

Algal Excellent Center (ALEC) at TISTR



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Senior Researcher

Biodiversity Research Center
(Algal Excellent Center)



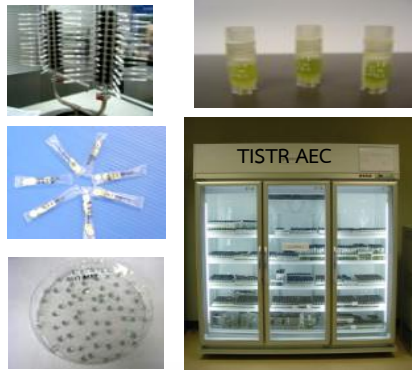
TISTR Algal Excellent Center (TISTR ALEC)

Vision: To be the excellent center in regional recognition

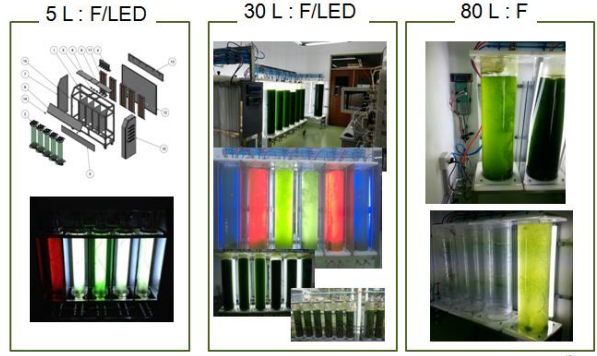
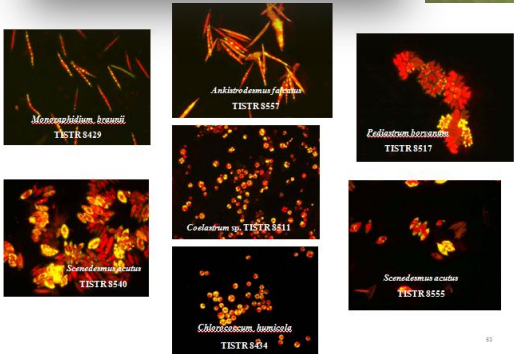
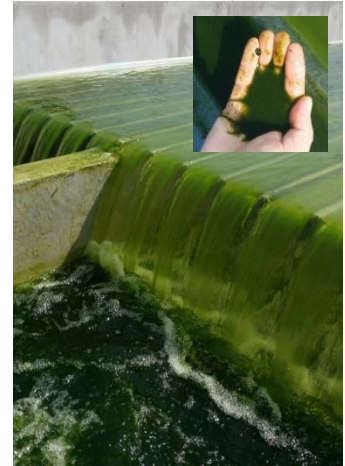
Total Budget: 180MB (~5.0 MUSD)

TISTR ACC / TISTR Algal Research Resources Center (TISTR ARRC)

Freshwater & marine microalgal researches and utilizations



New research facilities





Up stream research unit
Algal Resources

Mid stream research unit
Algal Biotech

Down stream research unit
Algal Platform

Commercialized potential

TRL level	Algal Resources	Algal Biotech	Algal Platform
Conserve	Culture collection Algae classification Culture preservation	Resources Utilization Preservation tech.	DNA barcoding & Biomaker Big Data
Research	Long term preservation Polyphasic Identification	R&D on Food, cosmetics, Agriculture, Energy and Environment. New compound explore	Hi-cell density Technology Harvesting Technology Extraction Technology Product development
Service	Strain identification Culture distribution Strain preservation	Research coaching Strain selection Std. and Concerned	Contract service Customized research SML consulting service
Networks	MIRCEN AOAIS	Think Algae Algae 4.0	DENSO, IHI PTTEP, Bangchak, MALEE

Outcome

Conserve
Platform
Tech.



Research
Platform
Tech.



Service
Platform
Tech.



Joint
venture



Output Resources Utilization ➡ Technology/Patent ➡ Production/processes ➡ Product

International

Global

Unstable earth and Sustainable development approaches

World Carbon footprint by nations

2015-2030 <http://www.sustainabledevelopment-goals.org/>
<http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

National

Algae Technology, Thailand Super cluster and Bio-economy

Customer

ว. : ความต้องการของภาคเอกชน

พันธมิตร/ลูกค้า/พันธมิตร

PTTEP, DENSO, IHI, Maico, ENERGY GROUP

Networks

THINK ALGAE's Acknowledgement

NETWORK

KU, CU, BIOTEC, ISTDIA, JU, PTT, PUBLIC

Functions

Strategy, Algae reso, Engineering

Services, Processes, Products

ALEC

TISTR Algal Excellent Center

New research facilities

Technology

TISTR Algal Excellent Center

Functional Ingredients, Cu₂ utilization technologies, Algae oil production, Algae cultivation technologies

TRL 1-3, TRL 4-5, TRL 6, TRL 7, TRL 8, TRL 9

Next gen. Agri. Technologies, Algaesoft daily set, Slim Neotoc and microalgae, Algae ball, Bio-fertilizer

TRL status: ■ Completed by TISTR ■ Co-developed with other Organizations/companies ■ Licensed

Product

Technology and Co-product Value Chains and Industrial Demonstration

Algae Conservation, Active algae, Cultivation Tech.

Next gen. bio-fertilizer, Next gen. Aquaculture feed

Develop the Practical and Reliability Algae Platform Technology for Industrial

Transform TISTR large scale algal cultivation to the platform of waste CO₂ utilization for agriculture and industrial used

Algae CO₂ fixation, Multi-product, Markets and value

Indoor 360 L, Outdoor 70,000 L, Indoor/Outdoor 1,000 L semi-pilot scale for food and feed

Responds the need for markets and product from industrial customers

Infrastructure

Indoor and outdoor cultivation technologies for challenging CO₂

TISTR algae cultivation technologies

Indoor 360 L, Outdoor 70,000 L, Indoor/Outdoor 1,000 L semi-pilot scale for food and feed

Lab scale for Food/Pharma

Industrial apply

Co2 capture PBRs (500 Liter) (Outdoor)

Algae Factory (5,000 liter) (Indoor)



Functional ingredients



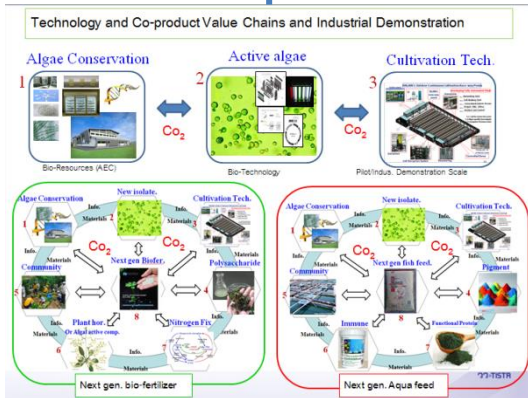
CO₂ utilization technologies



Algae oil production



Algae cultivation technologies



Next gen. Agri. Technologies



AlgaeSoft daily set



Siam Nostoc and microalgae

Algae ball

Bio-fertilizer

TRL statue :



Completed by TISTR



Co-developed with other Organizations/companies



Licensed



Up stream research unit

Mid stream research unit

Down stream research unit

Algal resources

Algal Biotech

Algal Platform

Products and Services

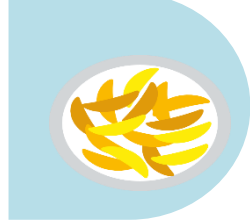
Conserve

Research

Services

Networks

Target Market



Food

cosmetics

Agriculture

Energy and Environment

Potential Customers



Startup



Unstable earth and Sustainable development approaches

"We have a big, bold agenda before us - now we must work to make it real in people's lives."
UN Secretary-General Ban Ki-moon



