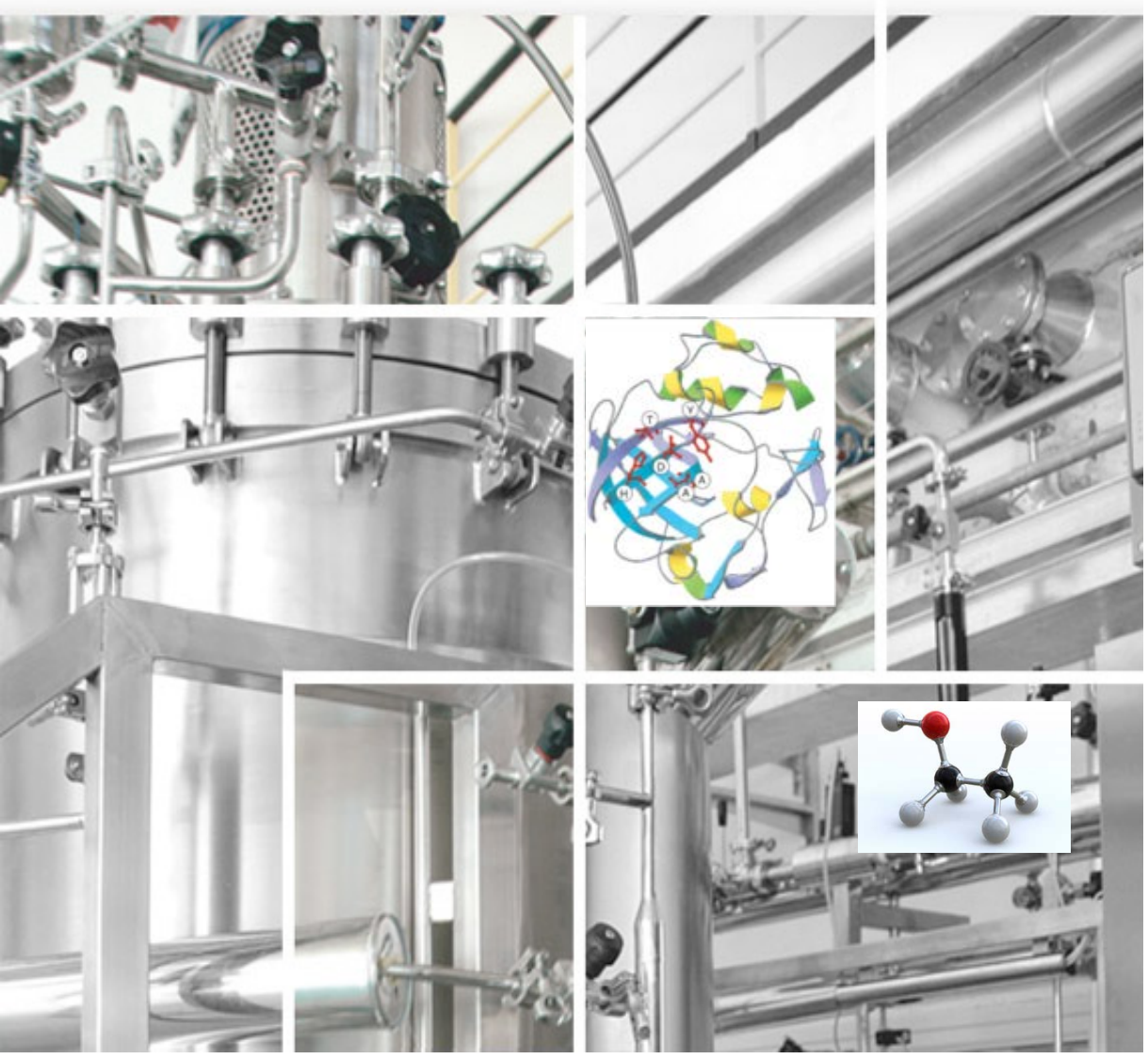


# NSTDA-JGSEE Integrative biorefinery laboratory

JST-Joint lab project on photocatalysis on sugar platform biorefiery



# Integrative biorefinery laboratory @INC2



**Enzymes**

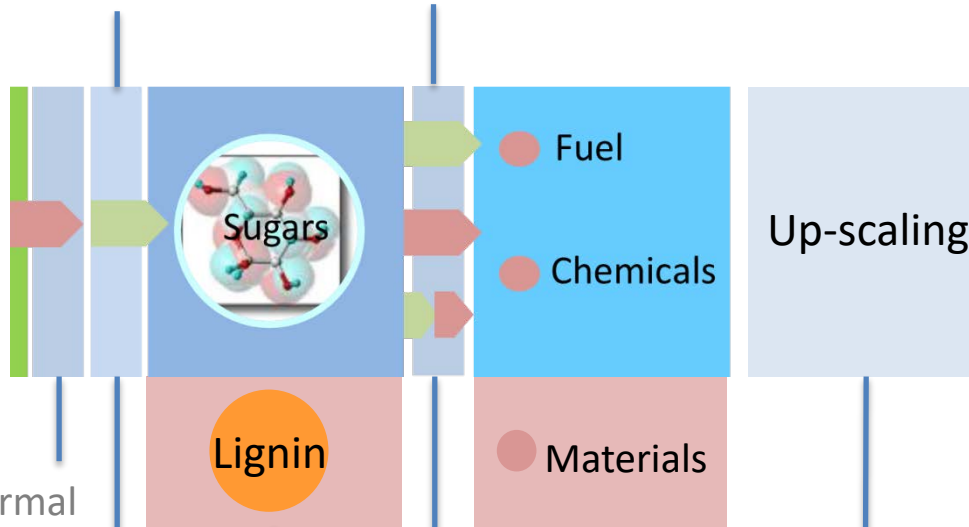
- Fungi
- Metagenomes



**BMCF**  
Synthetic biology



**NSTDA-JGSEE**  
**Integrative Biorefinery Laboratory**



Hydrothermal & Solvothermal pretreatment/ fractionation



**Enzymes**

- Anaerobic/ facultative bacteria

Lignin conversion  
**QUT**

Catalyst design & process optimisation

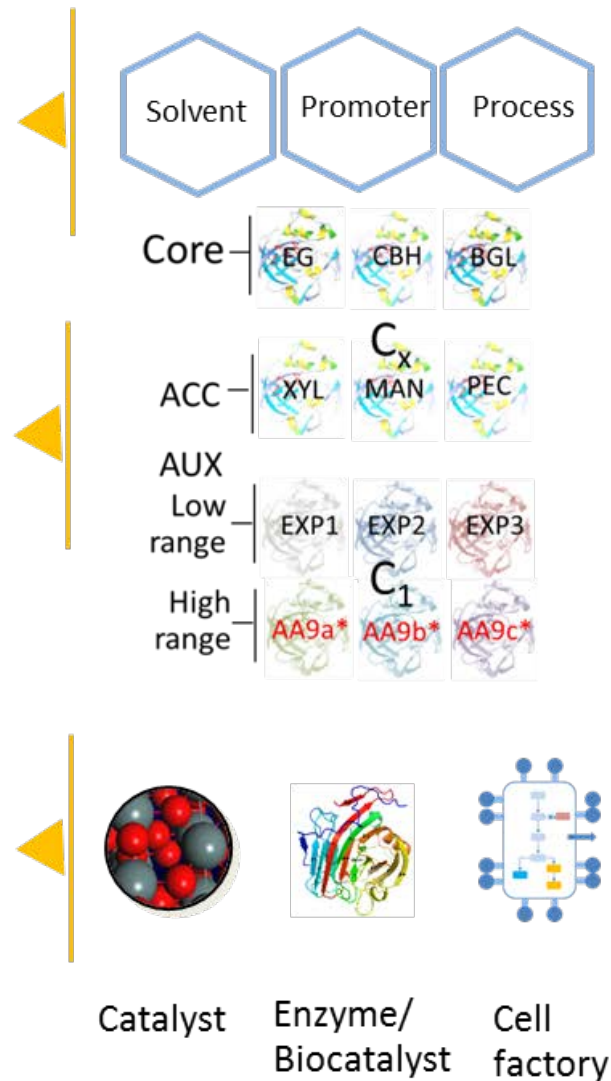
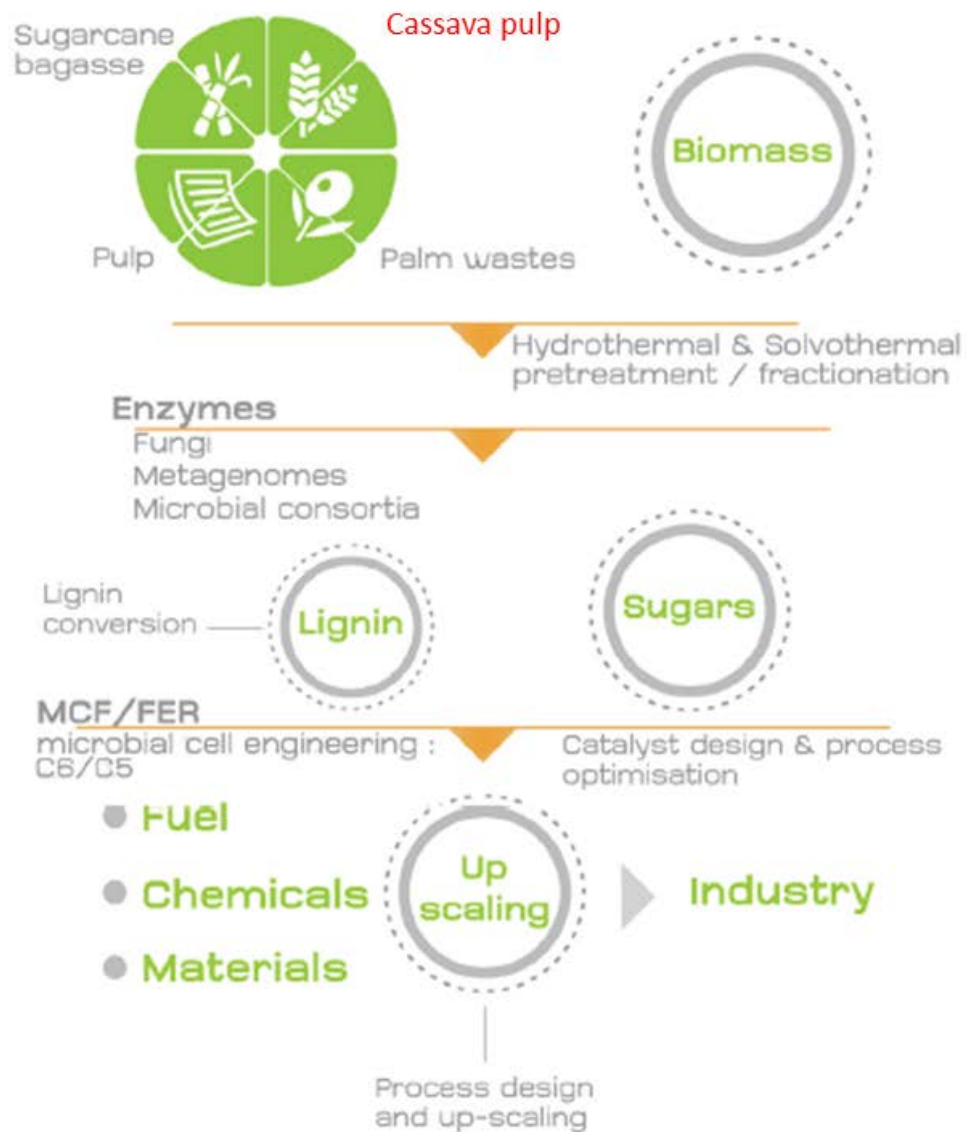


Process design and up-scaling



**Industry**

# IBL core research themes



+photocatalysts

