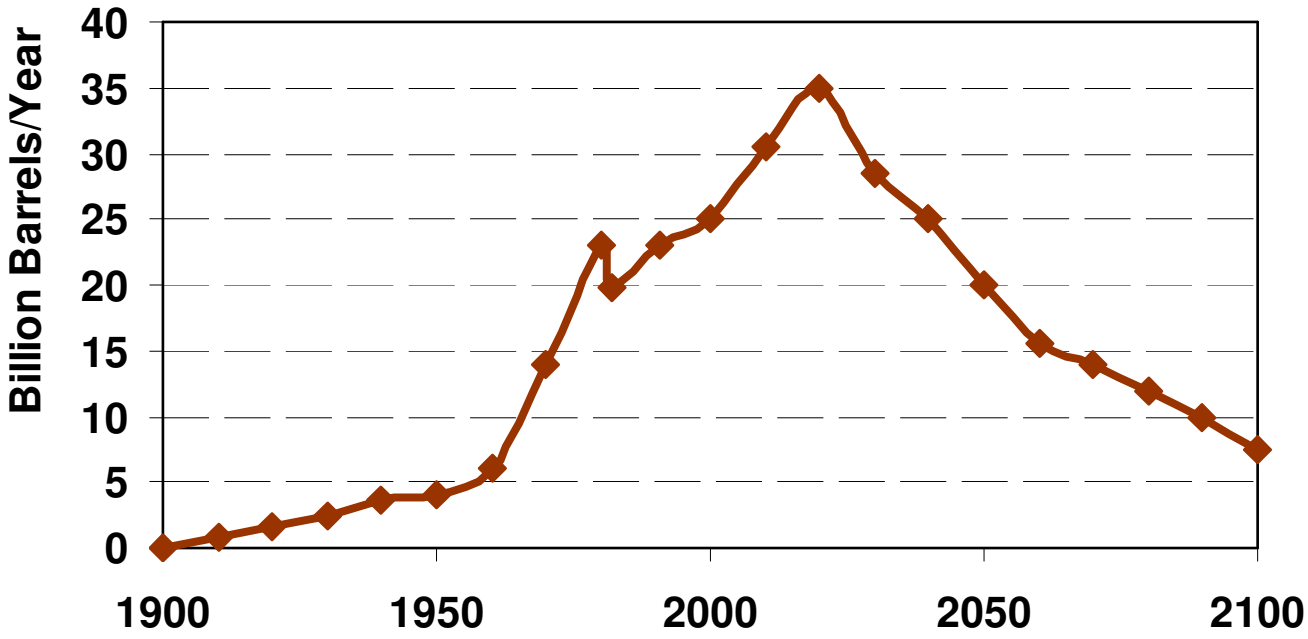
BIOFUELS – RESEARCH AND DEVELOPMENT, PROBLEMS AND PROSPECTS

Violeta Makarevičienė
Lithuanian University of Agriculture

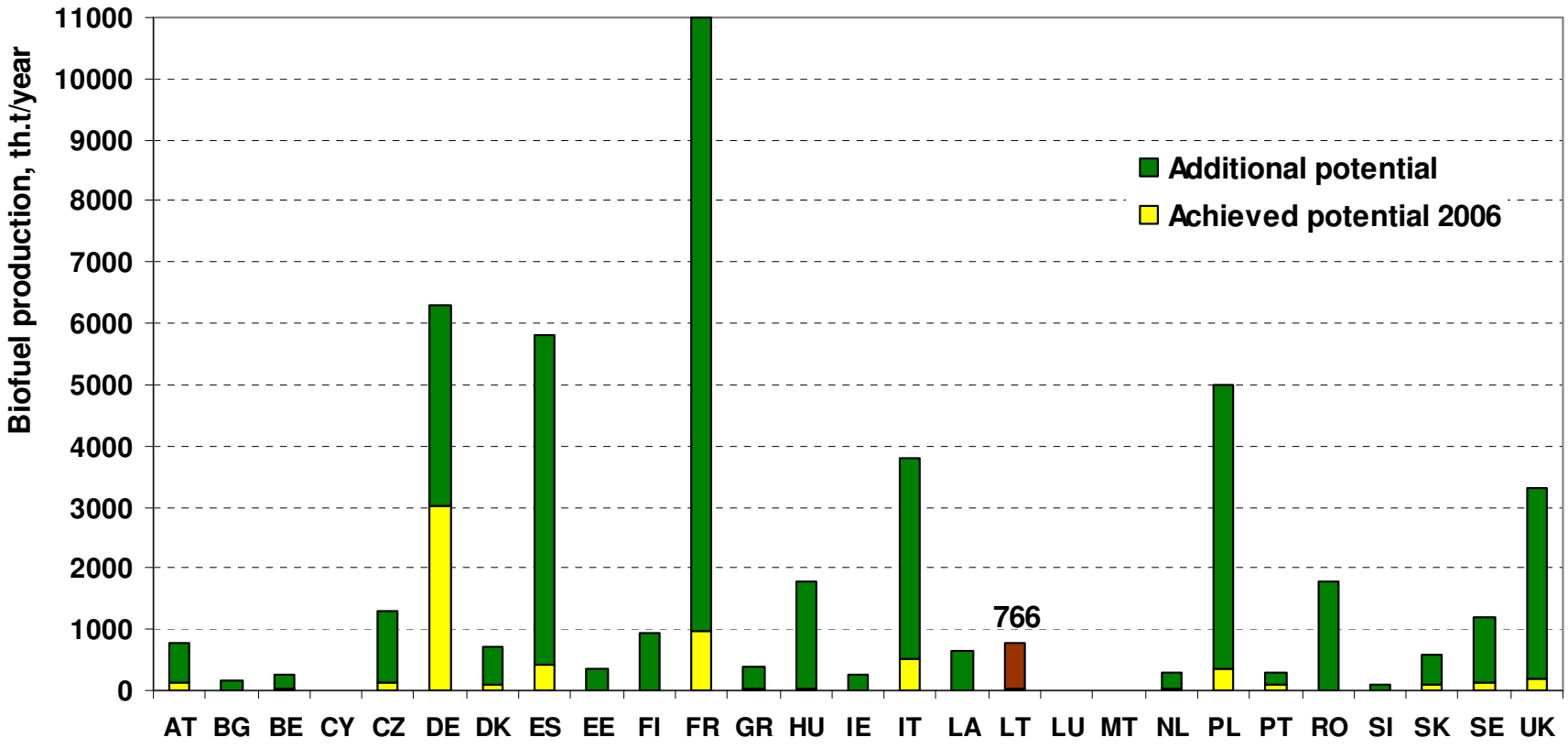
Round table on Industrial Biotechnology in Lithuania
4 September, 2008 Vilnius

