



International Workshop: Future Perspective of Bioenergy Development in Asia

Session 5: Future Perspective of Regional Development

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Definition of Bioeconomy in Malaysia vs Global

“Bioeconomy has been identified as a game changer for Malaysia’s economic growth. With our biodiversity and the abundance of biological resources, bioeconomy has the potential to increase the country’s economic competitiveness, create more job opportunities, enhance healthcare, ensure food security as well as address environmental and sustainability concerns”

Prime Minister of Malaysia,
BioMalaysia & Bioeconomy
Asia Pacific, 2014

“Bioeconomy is the knowledge-based production and utilization of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors”

Communiqué , Global
Bioeconomy Summit 2015

“Bioeconomy is interpreted in different ways by different actors. The OECD supposes the bioeconomy to be the aggregate set of economic operations in a society that use the latent value incumbent in biological products and processes to capture new growth and welfare benefits for citizens and nations.”

OECD 2006, The
Bioeconomy To 2030:
Designing Policy Agenda

“The term "Bioeconomy" means an economy using biological resources from the land and sea, as well as waste, as inputs to food and feed, industrial and energy production. It also covers the use of bio-based processes for sustainable industries. Bio-waste for example has considerable potential as an alternative to chemical fertilizers or for conversion into bio-energy, and can meet 2% of the EU renewable energy target”

European Commission,
Press Release 2012

Malaysia has the Right Ingredients to be the World Leader in the Production of Renewable Products

BIO-RAW MATERIALS

Cellulosic biomass



Palm residues
EFBs, PKC, PF



Woody Biomass



Short rotation crops
napier grass, arundo

Fats, oils, greases ("FOG")



Plant oils
crude palm oil



Glycerin
bio-diesel co-product



Animal fats
meat processing

MANUFACTURING HUB AND PORT

Infrastructure assets



Utilities
power, steam, water



Process
Glycell™, H2, O2



Logistics
inbound, outbound



Production assets



Chemical
catalysis



Bio-chemical
fermentation



Thermo-chemical
syngas, pyrolysis

BIO-PRODUCTS + DERIVATIVE PRODUCTS

Bio-materials (examples)



Plastics



Base oil



Consumer fibers



Rubber



Paints; solvents



Industrial fibers



Fertilizer



Consumer prod



Packaging



Specialty coatings

Bio-energy (examples)



