable agricultural residues (UP, SIRMET, BUCT, BUPEE, BENRAN)
T2.2 Theoretical modeling and optimization of the anaerobic digestion processes using various biodegradable agricultural residues (UP, UOWM, BUCT)
Deliverables
D2.1 *Mid-term project report (**M18**) – will also include progress from WP2, WP3, WP4, below*
D2.2 *Report on the experimental investigation of anaerobic digestion processes (**M20**)*
D2.3 *Report on the theoretical modeling and optimization of the anaerobic digestion processes (**M24**)*
D2.4 *Dissemination activities: 2 publications in International journals, 2 participations in Int. conferences (**M24**)*

Work Package 3

- Non-Biodegradable waste catalytic pyrolysis for the production of bio-char, bio-oil and syngas

Start date	M1	End date	M24	Total person months	28
Participant	GR: **UOWM**, UP, KUST CN: **BUCT**, BUPEE, BENRAN				

Tasks
T3.1 Experimental investigation of the catalytic pyrolysis process using various non-biodegradable agricultural residues (UOWM, KUST, BUCT, BUPEE, BENRAN)
T3.2 Theoretical modeling and optimization of the catalytic pyrolysis processes using various non-biodegradable agricultural residues (UOWM, UP)
Deliverables
D3.1 *Report on the experimental investigation of the catalytic pyrolysis process (**M20**)*
D3.2 *Report on the theoretical modeling and optimization of the catalytic pyrolysis processes (**M24**)*
D3.3 *Dissemination activities: 2 publications in International journals, 2 participations in Int. conferences (**M24**)*

Work Package 4

- Biogas and bio-oil utilization for hydrogen production

Start date	M6	End date	M30	Total person months	32
Participant	GR: **UOWM,** UP, KUST				

Tasks
T4.1 Experimental investigation through catalyst development and evaluation for the biogas and bio-oil reforming reaction to hydrogen production (UOWM, KUST)
T4.2 Theoretical modeling and optimization of the catalytic reforming processes for hydrogen production (UOWM, UP)
Deliverables
D4.1 *Report on catalyst preparation (synthesis protocols) and characterization results (**M20**)*
D4.2 *Report on catalytic performance evaluation (**M28**)*
D4.3 *Report on the theoretical modeling and optimization of the catalytic reforming processes (**M30**)*
D4.4 *Dissemination activities: 2 publications in International journals, 2 participations in Int. conferences (**M30**)*