Annual World Oil Production
(IEA Data&Forecast)



EU actions in the field of biofuel production and usage

Promotion of biofuels for transport by replacing of 2 % of fossil fuel by 2005 and 5.75 % fossil fuel by 2010 accompanied by detaxation of biofuels (Directive 2003/96/EC)



Potential of Lithuania ~ 50 % from present liquid fuel consumption in country (France ~ 22 %)

Strategic research agenda
(Biofuels in the European Union - Vision for 2030 and Beyond)

- ***Improving existing conversion technologies***
  - new developments of catalytic and separation processes (membranes, new adsorbents, ionic liquids, supercritical extraction);
  - ethanol production from starch by increasing yield and improving the quality of co-products;
  - biodiesel fuel production from alternative sources of fatty acids, improvement of the quality of by-products, their usage for the production of fine chemicals;
  - biodiesel fuel production applying biotechnological processes.

- ***Production of ethanol and ethanol derivatives from cellulosic biomass*** **applying more efficient biochemical systems and innovative fractionation and purification processes.**
- ***Production of synthetic fuels*** **(DME, methanol, F-T diesel and gasoline) through gasification.**
- ***Development of integrated refining concepts*** **(integration of new biorefineries with existing industrial complexes)**

Present situation in Lithuania

SC "Biofuture"
(bioethanol producer, 40 000 t/year)

Present situation in Lithuania

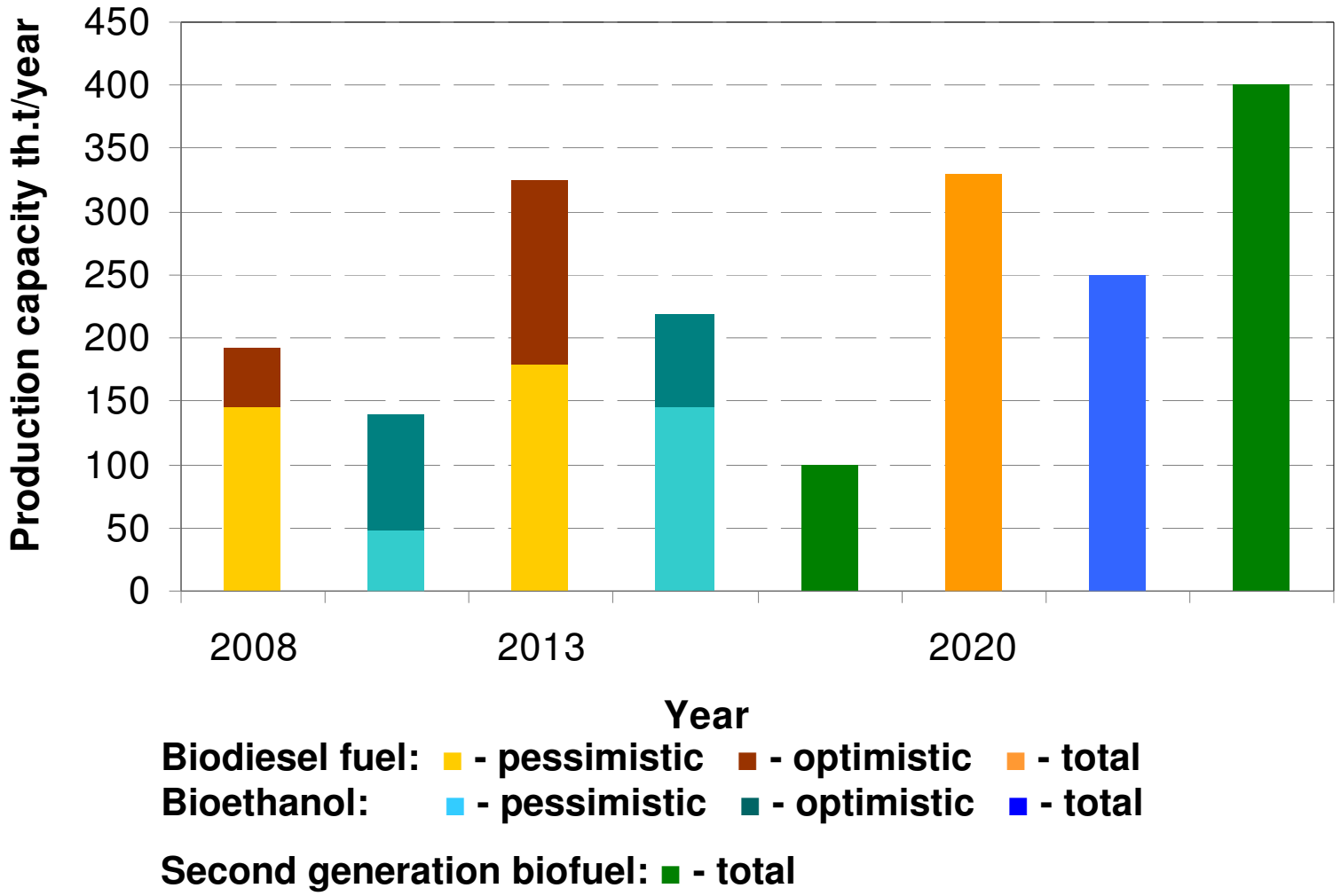
JSC "Rapsoila"
(biodiesel fuel producer, 30 000 t/year)