## Problems to be solved by photocatalysts

- Lignocellulose pretreatment & saccharification
  - Integration of photocatalysts to increase efficiency in biomass pretreatment step: lignin removal
  - Oxidative cleavages of crystalline cellulose structure: synergistic action with oxidative enzymes e.g. LPMOs?

Increasing sugar yields with less energy and chemical

- Synthesis of chemicals from lignocellulose derivatives
  - Substrates: sugar, lignin, cellulose, hemicellulose to chemicals
  - Limitation: Low specificity of photocatalysts
  - High specificity photocatalysts

Highly selective catalysts for value-added chemicals by fabrication techniques and molecular imprinting



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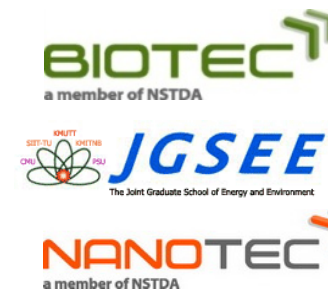
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## Theme 1: Photocatalysts for chemical synthesis

**Aim:** To develop photocatalysts with higher specificity for target chemicals

- To study the reactions for synthesis of high-value products from sugars and lignocellulose-derived components i.e. sugars and lignin with photocatalysts
- To study effects of fabrication conditions on morphological appearances, properties, photocatalytic activity and selectivity for photocatalysts
- To study the effect of chemical structures of sugars and organic lignocelluloses on mechanisms of photocatalytic reactions