Bio and renewable diesel



Ethanol



Jet fuel



Power/heat



Hydrogen

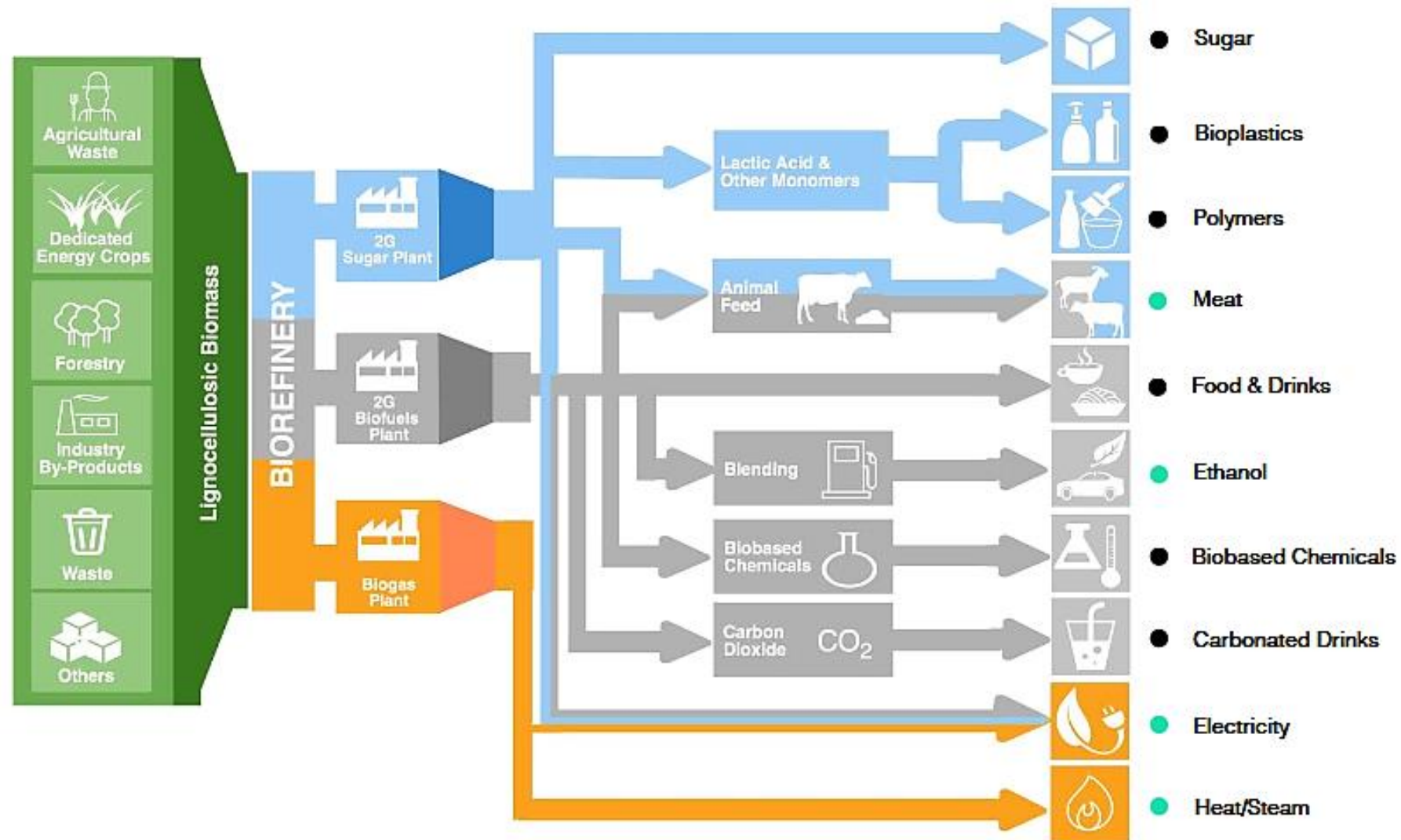


Methane



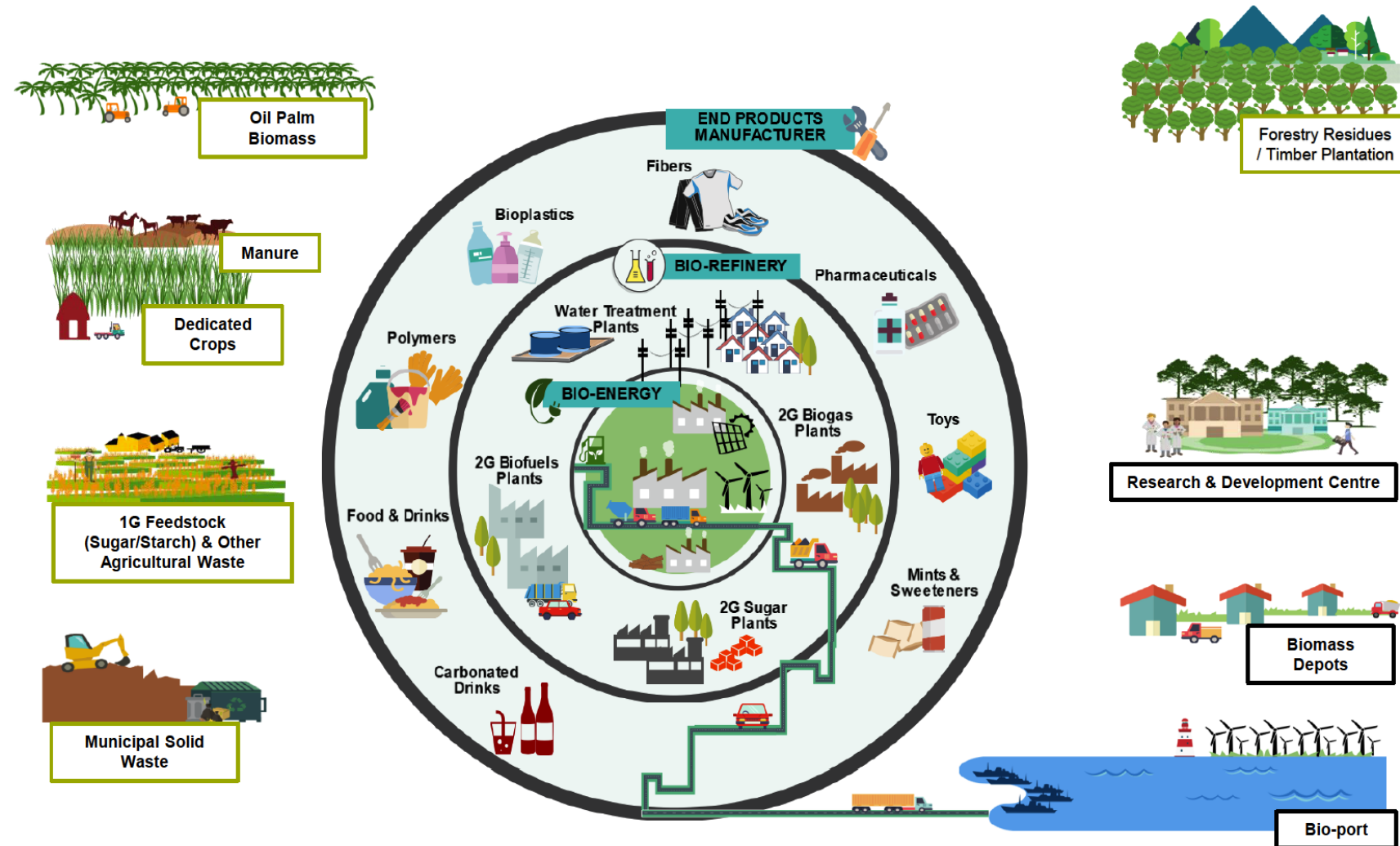
Bunker fuel