JSC "Mestilla"
(biodiesel fuel producer,100000 t /year)

Prognosis of biofuel production increase

Producer	Production, thousand tons			Capacity, thousand tons		
	2005	2006	2007	2008	2009	2010
Biodiesel fuel						
JSC „Rapsoila“	7	10.3	30	30	30	30
JSC „Arvi cukrus“			12	12	24	24
CC „SV Obeliai“			8	20	20	20
JSC „Mestilla“				100	100	100
JSC „Baltijos biodyzelino centras“				30	30	30
Total	7	10.3	50	192	204	204
Bioethanol						
JSC „Biofuture“	6.6	14.3	40	40	40	40
JSC „Arvi cukrus“				16	16	16
JSC „Leo & Co“					50	50
JSC „Nordetanolis“					80	80
JSC „Pasvalio agrochemija“					18	18
Total	6.6	14.3	40	56	204	204
Total biofuel	13.6	24.6	90	248	408	408

Prognosis of biofuel production increase



Research, development and demonstration in Lithuania

1. National Technology Platforms

- **NTP *"Biofuel for Transport"***
- **NTP *"Biomass and Biofuel"* (production of heat and electricity)**
- **NTP *"Biotechnology"***

2. National Programs of R&D

"*National Program of Industrial Biotechnology*"
(R&D in the field of bioenergy is included in the program)