## Theme 2: Application of photocatalysts on biomass pretreatment and hydrolysis

**Aim:** To increase sugar yields with less energy and chemical consumption for sugar platform biorefinery

- To study the applicability of photocatalytic reactions on developing new route of lignocellulose pretreatment
- To study the synergism of photocatalysts and enzymes on hydrolysis or modification of lignocelluloses
- To combine photocatalysis to sugar platform biomass conversion for production of ethanol or chemicals

- Development of fibrous photocatalysts for glucose conversion
- Improvement of photocatalysts by loading or doping
- Surface modification of photocatalysts by molecular imprinting technique for enzymatic NAD(P)H production
- Development of composite photocatalysts for oxidative degradation of lignin



## ***Expected technology exchange/transfer***

### **From KU to JGSEE/NSTDA**

Fabrication of photocatalysts with higher selectivity for catalytic reaction

Design of photocatalytic reactor

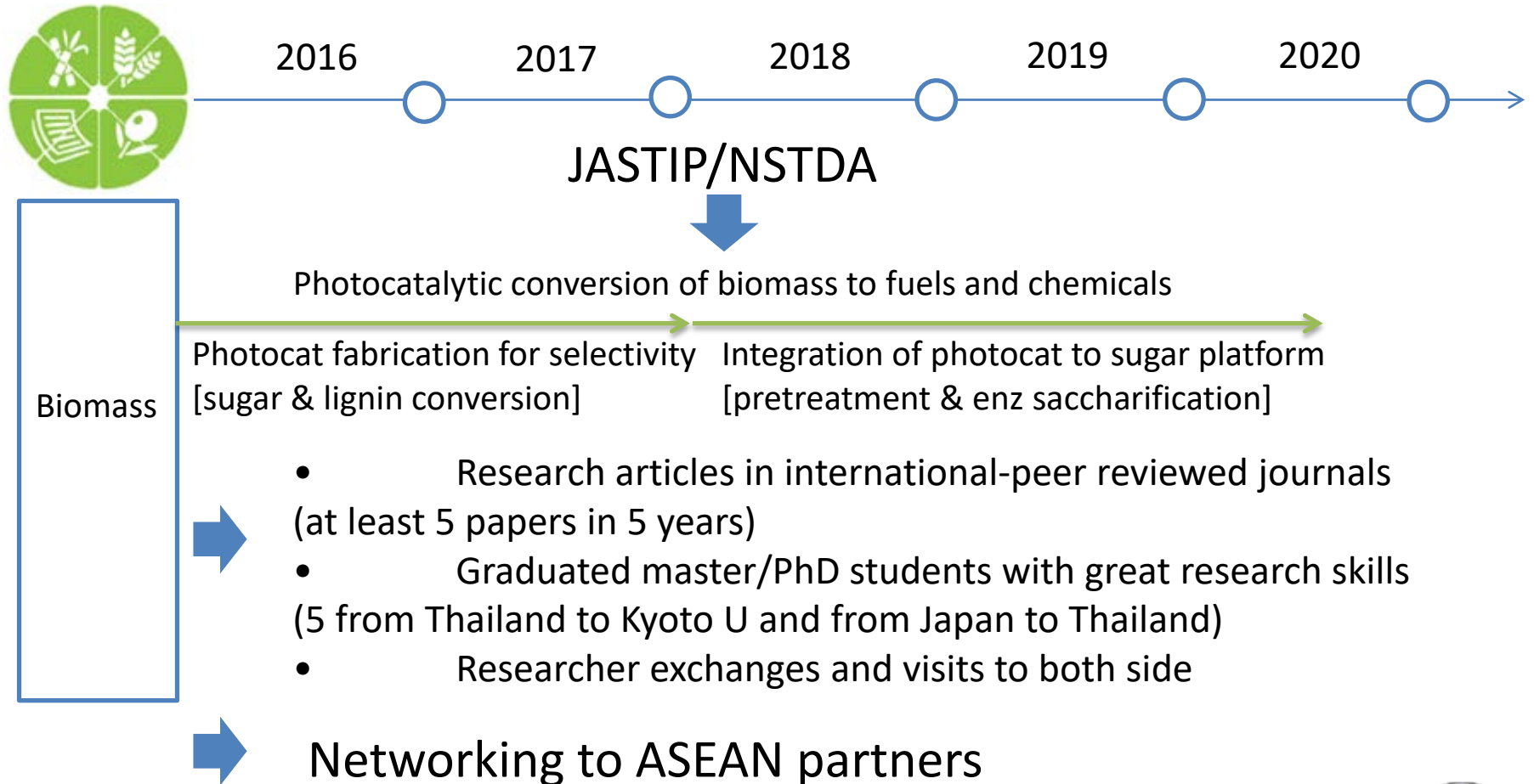
### **From JGSEE/NSTDA to KU**

Testing of photocatalysts in hydrothermal/solvothermal reaction

Integration of photocatalysts to sugar platform biomass conversion

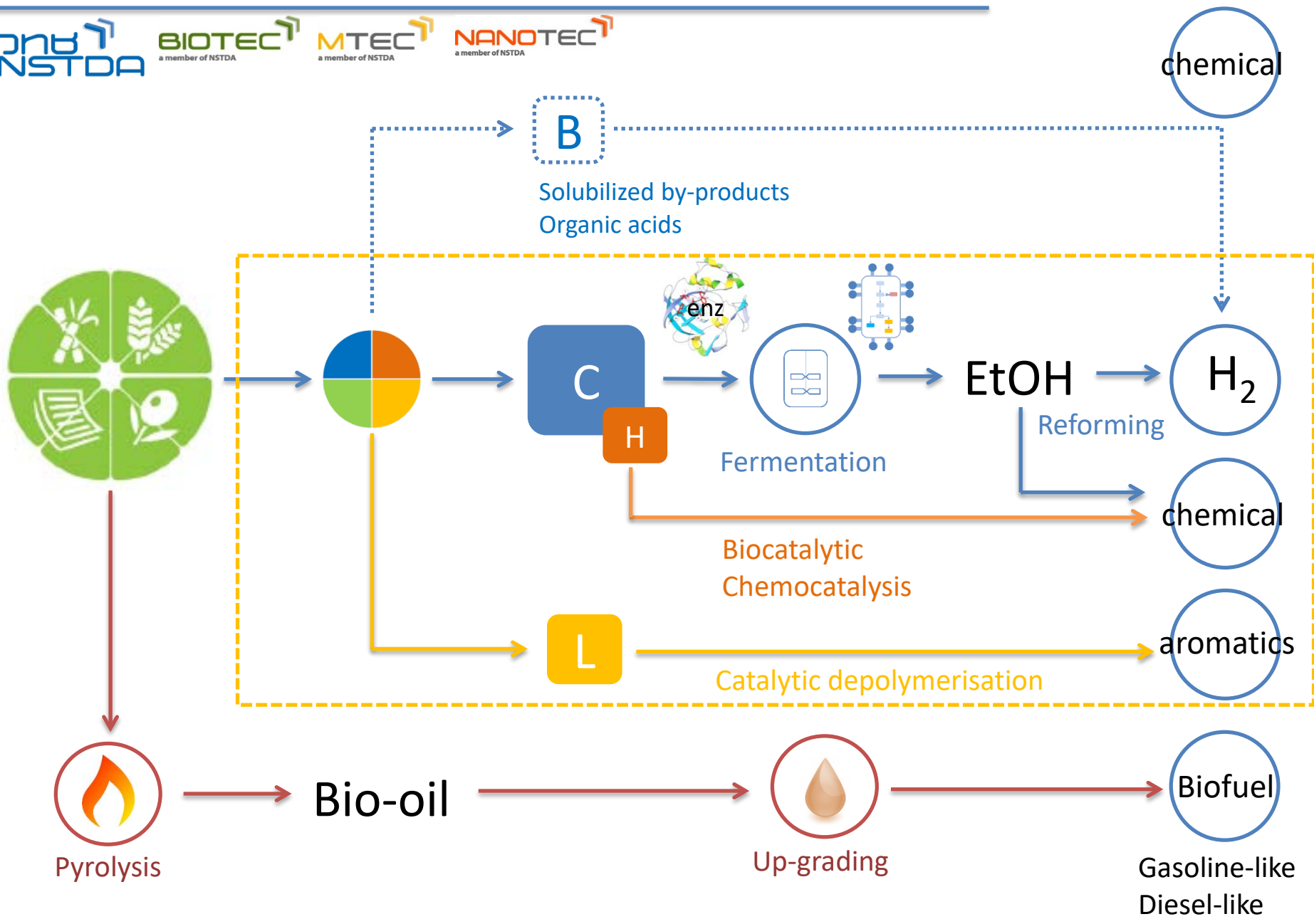
# Renewable energy and new energy technology program

## NSTDA-Kyoto U: Biomass to Energy and Chemicals[B2EC]





# NSTDA Integrated biorefinery research network



# Bioenergy for sustainability of nature and society

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Thank you..