We are Taking Portfolio Approach and Integration Allows a Sustainable and More Resilient Business Model



The Bio-Hub Concept; A Circular Economy Model

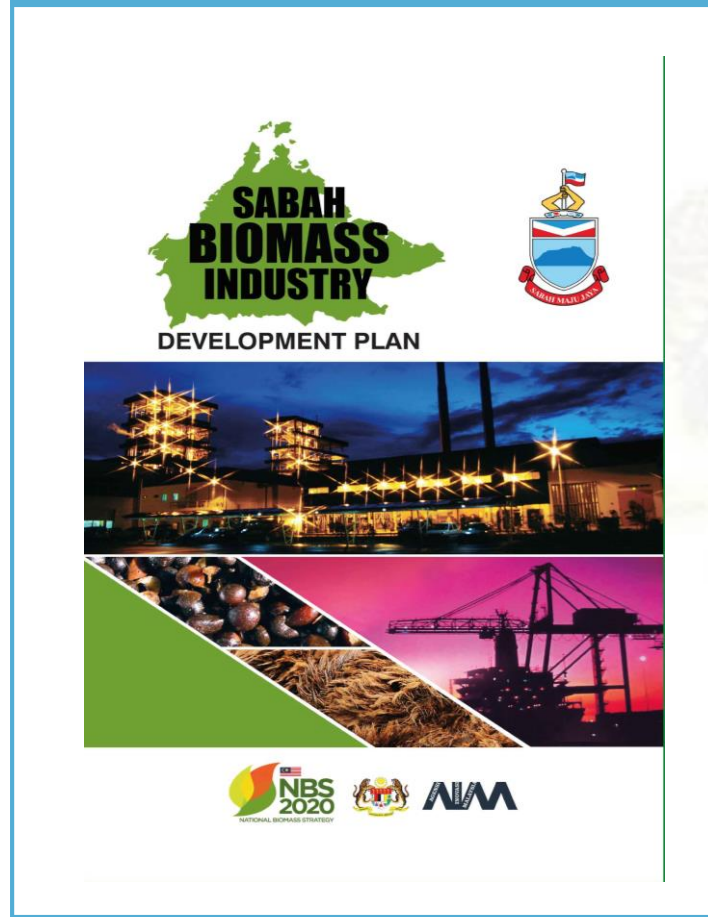
WASTE TO WEALTH: INNOVATION IN GREEN SECTOR