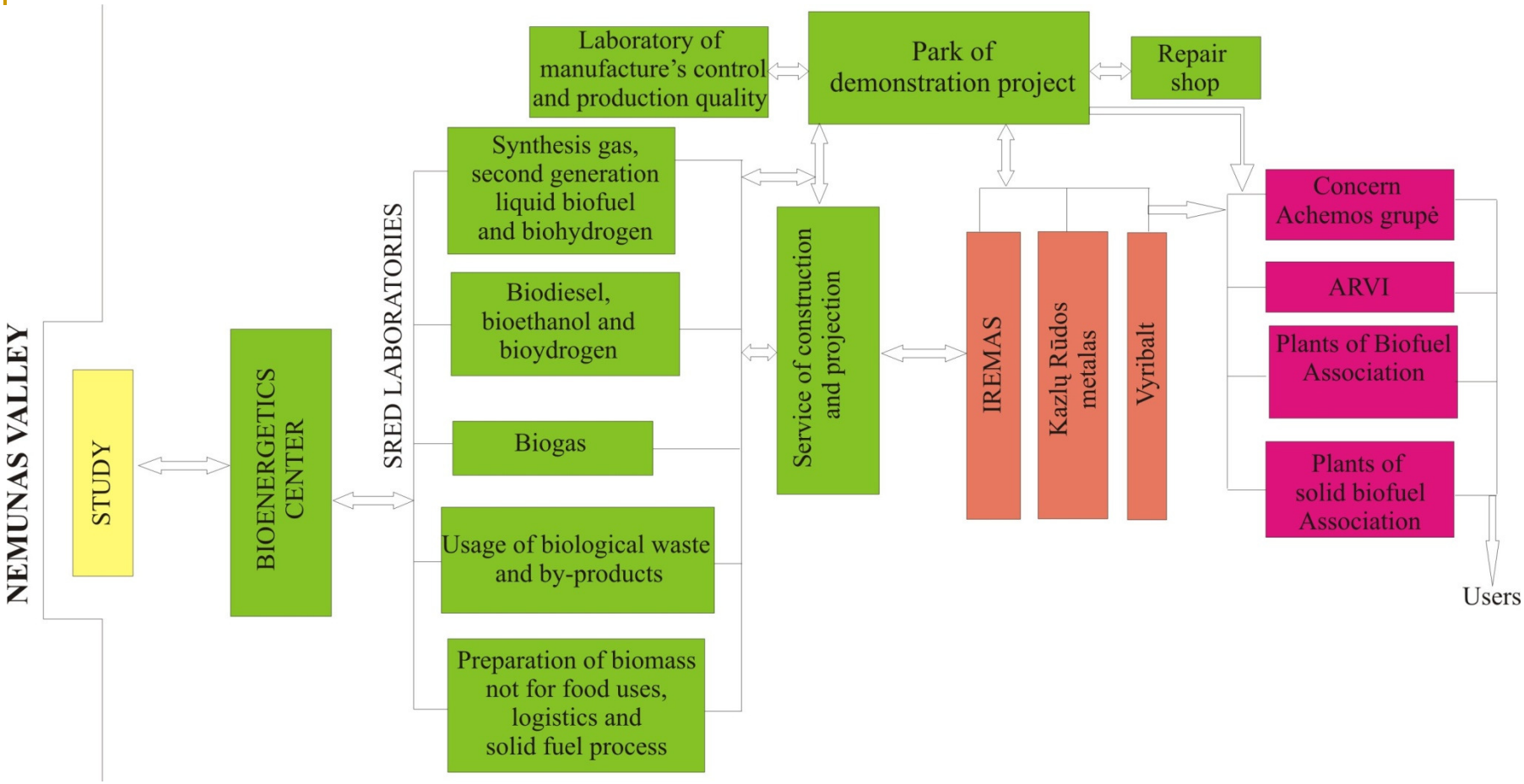
In the nearest future will be adopted program *"Sustainable Energy"*

3. Research Valleys and Centers

Research valley "Nemunas" (at Lithuanian University of Agriculture)

Establishment of "National Bioenergy Research, Technological Development and Competence Center" is scheduled

Research, development and demonstration in Lithuania



Structure of National Bioenergy Research, Technological Development and Competence Center

Current and future R&D in the field of biofuel in Lithuania

1. Development of biodiesel production technologies:

- biodiesel production from new raw materials (rapeseed containing high amounts of erucic acid and glucosinolates, linseed, false flax, crambe, animal fatty waste);
- biodiesel production applying heterogeneous catalysis;
- biodiesel and biolubricant components production by using biocatalysts – immobilized lipases;
- biotechnological biodiesel production *in situ* (direct oil extraction and transesterification in seeds).

2. Development of production technologies of alcohols to be used for biofuel production:

- bioethanol production from grain and maize by using new and more effective enzymes and membranes for dewatering;
- bioethanol production from sugar beets;
- biobutanol production.

Current and future R&D in the field of biofuel in Lithuania

3. Development of technologies of rational utilization of biofuel production waste and by-products:

- biogas production;
- glycerol phase utilization;
- free fatty acid esterification by chemical and biotechnological methods.

4. Development of second generation biofuel production technologies:

- hybrid technologies of *syn*gas production;
- synthetic fuels for diesel engines (F-T biodiesel, bio DME, biomethanol);
- Koch biodiesel production from organic waste;
- hydrogen (to be used for fuel cells) production processes from biomass;
- conversion of cellulose containing biomass into alcohols.