UNITED NATIONS SUSTAINABLE DEVELOPMENT SUMMIT 2015
 25-27 SEPTEMBER



THE GLOBAL GOALS
 For Sustainable Development

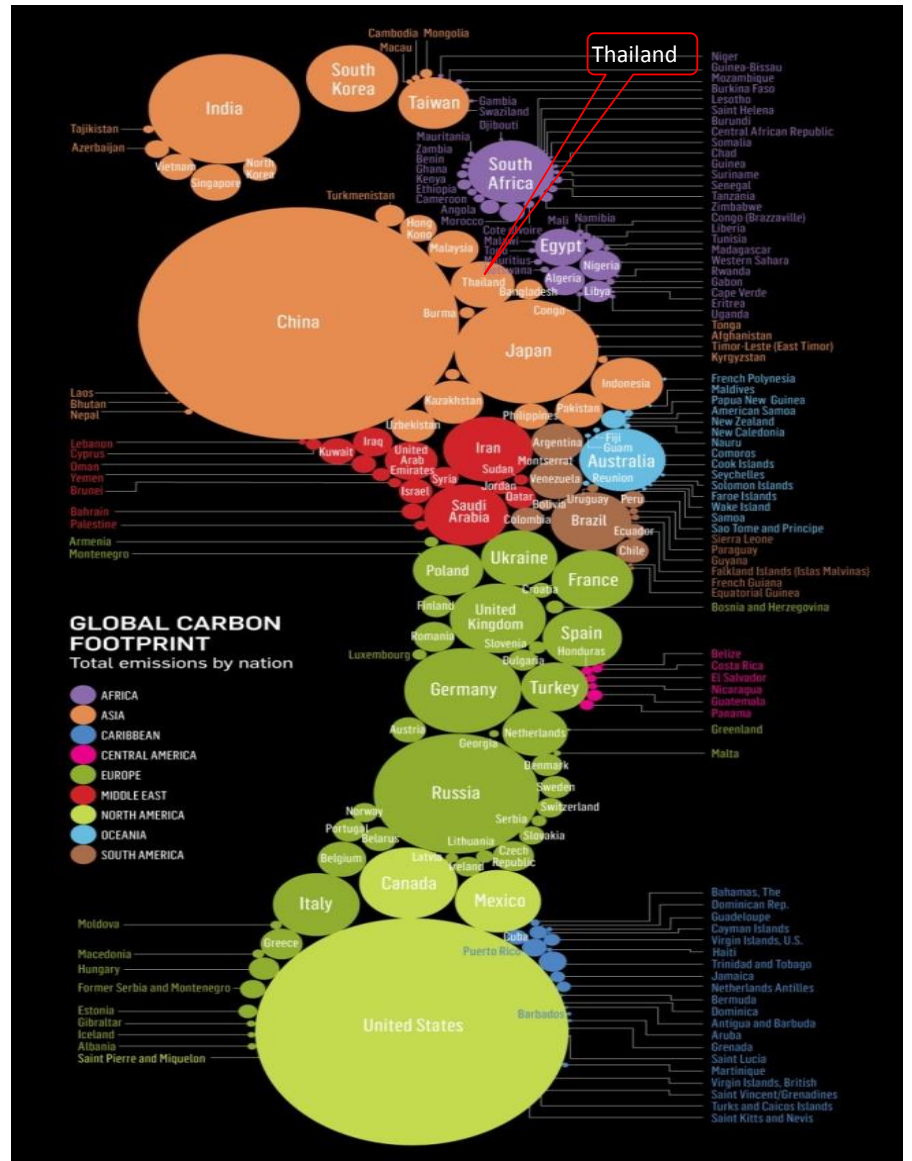


1 NO POVERTY	2 ZERO HUNGER	3 GOOD HEALTH AND WELL-BEING	4 QUALITY EDUCATION	5 GENDER EQUALITY	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY	8 DECENT WORK AND ECONOMIC GROWTH	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	11 SUSTAINABLE CITIES AND COMMUNITIES	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION	14 LIFE BELOW WATER	15 LIFE ON LAND	16 PEACE, JUSTICE AND STRONG INSTITUTIONS	17 PARTNERSHIPS FOR THE GOALS	SUSTAINABLE DEVELOPMENT GOALS