- Integrated Hub where **waste streams of one company is the feedstock** for the other
- **In added value:** Optimising existing volumes of feedstocks, products and side products that provide synergies for regional biobased industry or companies
- **International Collaborations:** strategic alliances with industrial companies and suppliers in container and bulk, and localised forestry and plantation waste feedstocks.
- **Centralised Utility and Shared Infrastructure, A Plug & Play Model:** Tank Storage for Edible Oil, Biofuels, Biopolymer/Biochemical and Agro/Biomass Terminal
- **Clean and Renewable Energy** for Power Production with Biomass Co-Firing using waste from BioHub
- **In efficiency:** optimal use of utilities, raw materials and residual streams from companies in various sectors, including a CO₂.
- **In public-private cooperation:** businesses from various sectors, science and government create new investment opportunities, inclusive development model
- **Localised knowledge & innovation:** Platform for Development of Skilled Workers for BioProcess Industry and Maintenance with World's leading (technical) universities. (Job Creation)

The Sabah Biomass Industry Development Plan can strengthen Malaysia's proposition as the Premier Biomass Processing Hub

Sabah Biomass Industry Dev. Plan



The Sabah Biomass Opportunity ...

Could help Sabah capture:

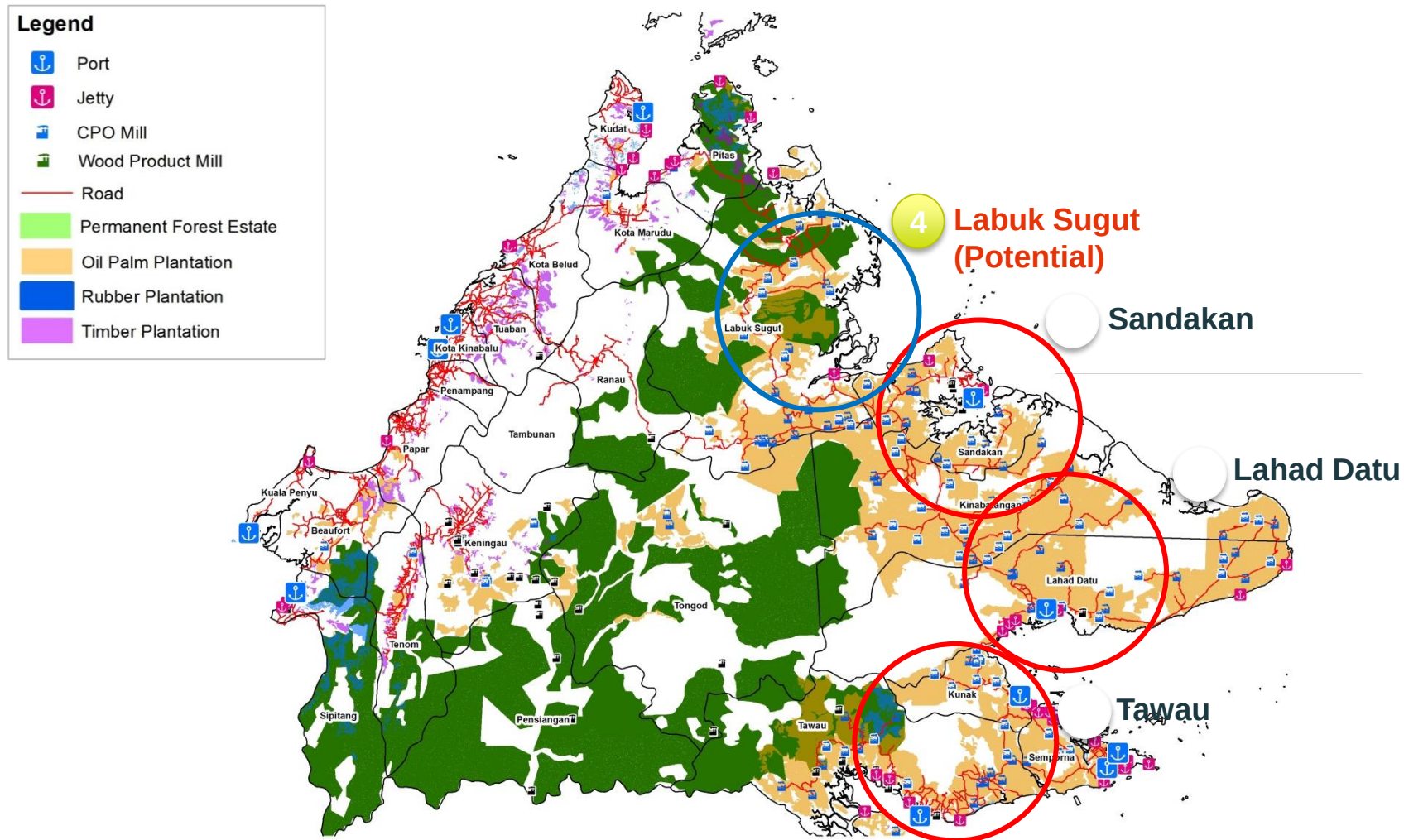
~RM3.2 billion* additional revenue per year