5. Development of new biocatalysts for biofuels production

Current and future R&D in the field of biofuel in Lithuania

LITHUANIAN UNIVERSITY OF AGRICULTURE

LABORATORY OF CHEMICAL AND BIOCHEMICAL RESEARCH FOR ENVIRONMENTAL TECHNOLOGY

International projects

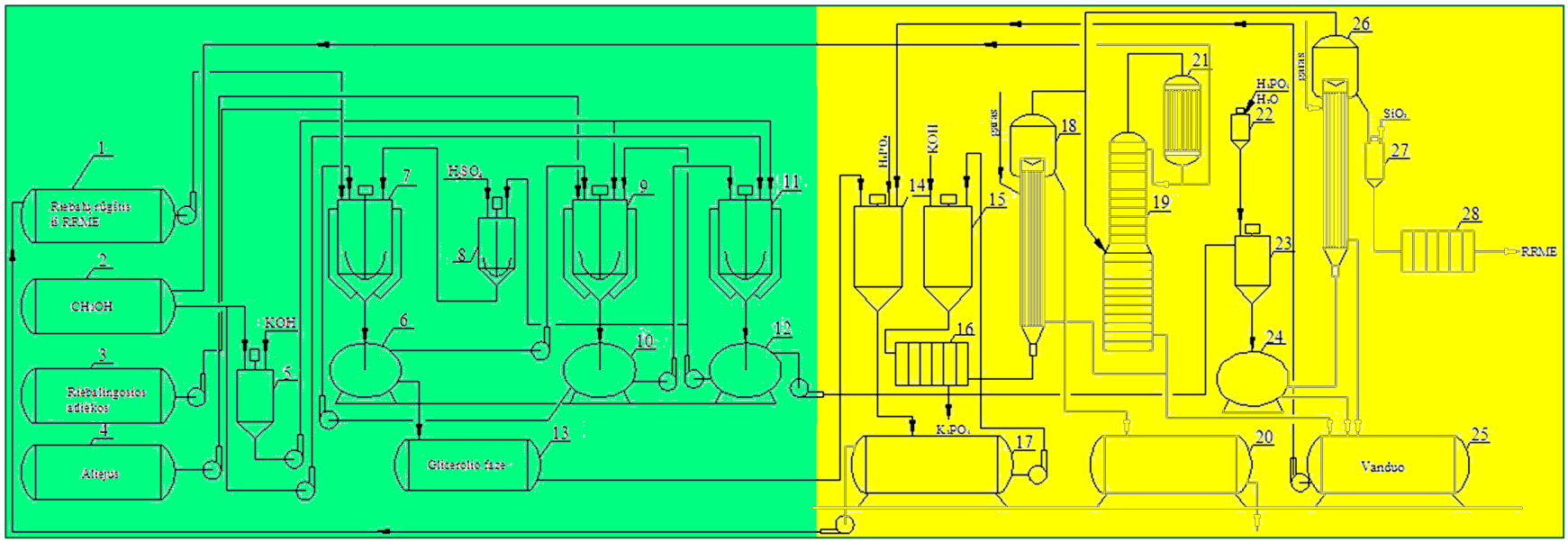
- EUREKA. *Sustainable processing of waste fats to be used in SME for energy purposes.*
- EUREKA. *Development of technology for processing plant oils and spent fats as components of biodegradable lubricants and fuels.*
- EUREKA. Development of technology to manufacture biofuels using *Camelina Sativa* oil as new raw material base.
- *Sustainable production of biodiesel fuel from renewable resources and fatty wastes.* Lithuania-Latvia, Taiwan).

Projects of National Program of Industrial Biotechnology

- Development of new biodiesel fuel and biolubricant production technologies based on biocatalysis.
- The search for new biofuel components and investigation of second generation biofuel production technologies.
- Technologies of rational utilization of by-products of biofuel production.

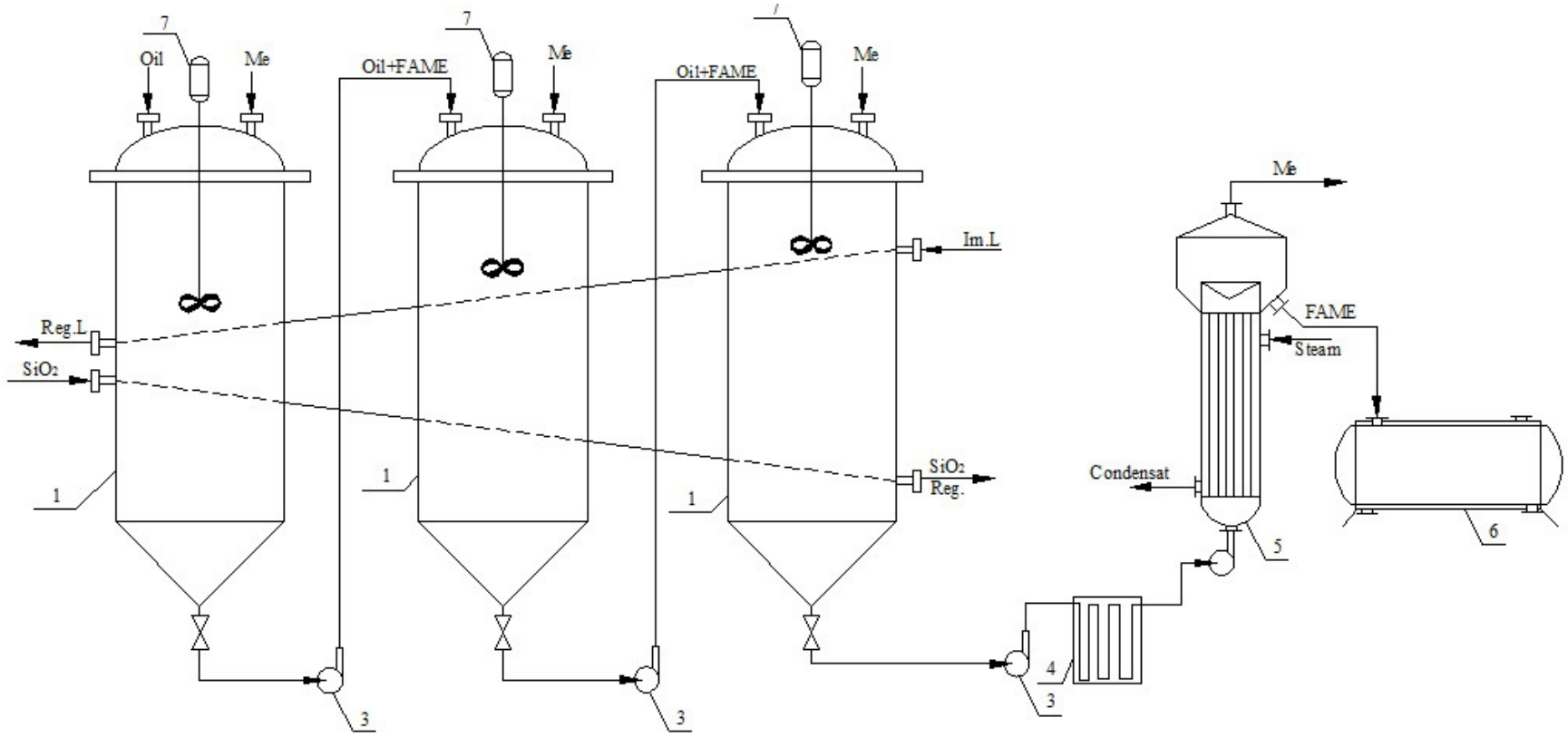
At 2007 “Biomass Energy Center” established