2015-2030 <http://www.kroobannok.com/article-76582->

UN sustainable development summit, New York, 2015

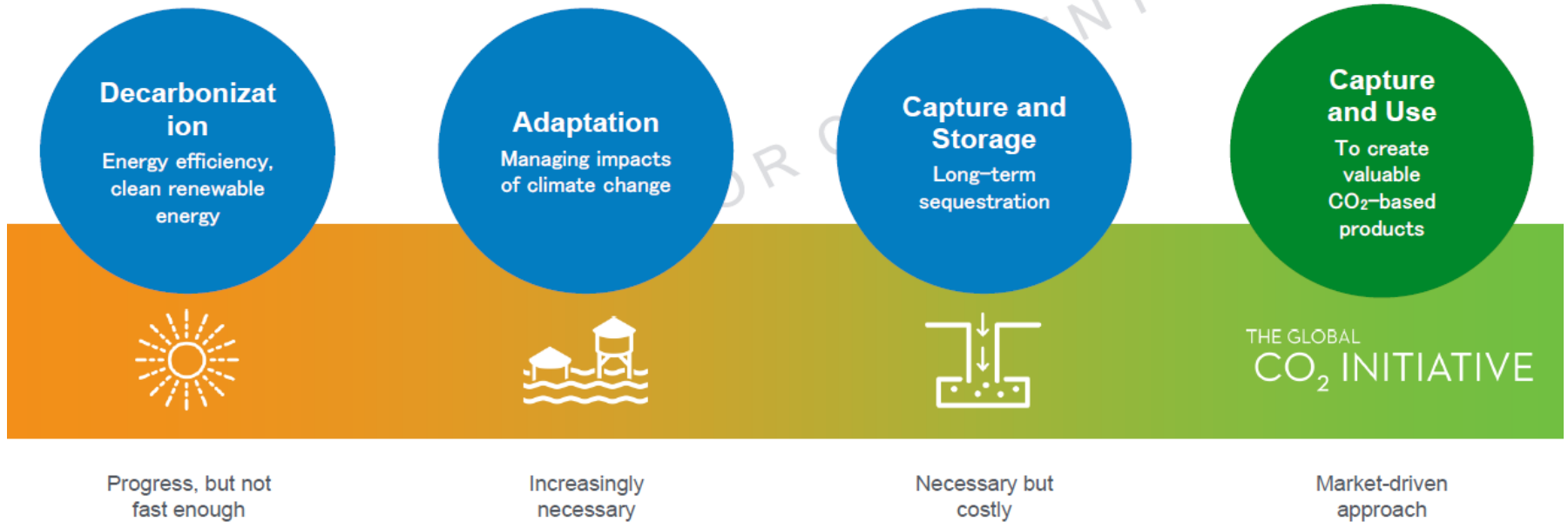
Global Carbon Footprint by nations



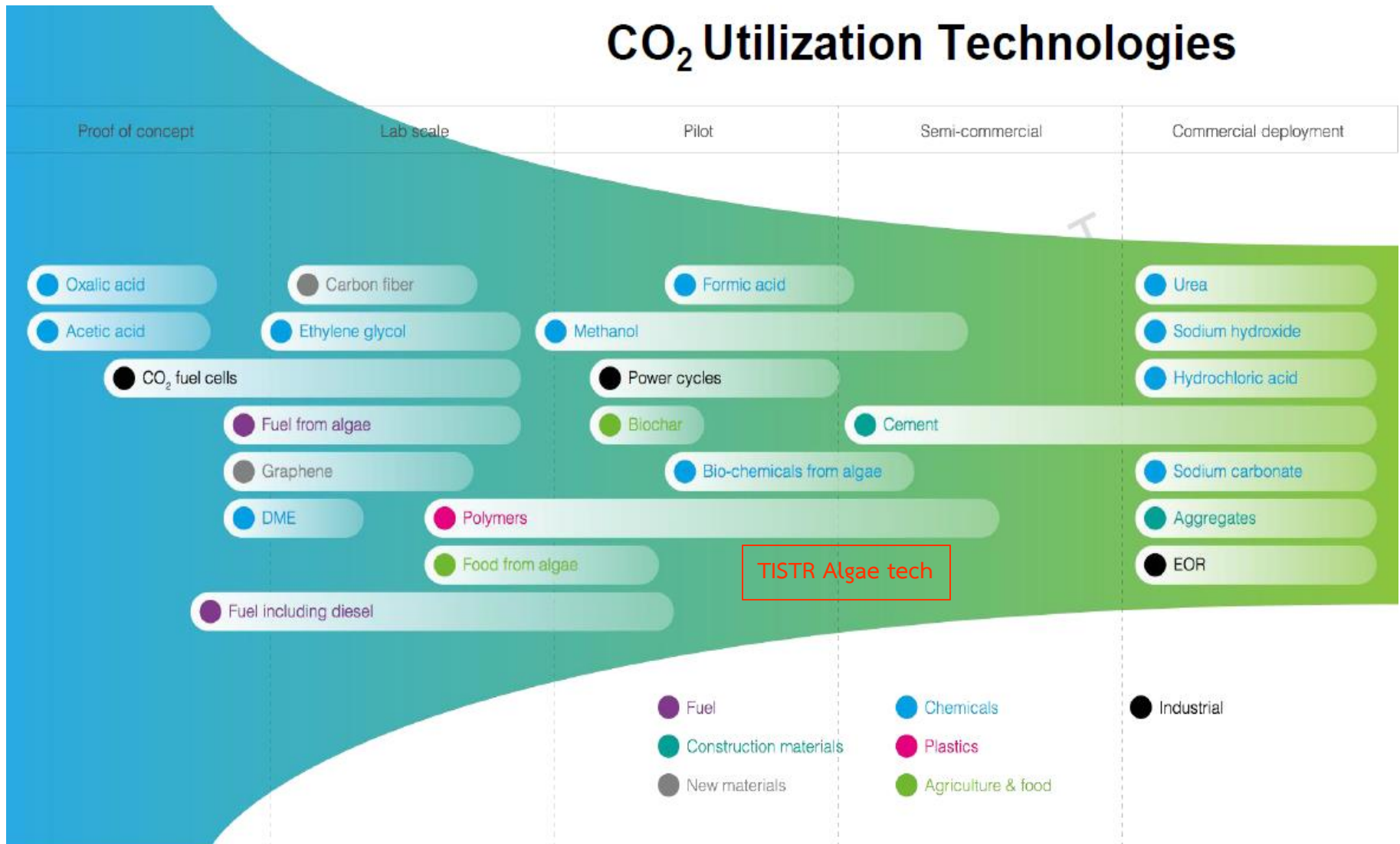
<http://www.sustainablecitiescollective.com/130531/global-carbon-footprint-nation>

Introduction

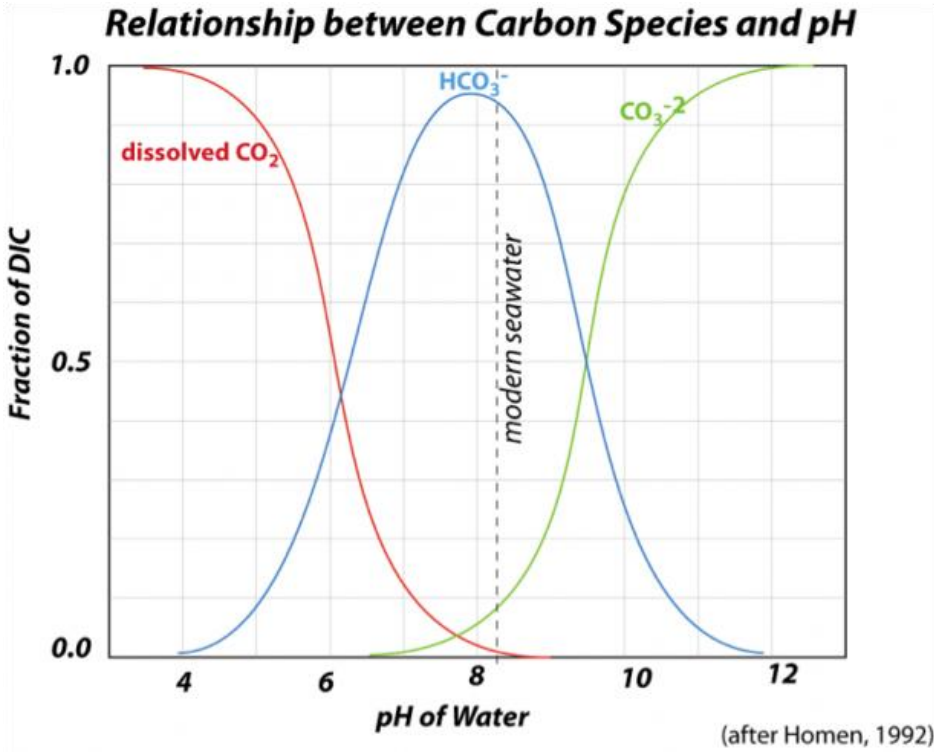
CO₂-based products are one part of the solution



CO₂ Utilization Technologies



pH



(after Homen, 1992)