~25,000+ new Green jobs

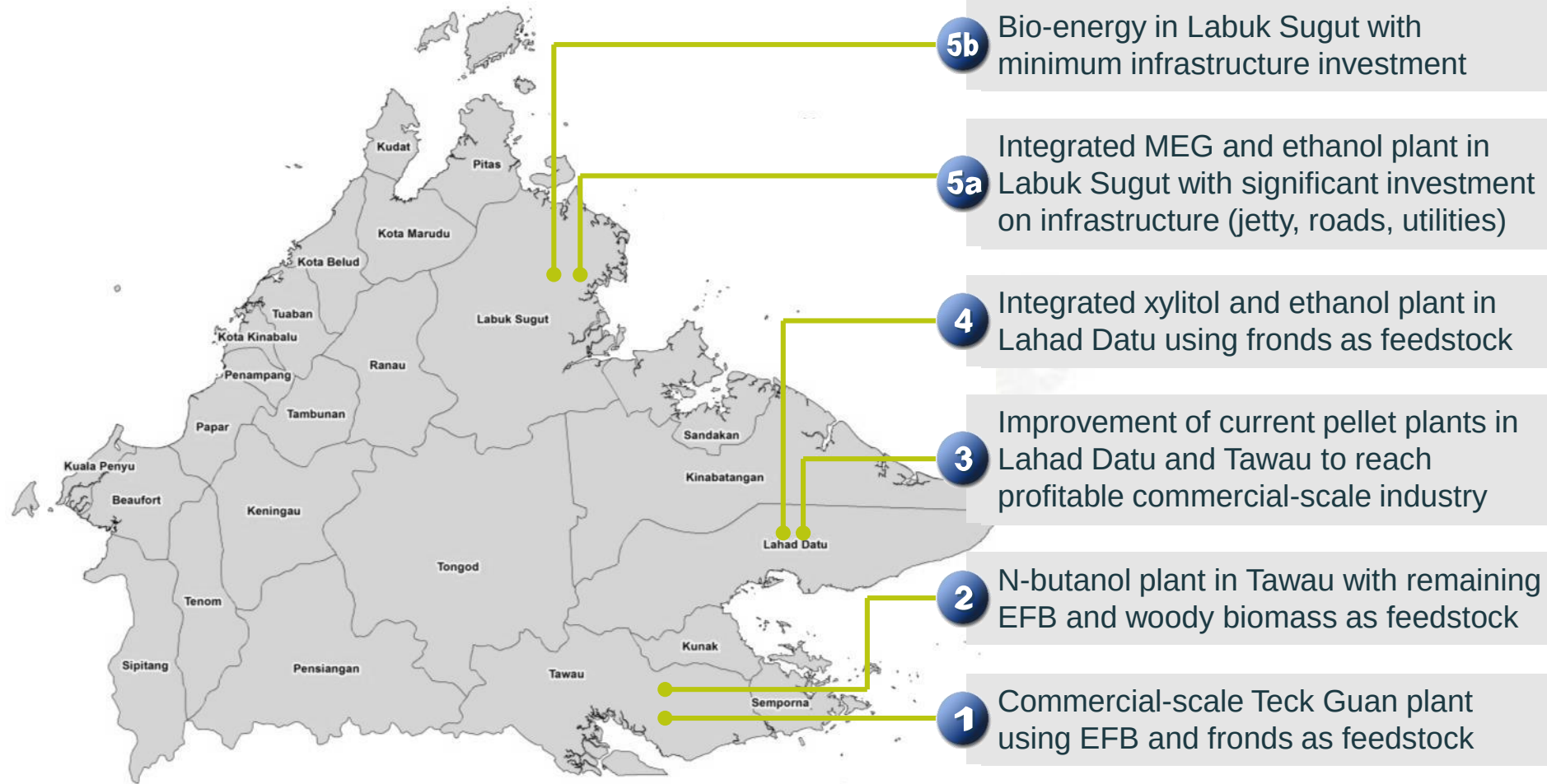
~RM13.5 billion in investments

Note: The forecast is based on dedicated feedstock supply and not taking into consideration feedstock sharing/optimisation.