Current and future R&D in the field of biofuel in Lithuania



Biodiesel fuel production technology from fatty waste (esterification and transesterification)

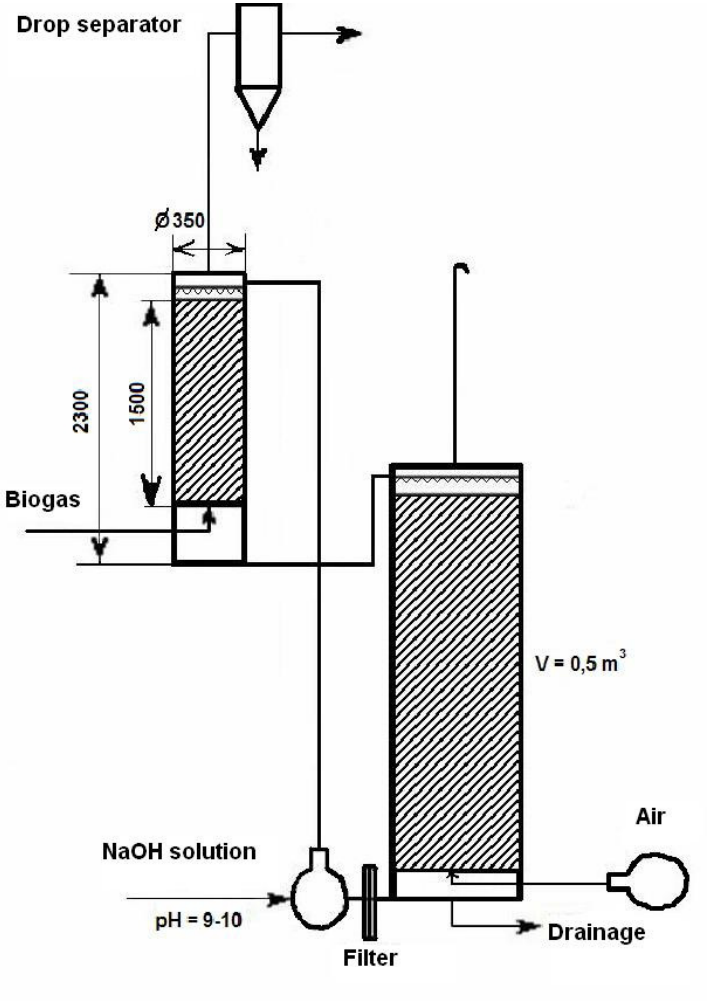
Current and future R&D in the field of biofuel in Lithuania