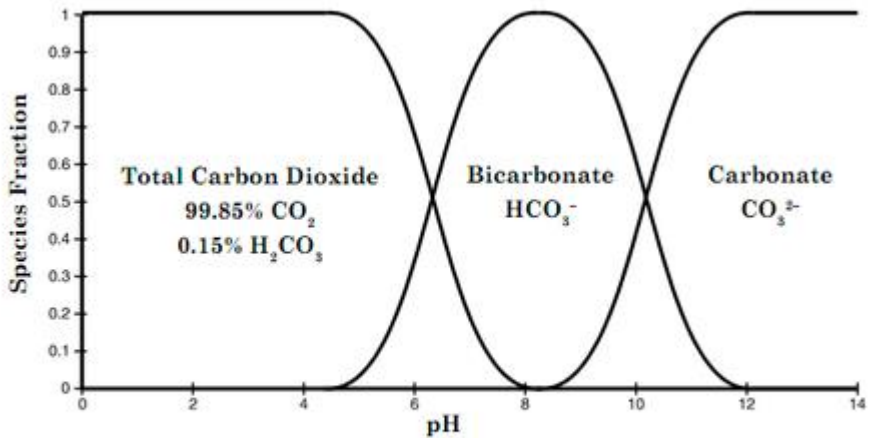
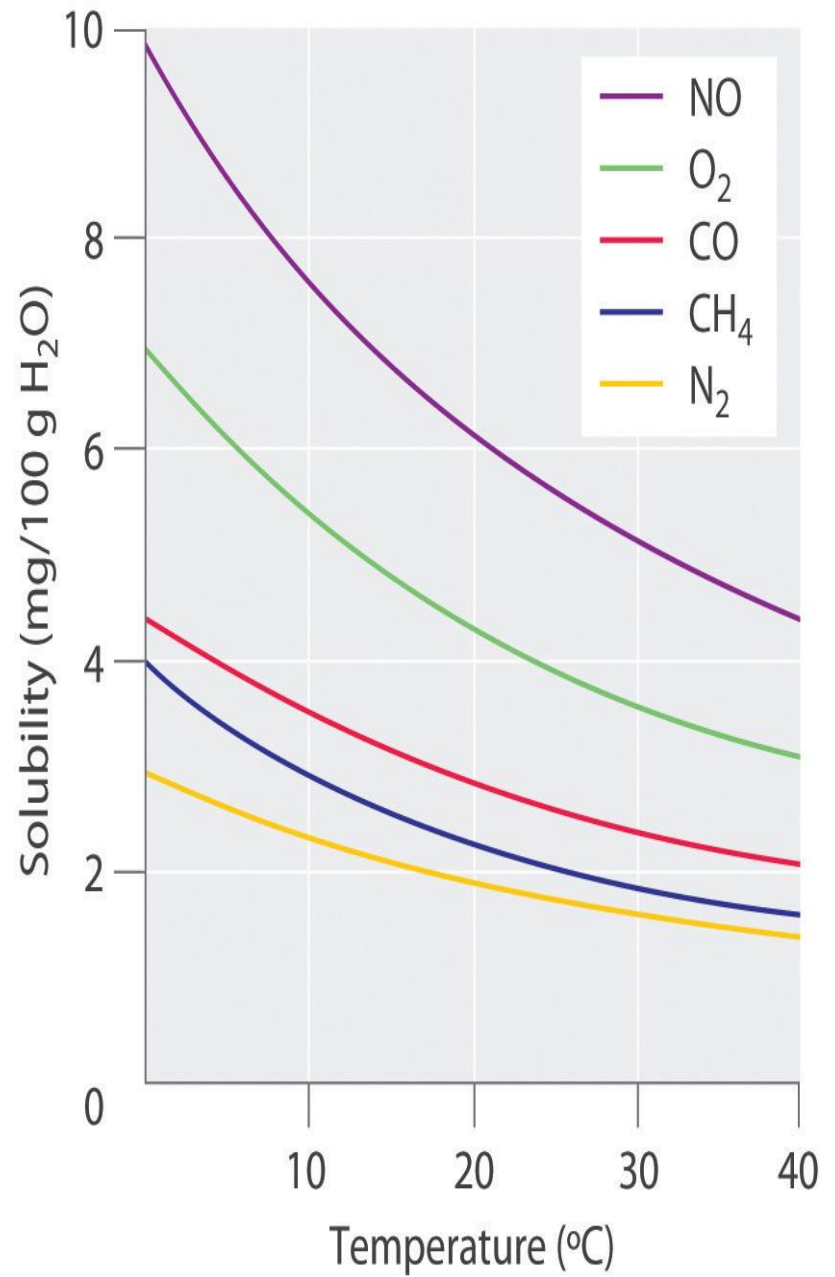


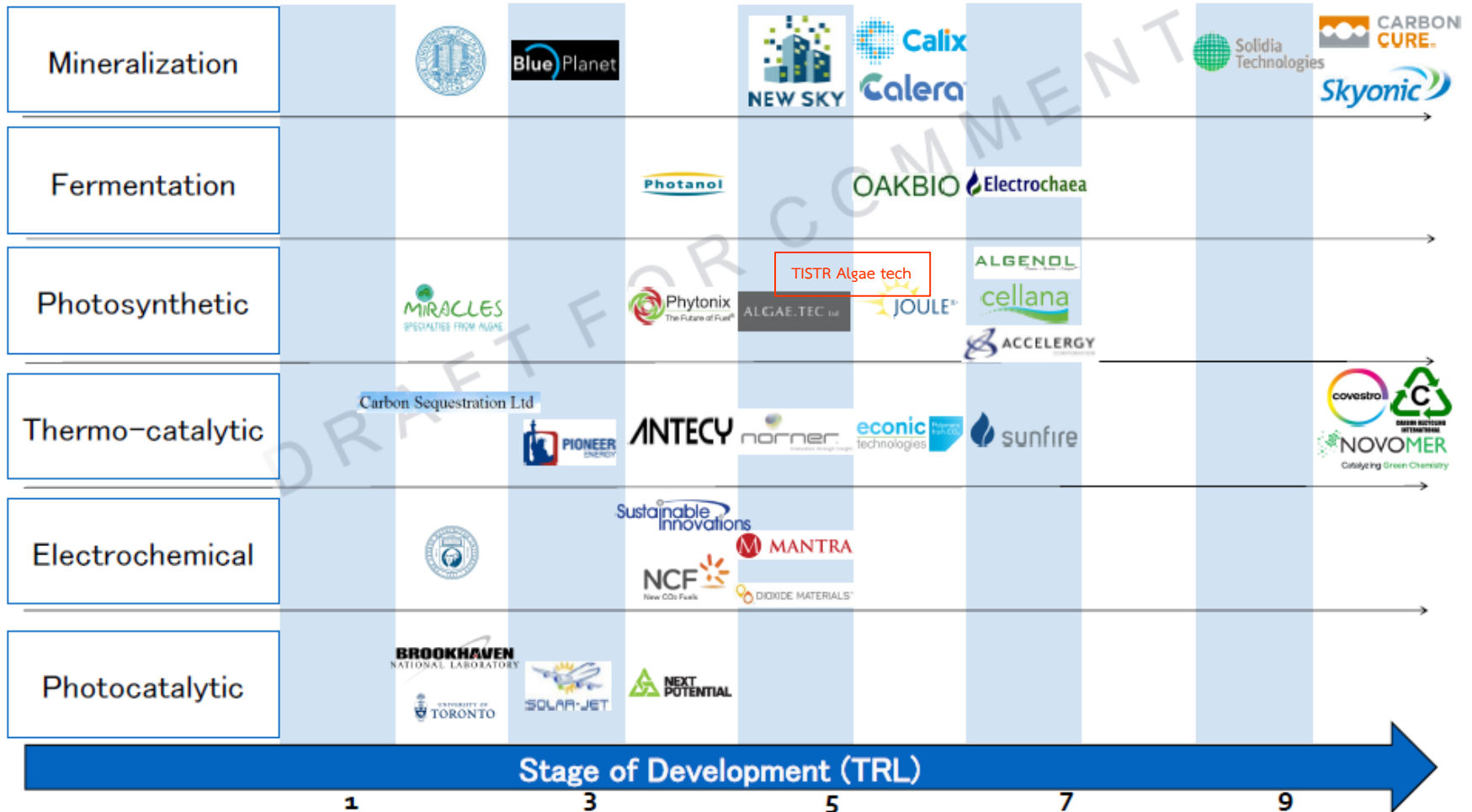
Figure 1 – Distribution of Total Carbon Dioxide, Bicarbonate, and Carbonate vs. pH