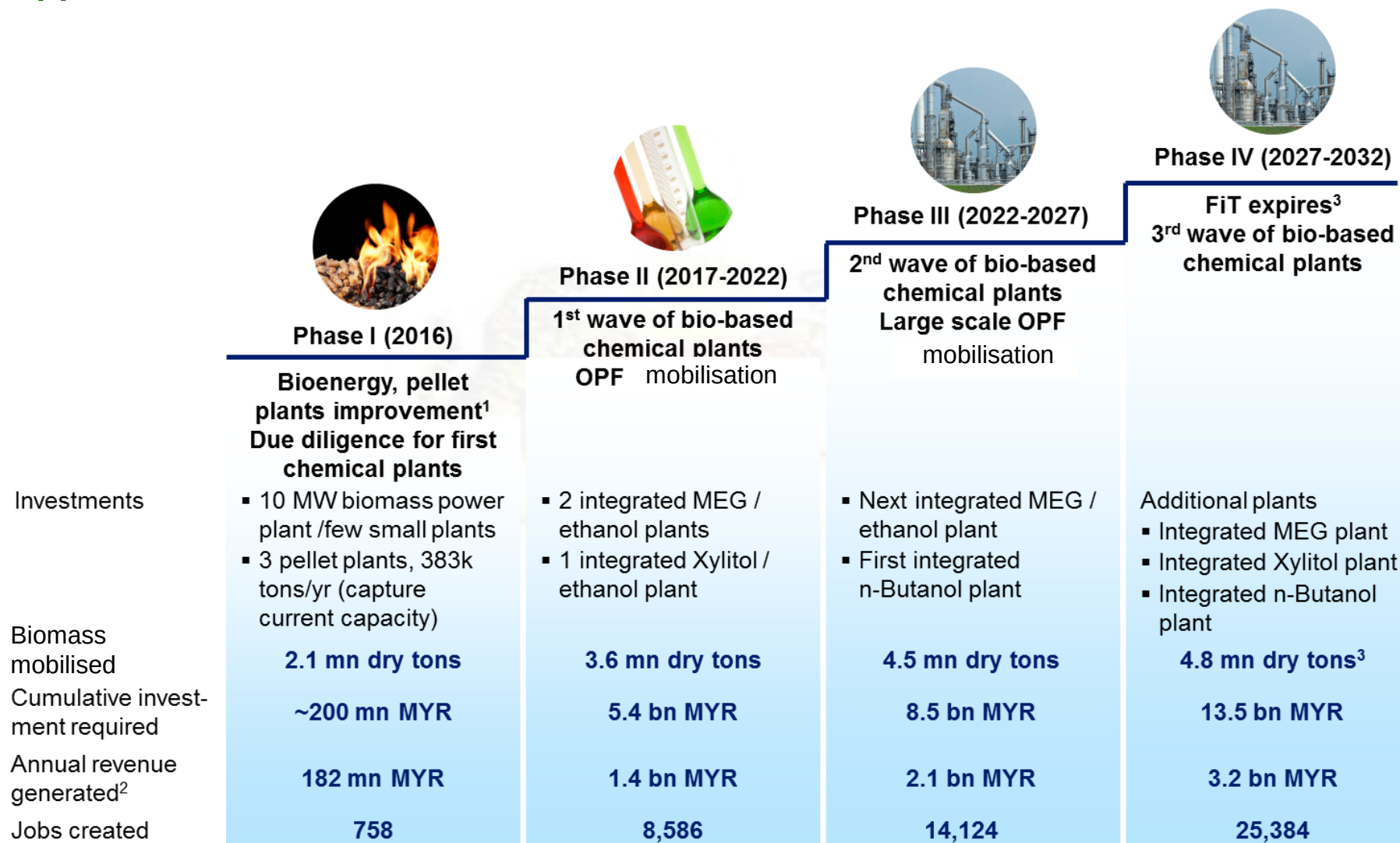
Sandakan, Lahad Datu, and Tawau can mobilise 4.8 million dry tonnes of biomass with future potential in Labuk Sugut



5 investments were identified as opportunities for Sabah within 10 years



The Sabah biomass industry offers several development opportunities over time



Sarawak has the opportunity to become a leader in high-value biomass industries, and Asia's First Integrated Biomass Hub

Sarawak Biomass Industry Dev. Plan



The Sarawak cluster could become Asia's ...