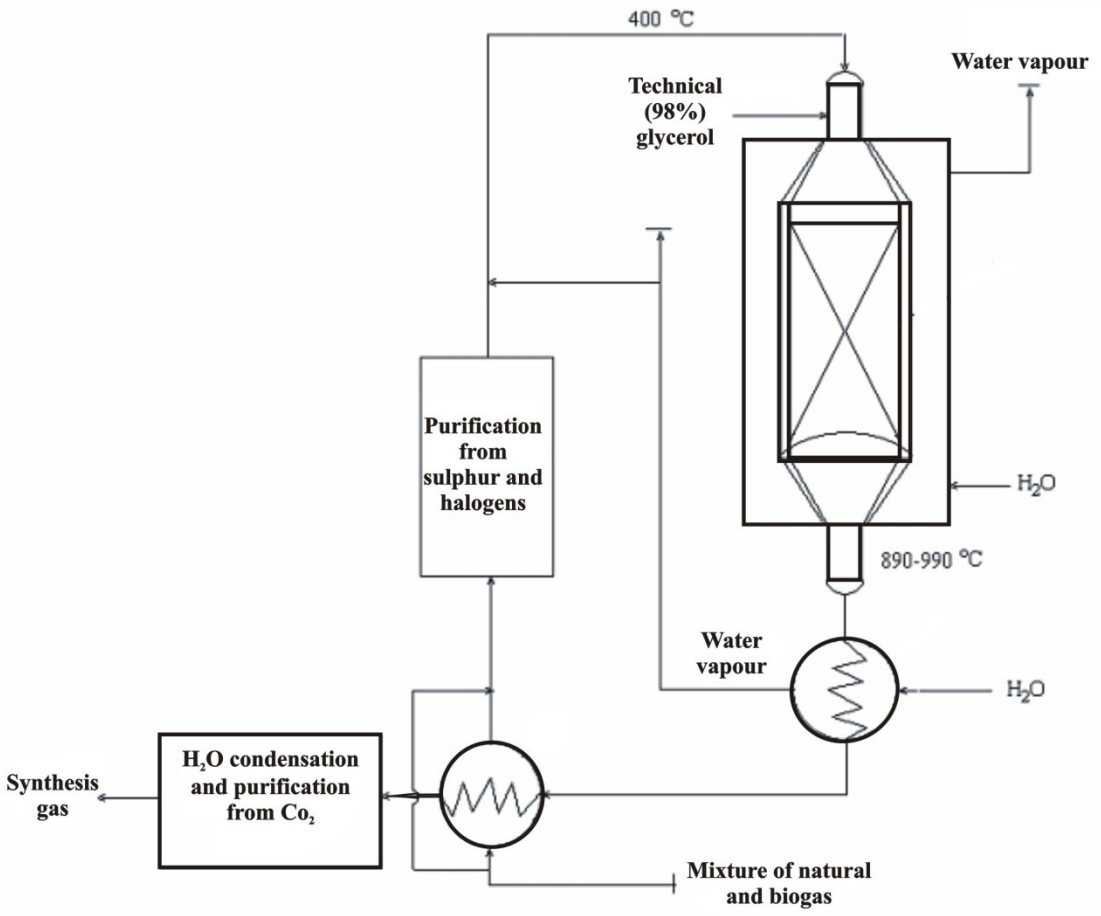
Principal biotechnological scheme of the esterification and transesterification of oil and fatty waste by methanol, using the biotechnological method:

1 – transesterification reactor, 2 – mixer, 3 – pump, 4 – filter, 5 – film evaporator, 6 – FAME receptacle, 7 – el. engine (Me – methanol, Im.L. – immobilized lipase, SiO2 – silica gel, Reg.L. – lipase to regeneration, SiO2 reg. – silica gel to regeneration)