Temperature



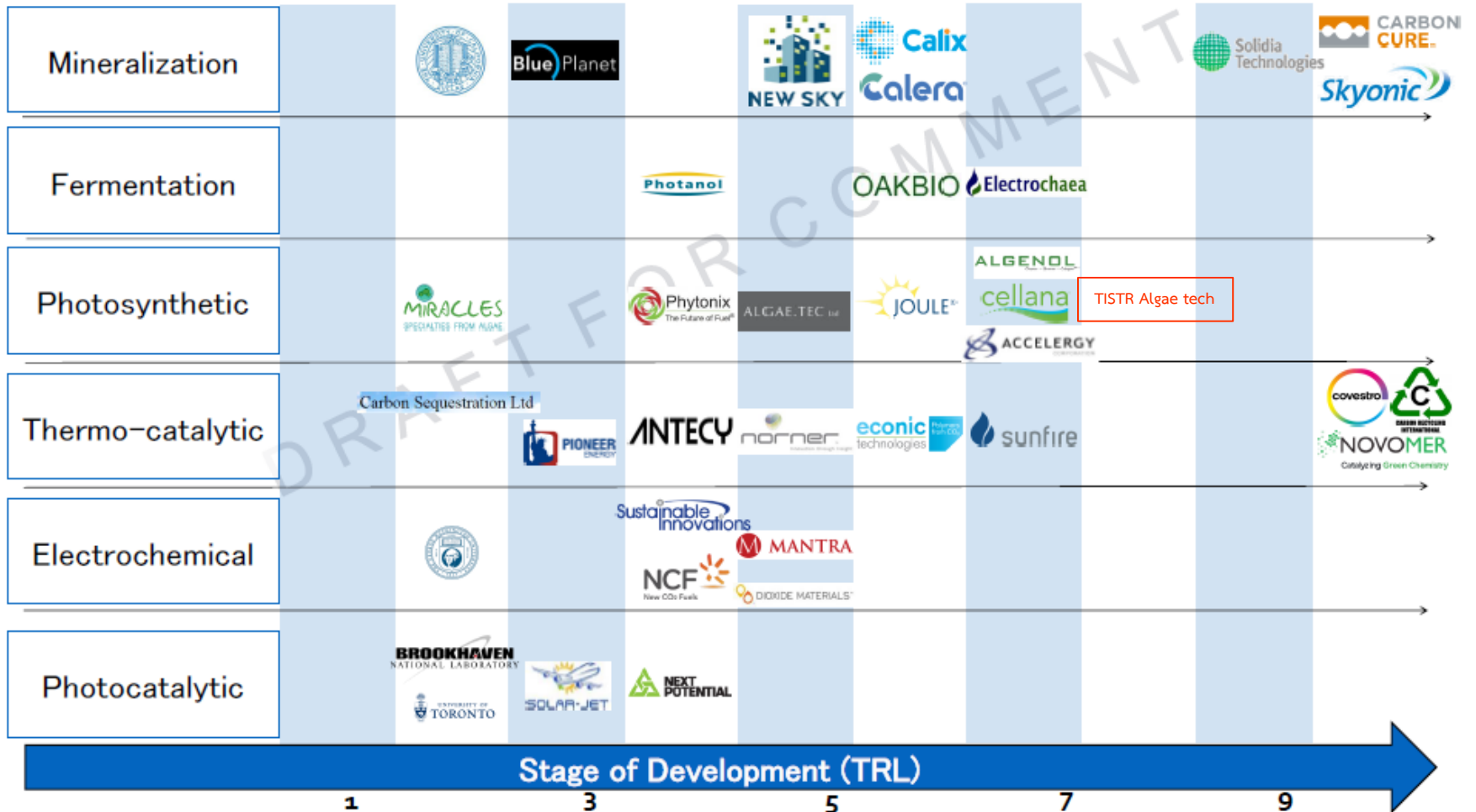
Technology landscaping: Technology readiness of different pathways

Before

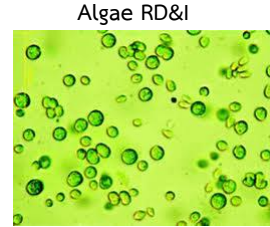
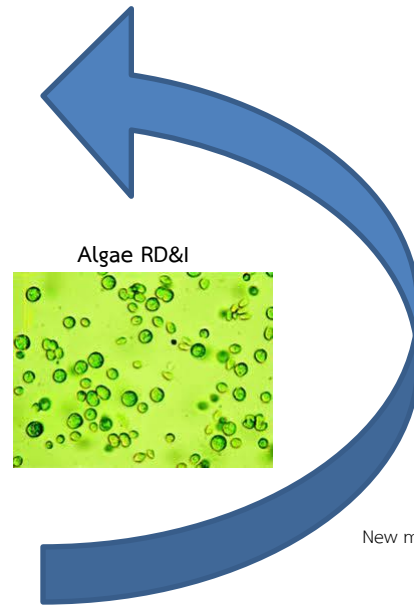
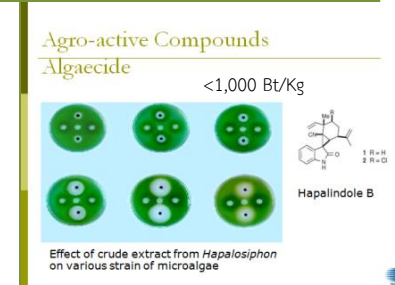
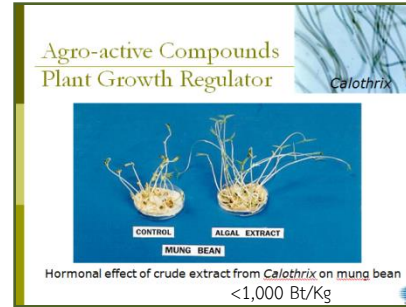


Technology landscaping: Technology readiness of different pathways

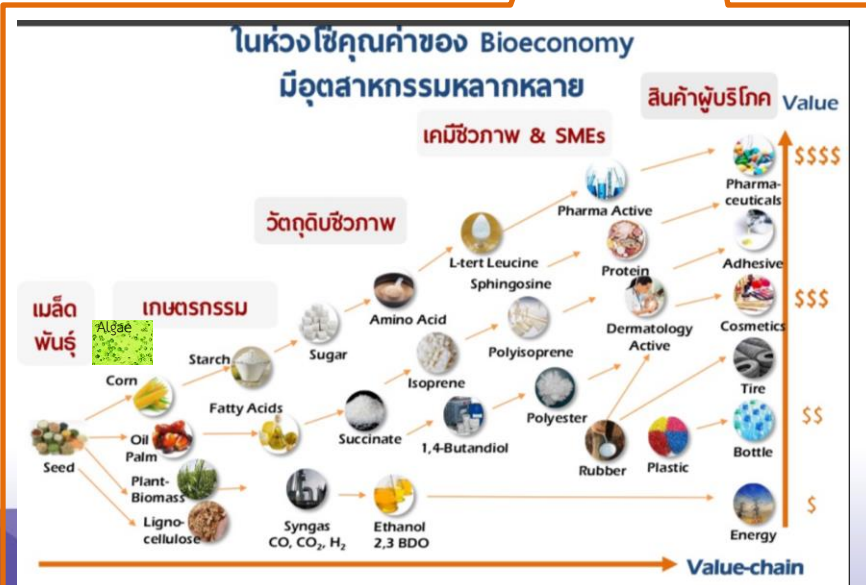
After



Algae Technology ,Thailand Super cluster and Bio-economy



New market





TISTR ALEC



2012-2016
TISTR AEC

Product/Process innovation



TISTR Algal Excellent Center (TISTR AEC)
 Vision: To be the excellent center in regional recognition
 Duration: 5 years (2013-2017)
 Total Budget: 250 MB (~8.0 MUSD)
 2013-14 allocated budget: 60 MB (~1.87 MUSD)(building construction)
 TISTRACC TISTR Algal Research Resources Center (TISTR ARRC)
 Freshwater & marine microalgal strains