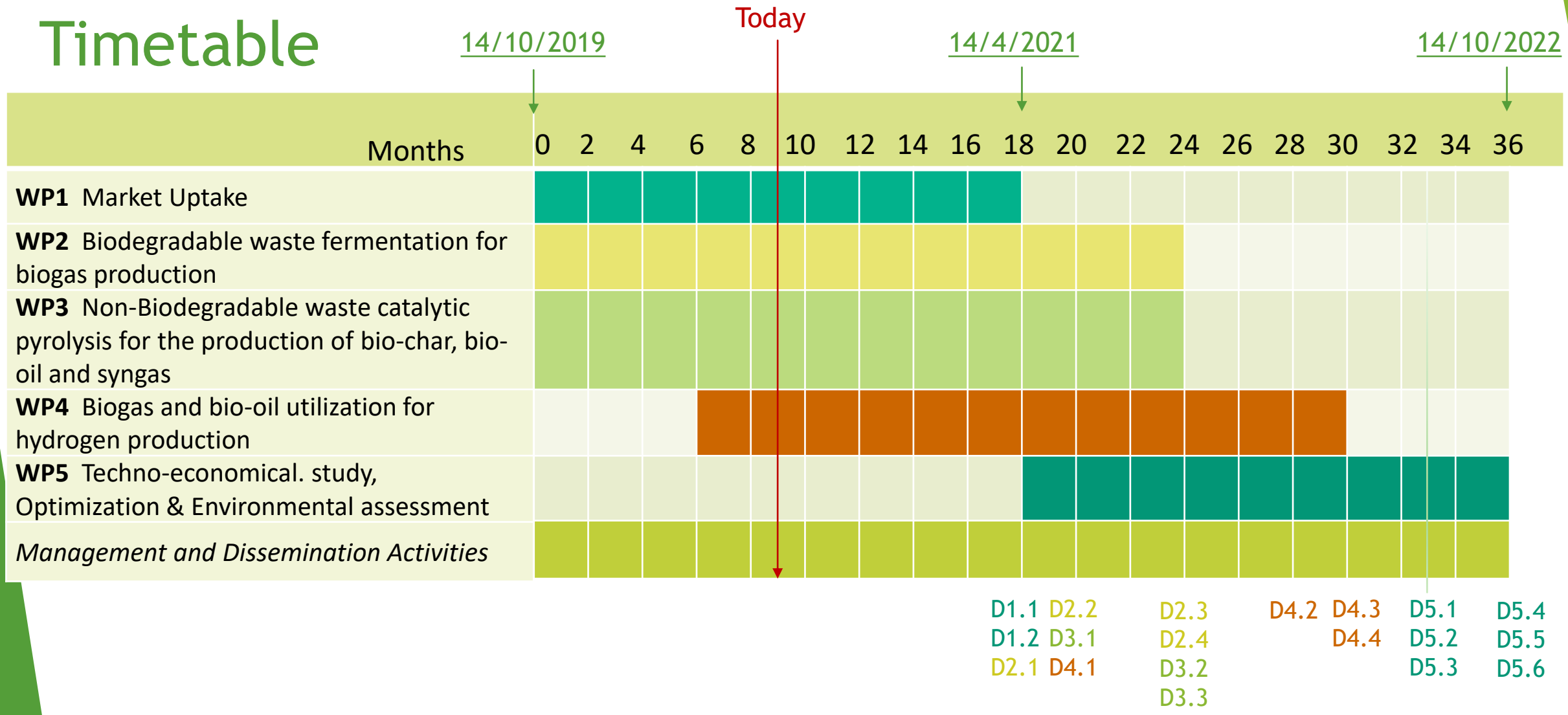
Work Package 5

- Techno – Economical Study & Optimization & Environmental Assessment

Start date	M18	End date	M36	Total person months	26
Participant	GR: **SIRMET,** UP, UOWM CN: **BUCT**				

Tasks
T5.1 Theoretical modeling and optimization of the overall plant performance using various non-biodegradable agricultural residues (UP, UOWM)
T5.2 Theoretical modeling and optimization of the overall plant performance for generation of electricity in Solid Oxide Fuel Cells (UP, UOWM)
T5.3 Techno – Economical Study (SIRMET, UP, BUCT)
T5.4 Environmental Assessment (UP, TEIWM, BUCT)
T5.5 Feasibility / demo project (SIRMET, UP, BUCT, BUPEE, BENRAN)
Deliverables
D5.1 *Report on the theoretical model for the processing plant and SOFC integrated unit (**M33**)*
D5.2 *Report on the techno-economic study (**M33**)*
D5.3 *Environmental assessment **(M33)***
D5.4 *Feasibility / demo project (**M36**)*
D5.5 *Dissemination activities: 2 publications in International journals, 2 participations in Int. conferences (**M36**)*
D5.6 *Final project report (**M36**)*

Timetable


14/10/2019
Today
14/4/2021
14/10/2022
Months
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
WP1 Market Uptake
WP2 Biodegradable waste fermentation for biogas production
WP3 Non-Biodegradable waste catalytic pyrolysis for the production of bio-char, bio-oil and syngas
WP4 Biogas and bio-oil utilization for hydrogen production
WP5 Techno-economical. study, Optimization & Environmental assessment
Management and Dissemination Activities
D1.1 D2.2
D1.2 D3.1
D2.1 D4.1
D2.3
D2.4
D3.2
D3.3
D4.2 D4.3
D4.4
D5.1
D5.2
D5.3
D5.4
D5.5
D5.6

SYNAGRON Communication & Dissemination

Dissemination to the scientific community

Greek Partners:

- **Eight (8) publications** in peer reviewed international journals.
- Participate in at least **eight (8) international conferences or workshops** of high repute (EUROPACAT, WHEC, etc.)

Chinese Partners aim to achieve similar results.

Common Publications - at least 50% of project's publications will involve members of both Consortia (i.e., at least 4 common publications).

- Possibility of launching a common patent application

Dissemination to the wider public:

- **Websites** – will include **forums** where the partners together with participating members and interested parties (farmers, companies, private and public bodies) will interact, exchanging information, knowledge and opinions → UP
- **Quarterly electronic newsletters** presenting actions of the specific quarter and those to be implemented in the next three months → UOWM
- **Stakeholder groups** will be identified in each participating country within the first six months of the project's start → UP, UOWM, SIRMET
- **Information days,** at the beginning and end of project will be organized in China and Greece. The strong cooperation links with national and regional actors and authorities as well as commercial and industrial enterprises will be exploited. Strong emphasis will be placed on inviting/attracting agricultural co-operations → UP, UOWM, SIRMET

UNIVERSITY OF PATRAS
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ

Thank you

For more information

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