Current and future R&D in the field of biofuel in Lithuania

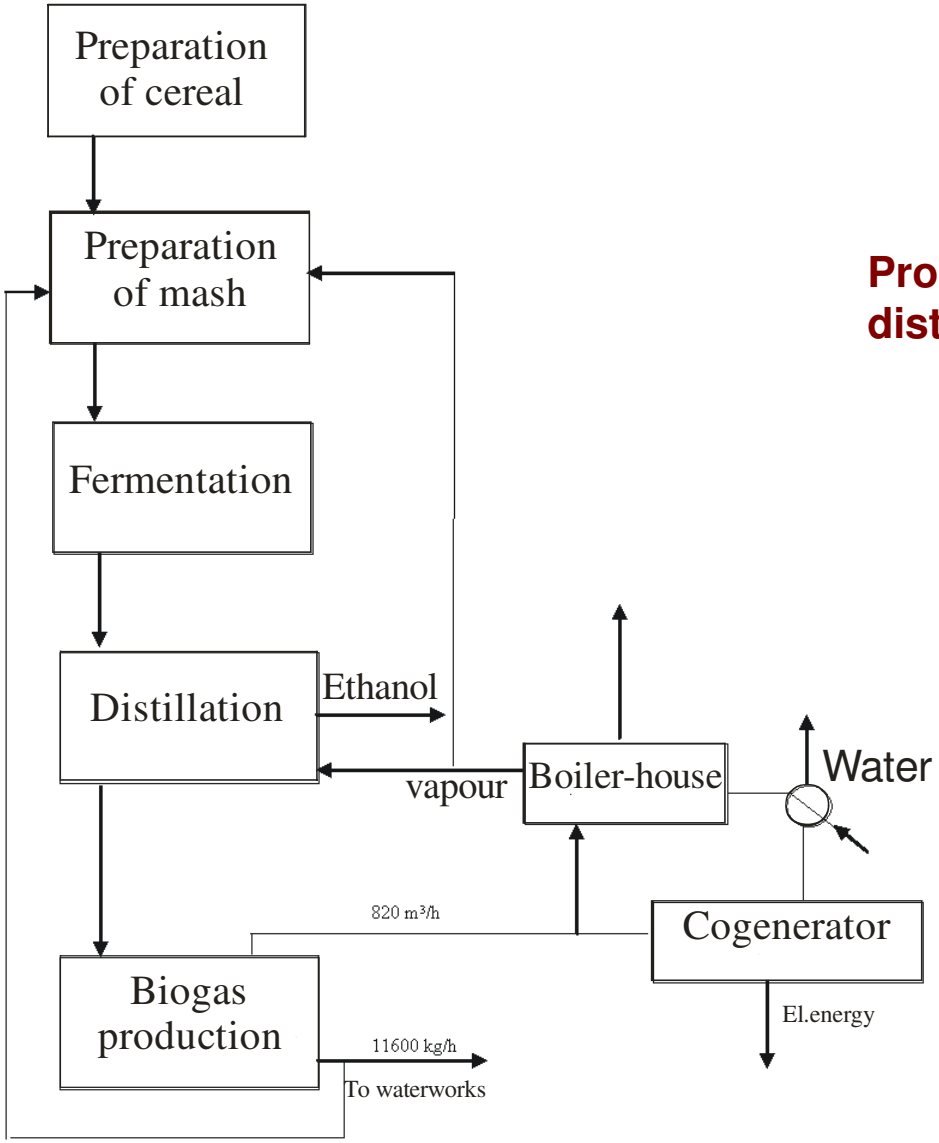


Biogas purification (sulphur removal)



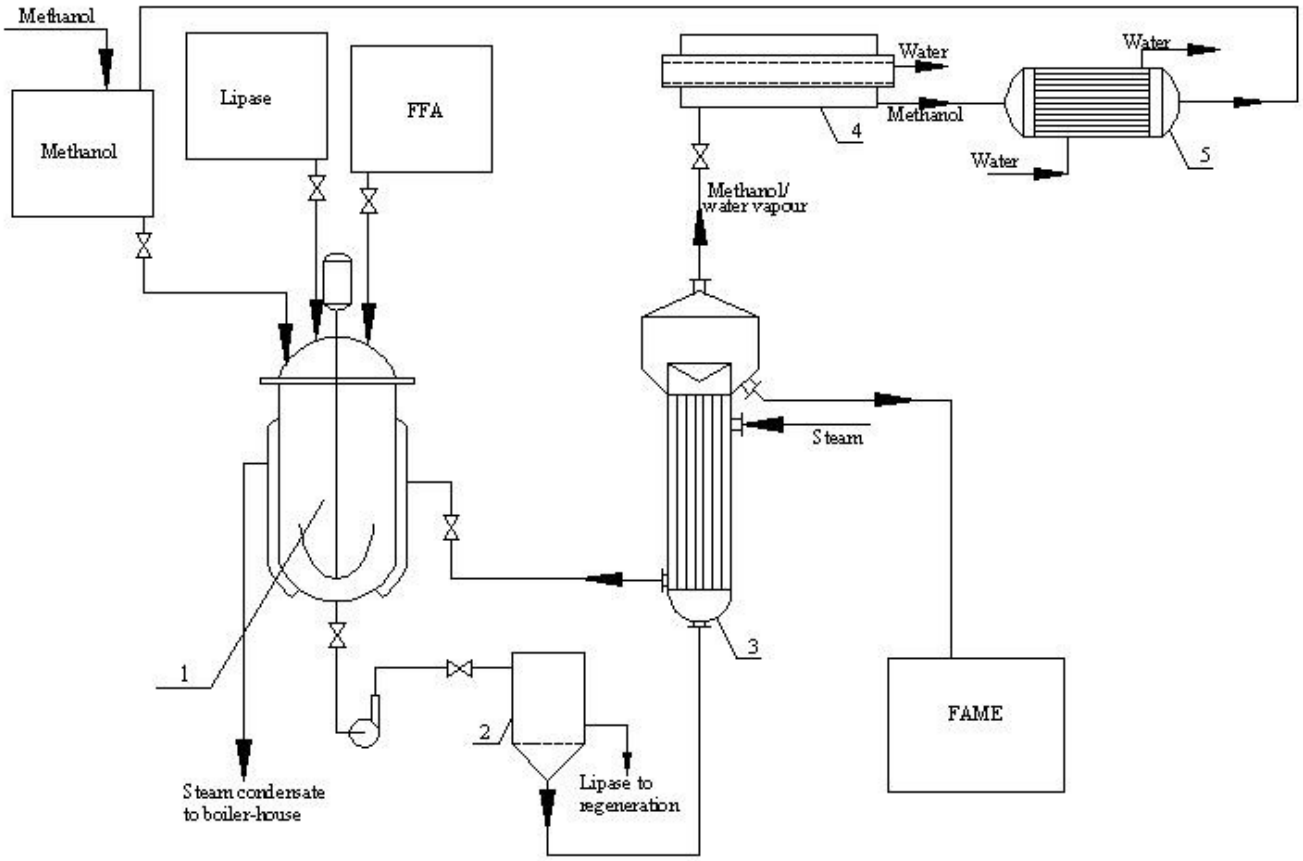
Biogas riforming

Current and future R&D in the field of biofuel in Lithuania



Production of bioethanol with utilization of distiller grains for biogas production

Current and future R&D in the field of biofuel in Lithuania



Utilization of free fatty acids for biodiesel fuel production applying biochemical catalysis

Thanks for Your attention

Dr. Violeta Makareviciene
LITHUANIAN UNIVERSITY OF AGRICULTURE
Institute of Environment
LABORATORY OF CHEMICAL AND BIOCHEMICAL RESEARCH FOR ENVIRONMENTAL TECHNOLOGY
e-mail: agrotech@lzuu.lt