2004-2010

Technology Transfer & Service

<p>Biofertilizer (N₂-fixing)</p>  <p>Heterocysts N₂-fixing cells</p>	<p>Soil conditioner (polysaccharide-producing)</p> 
<p>Food (edible <i>Nostoc</i> ball)</p> 	<p>Testing service Thai Industrial Standard TIS 2321-2549 "Weather Resistant Emulsion Paints"</p> 

1995

Algae Culture collection and R&D

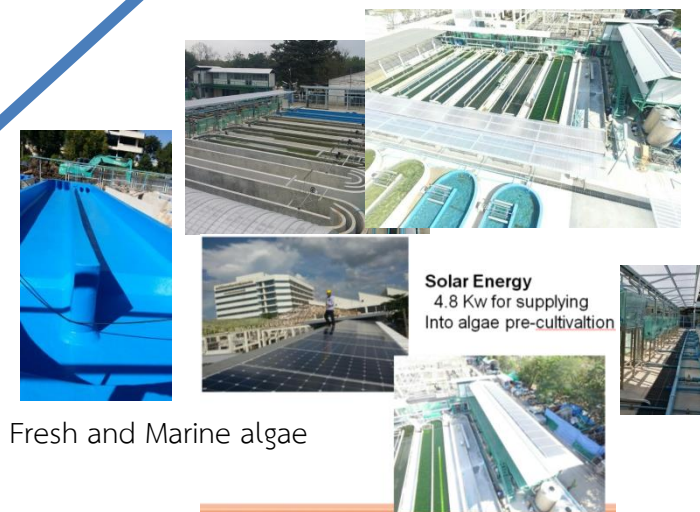


2011-2015

THINK ALGAE

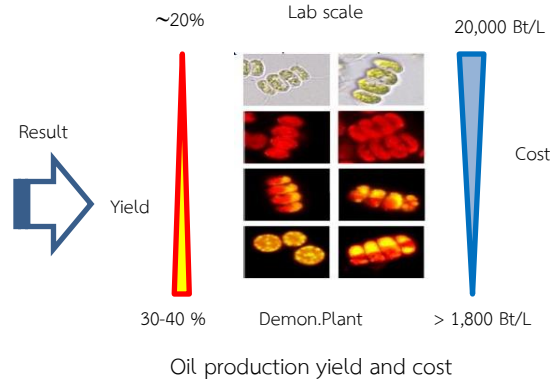


2015-2016

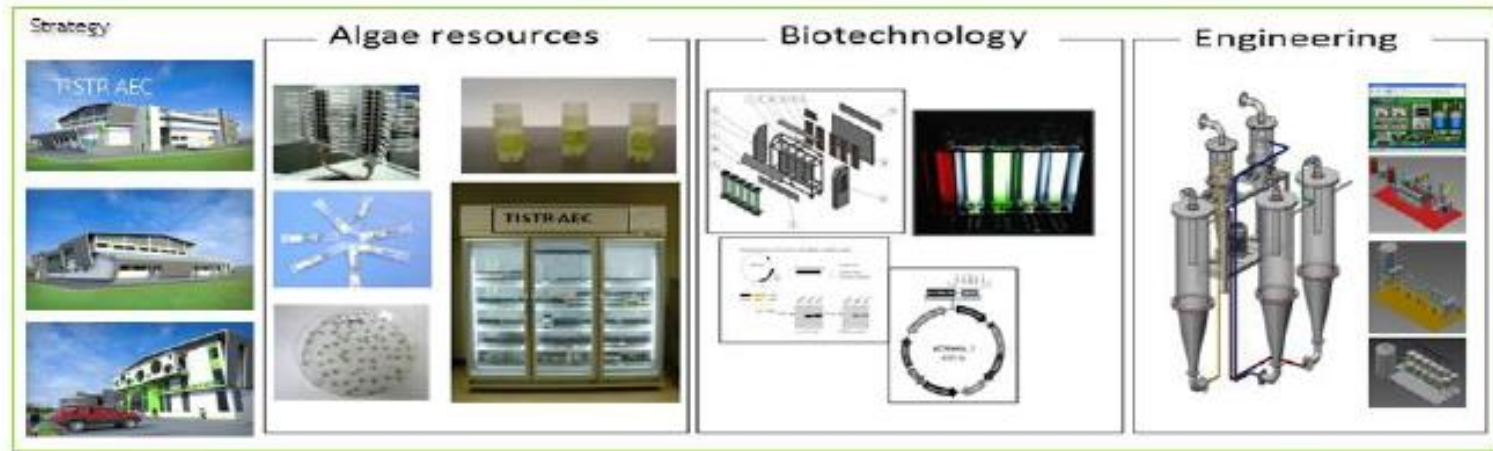


Fresh and Marine algae

Solar Energy
4.8 Kw for supplying Into algae pre-cultivation



Technology network and Innovation for algae researches



Services



Processes



Products



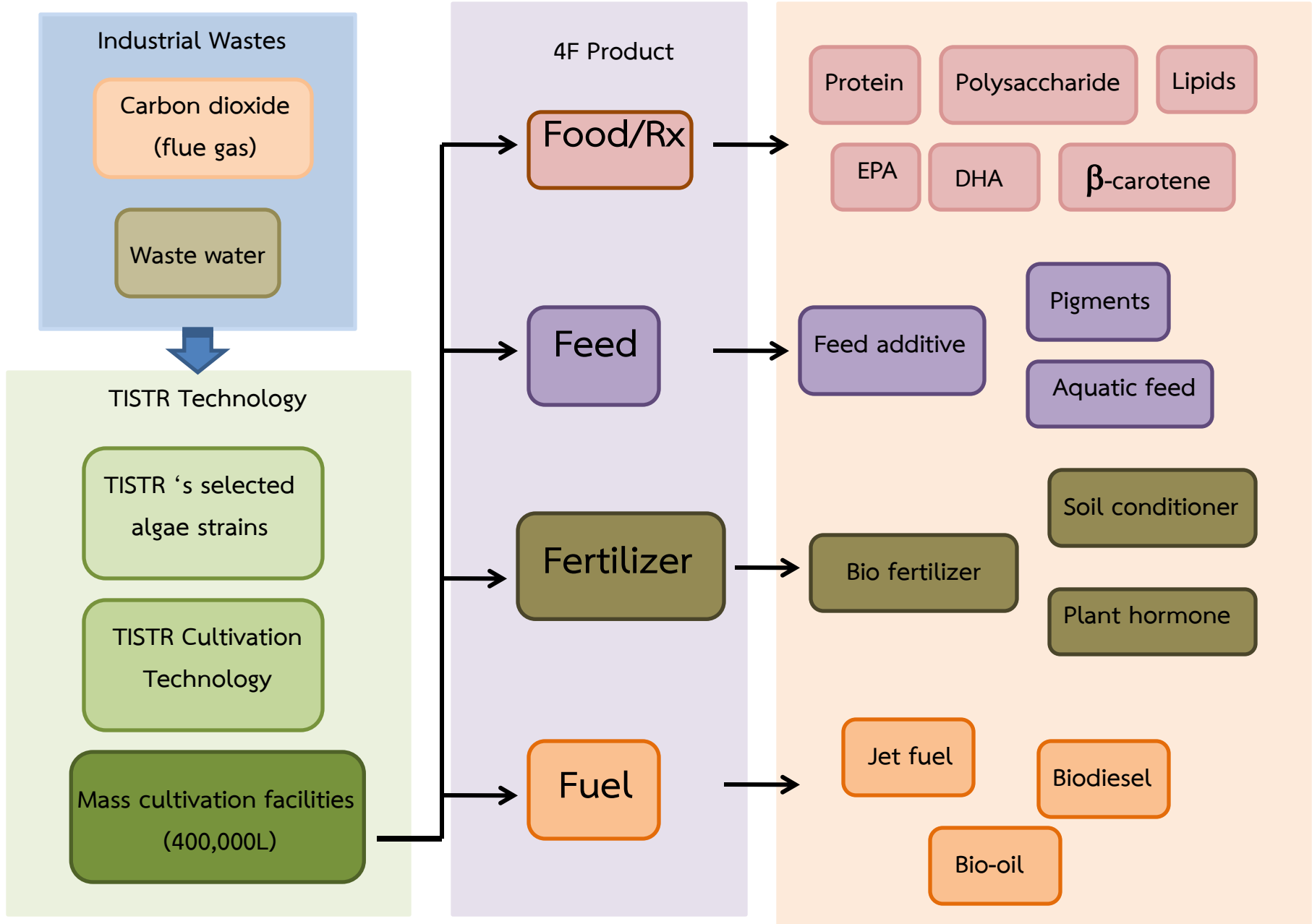
Algae Co2 fixation



Multi product

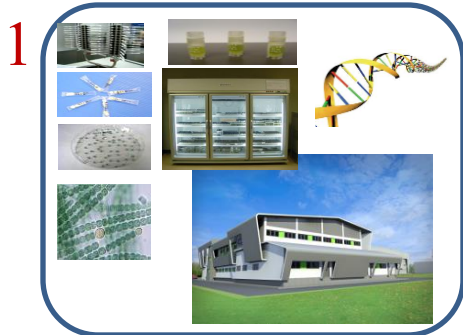


Markets and value



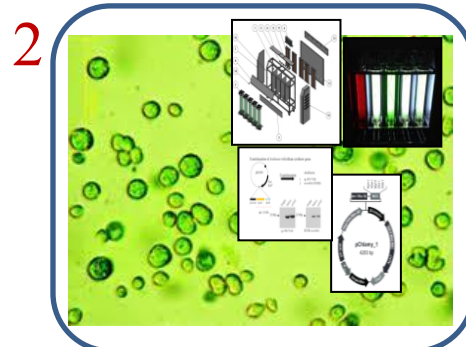
