

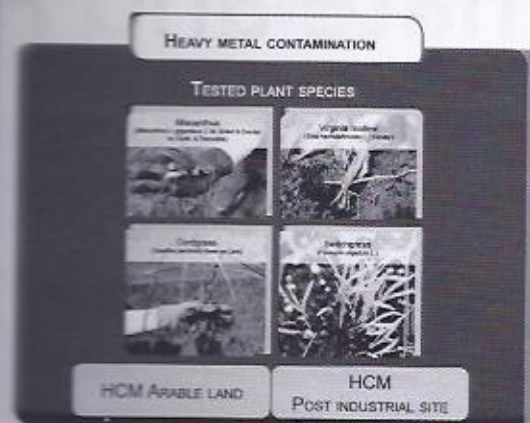


Inżynieria Środowiska w Energetyce i Motoryzacji

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The scientific and technological goal of the project is to develop and validate a novel approach combining phytoremediation and biomass production on heavy metal contaminated (HMC) sites which could be then safely used as a local energy carrier. The innovation is to demonstrate a complex solution which will cover the whole value chain: from setting the brownfield management target through successful energy production, biofuel feedstock preparation up to conversion to energy in a local small scale gasification installation. The goal can be achieved by three main objectives:



OBJECTIVE 1

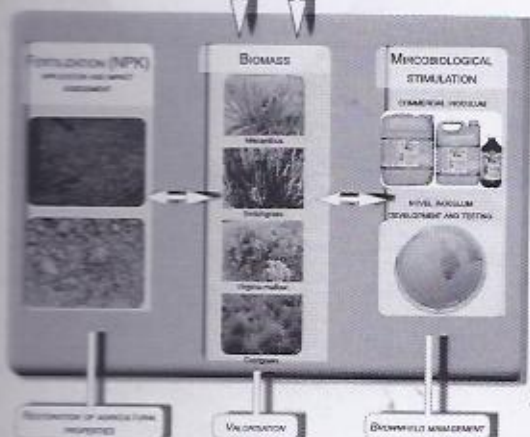
Selection of optimal energy crop species suitable for both biomass production and phytoremediation purposes of HMC sites

In order to accomplish Objective 1 pilot experiments and a testing campaign will be designed and executed by IETU and VITA34 using four pre-selected species of energy crops already tested by IETU (*Miscanthus giganteus*, *Sida hermaphrodita*, *Spartina pectinata*, *Panicum virgatum*) as they proved to deliver good biomass yield at HMC sites together with high metal uptake.

IETU will provide knowledge and data of the pre-selected plant species as well as guidance on their cultivation requirements. VITA34 will provide expertise on engineering of phytoremediation operations combined with energy crop production. The tests will be carried out on existing test plots provided by IETU and new experimental plots to be set up at sites provided by IETU in Poland as well as by VITA34 in Germany.

Biomass from existing plantations will enable preliminary biomass validation as biofuel feedstock under Objective 3 as well as provide material for microbiological investigations and trials for microbial stimulation under Objective 2 already at the initial project phase. In project year 2, 3 and 4 the tests will be performed using biomass from the newly established plots.

The study will deliver information which energy crop species are optimal in terms of biomass yield, robustness and relative site management goals and a simple method for selection of optimal energy crop species will be elaborated to help transfer the Phyto2Energy concept to HMC sites management practice.



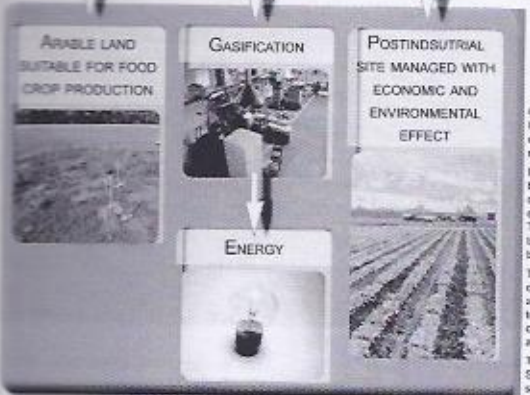
OBJECTIVE 2

Development of a microbiological method stimulating the biomass yield at HMC site

The aim of Objective 2 is to ensure healthy and sustainable phytoremediation driven energy crops production at HMC sites. The main task includes identification of plant growth promoting rhizobacteria, bacterial endophytes and mycorrhizal fungi that enhance the growth of the selected energy plant species and to investigate the beneficial partnership between plants and their isolated microorganisms as a strategy to accelerate plant biomass production and clean-up of the contaminated areas.

As a starting point to achieve this an already existing inoculum (EniFarma Plus™) provided by ProBiotics will be used to stimulate the biomass yield and phytoremediation effect as a basis for innovations and optimization. In addition new plant growth promoting microorganisms will be isolated from the microsphere of the respective plant species to obtain new strains and to design new and more targeted formulations for enhancing plant growth. Moreover, the functional diversity of the rhizosphere microflora and bacterial endophytes will be studied by IMGU to define strategies to enhance the abundance and activity of plant beneficial microbes in situ.

As a result a composition of a novel inoculum will be proposed to stimulate the phytoremediation driven energy crops production respectively to the relative brownfields management goal together with a set of indicators enabling monitoring the success of energy crops cultivation and a phytoremediation effect.



OBJECTIVE 3

Valorization of the biomass from the HMC sites as a local energy carrier

Objective 3 is to demonstrate an environmentally safe way of converting the HMC biomass into energy in a small scale local installation with special focus on gasification as a promising technology which may become a competitive niche alternative for handling HMC biomass.

ISPE in cooperation with SUT will work out a list of parameters to valorize the biomass from HMC sites as biofuel from the viewpoint of the characteristics of the equipment and technical options of potential installations as well as environmental aspects with stress on small scale gasification installations. To valorize the biomass ISPE and SUT will carry out gasification tests of the biofuel using a small scale fixed bed downdraft gasifier installation provided by SUT.

The impact of the biofuel feedstock parameters on the quality and composition of the end gas and end products from gasification will be evaluated and analyzed according to the list of the elaborated parameters. The gasification tests and the biofuel products analysis will allow to understand which char-rich fractions are formed, how heavy metals behave during the process and if and which mineral components may affect the gasification process.

The guidance on the improvement of the process parameters worked out by SUT and ISPE will aim at concentrating most of the heavy metals char-rich samples. IETU and ISPE will then assess the applicability of the ash (and char) for land applications as mineral fertilizer in remediation process.