Technology and Co-product Value Chains and Industrial Demonstration

Algae Conservation



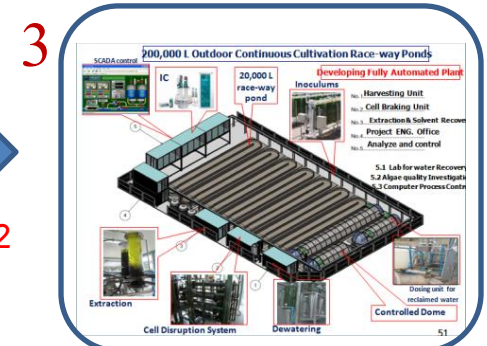
Bio-Resources (AEC)

Active algae



Bio-Technology

Cultivation Tech.

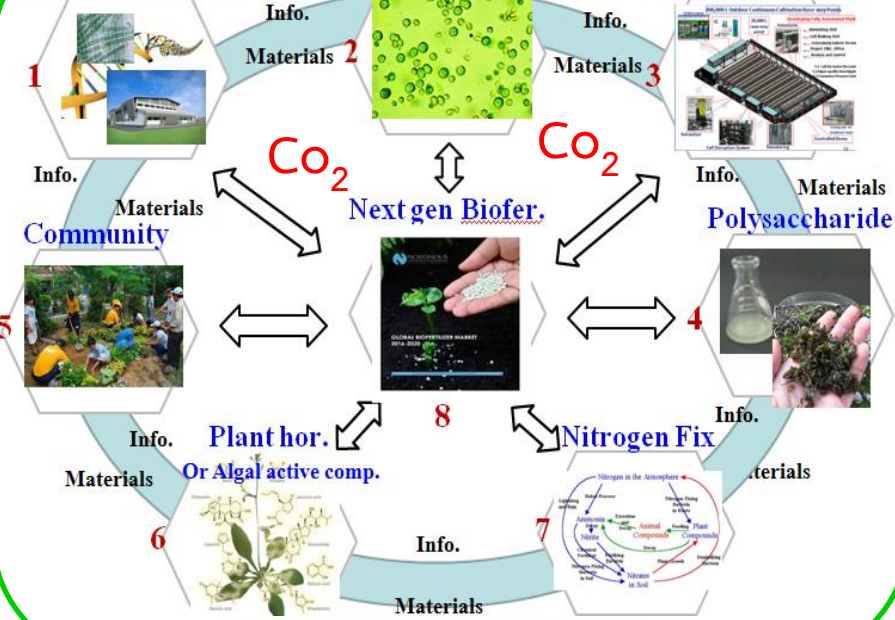


Pilot/Indus. Demonstration Scale

Algae Conservation

New isolate.

Cultivation Tech.



Next gen. bio-fertilizer

Algae Conservation

New isolate.

Cultivation Tech.



Next gen. Aqua feed



Functional ingredients



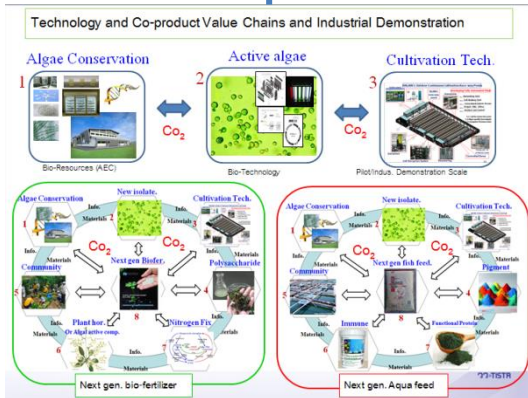
Co₂ utilization technologies



Algae oil production



Algae cultivation technologies



Next gen. Agri. Technologies



Algaesoft daily set



Siam Nostoc and microalgae

Algae ball

Bio-fertilizer

TRL statue :



Completed by TISTR



Co-developed with other Organizations/companies

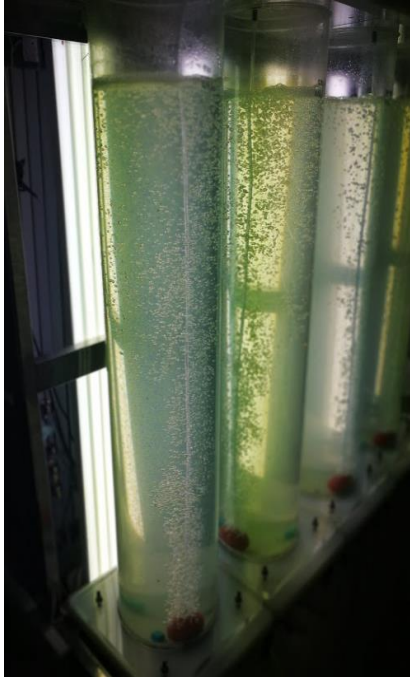


Licensed

ALEC BMC (Business Model Canvas)

<p>Key Partners</p> <ul style="list-style-type: none"> - Ministry of Natural Resources and Environment (MNRE) - Ministry of Agriculture and Cooperatives (MOAC) - Ministry of Commerce (MOC) - Ministry of Energy (MOE) - Universities - National Food Institute - National algae network (THINK ALGAE) and international network (AQAIS) - PTT/Bangchak/SCG/Malee Group - Startup and SME or SML - DENSO/IHI/Meijo U. Japan - UKM U. Malaysia 	<p>Key Activities</p> <ul style="list-style-type: none"> -Culture collection - Networking - Research/analysis services - Consultancy service - Licensing/patent/standard - Verifying -Incubation of Technology -Technology Transfer 	<p>Value Proposition</p> <ul style="list-style-type: none"> - Algae resources and utilization - Infrastructure (TISTR AEC) - Newness/Uniqueness -Lab scale to Demonstration scale (400,000L) -Up to downstream processing - High Value Added - Custom designed processes/products - Climate Change Adaptability - Credibility/truthfulness 	<p>Customer Relationships</p> <ul style="list-style-type: none"> - Researchers - Government and Private sector - Communities - Startup and SME network - International private sector 	<p>Customer Segments</p> <ul style="list-style-type: none"> - B2G : MNRE : MOE : MOC : AIST (Japan) - B2B : PTT (energy/high-value product) : Bangchak (energy/high-value product) : SCG (energy/environment) : Enserve (energy/high-value product) : Malee Group (environment/high-value product) : Mitrphol (environment/high-value product) : Papop (environment) : Siam Nostoc (food) : Patamak (fertilizer) : DENSO (Japan) (energy) : IHI (Japan) (environment)
	<p>Key Resources</p> <ul style="list-style-type: none"> -Algae Resources -Researchers/ knowledge - Infrastructure (TISTR AEC) -knowledge/patent - Equip/Outdoor facilities - Financial (ITAP/STIM) - Business Development partnership - Management 		<p>Channels</p> <ul style="list-style-type: none"> - Online media : TISTR website : Our own Link APP : Facebook : Instagram : Web site - Traditional Media : TV : Radio : Publication - Event : Exhibition/conference - Networking/Partnership National and International 	

TISTR Algae Excellence Center (ALEC) for Bio-based Economy Industries (from research to platform of technology)





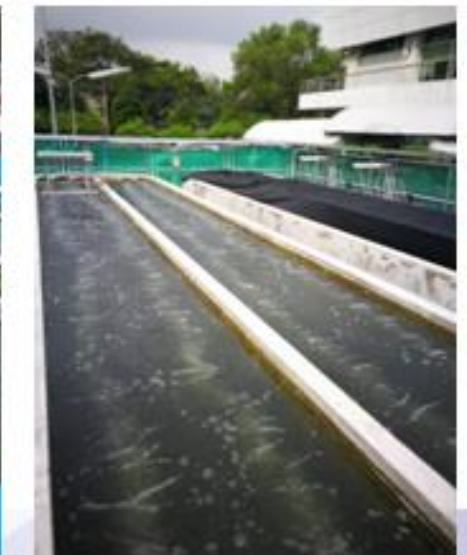
Pigment



Functional protein/ingredient



Indoor and outdoor cultivation technologies for challenging CO_2



Nostoc Commune Innovation series

Product re-branding

มุกหยก

Green Cavier

Green Pearl

Algae Cavier



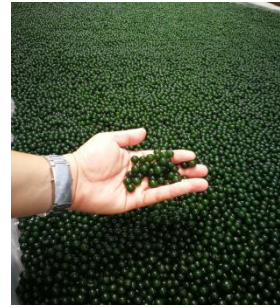
6 Outdoor Algae bead industrial scale production

20,000-70,000L

ORPS



patented



5 Outdoor Algae bead mass scale production
1,000 L Cube tank

patented

Mass cultivation scale for food and feed industrial

Outdoor scale: Mass and cost efficient

4 Algae Bead production
30-80 L PBR

Indoor scale: GLP and precision

3 Algae Bead formation
10-20 L carboy

patented

Laboratory scale for high value functional food and cosmetics ingredient

50x biomass/20Day

2 Primary cultivation
200 ml flask

Patented*

1 Culture collection and selection

10-20 new strains selecting

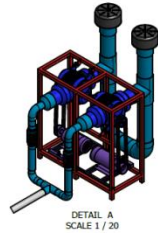
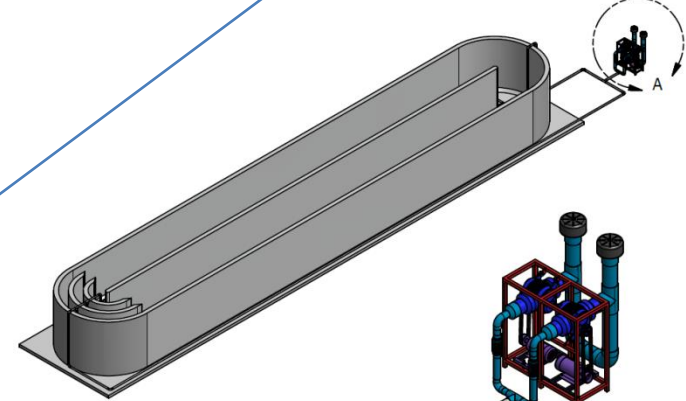
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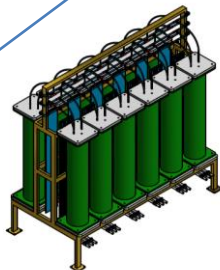
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TISTR algae cultivation technologies

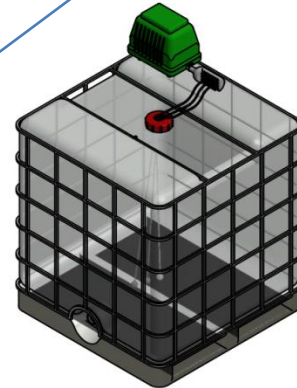


DETAIL A
SCALE 1 / 20



Indoor 360 L

Lab scale for Food/Pharma.



Indoor/Outdoor 1,000 L

semi-pilot scale for food and feed

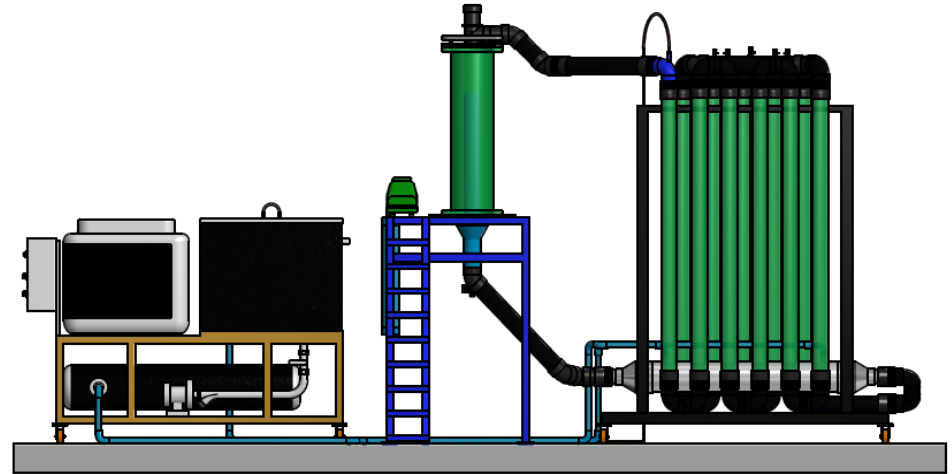
Outdoor 70,000 L

Industrial scale
for feed and food

Co2 capture PBRs

(500 Liter)

(Outdoor)



Algae Factory

(5,000 liter)

(Indoor)