1st Commercial-scale biomass plantation

1st Multi-feedstock Biomass Hub

1st Bio-port

1st 2G Ethanol plant

1st 2G Bio chemicals plant

And could help Sarawak capture:

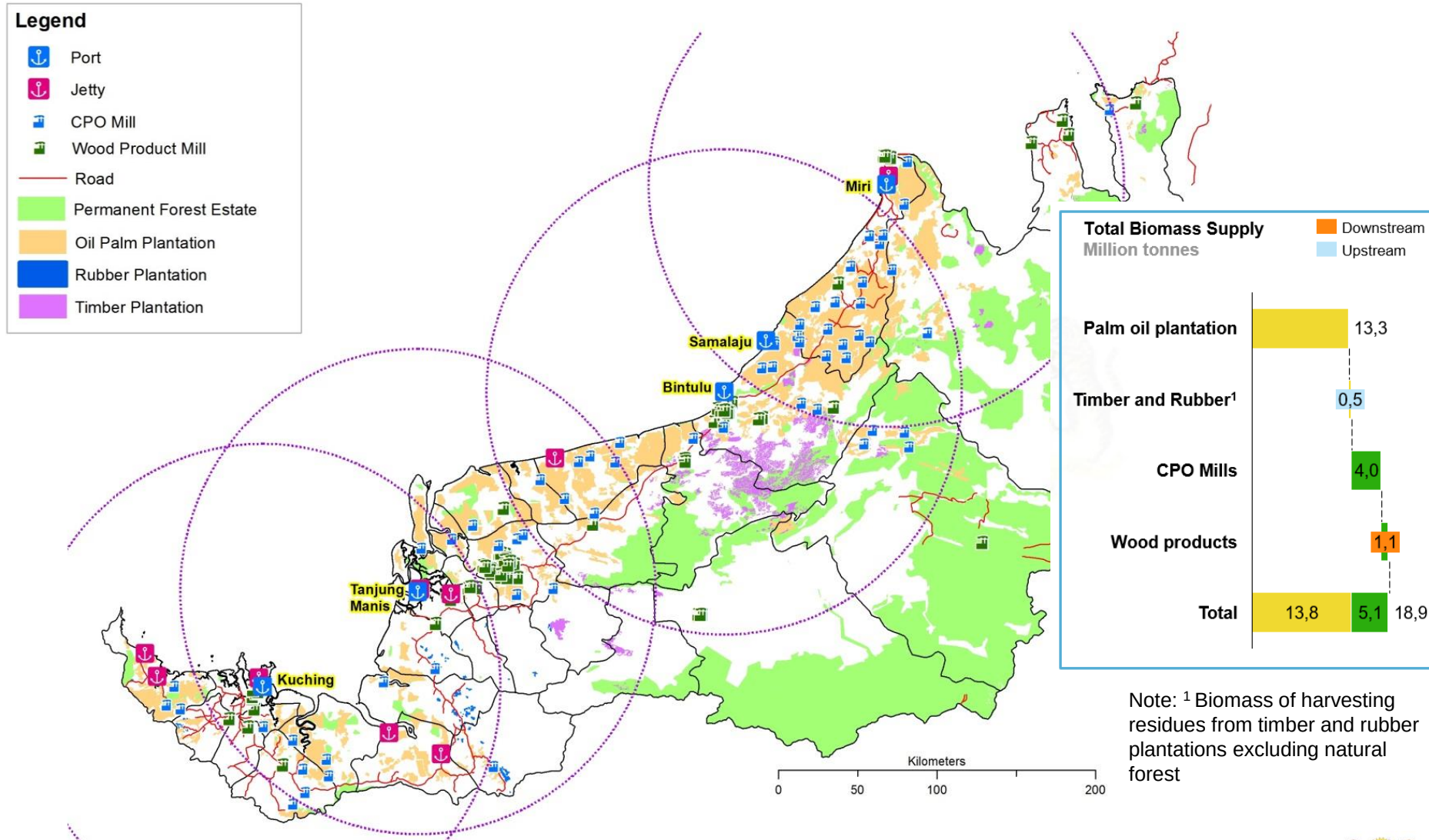
~RM4.8 billion* additional revenue
per year

~35,000+ new Green jobs

~RM18 billion in investments

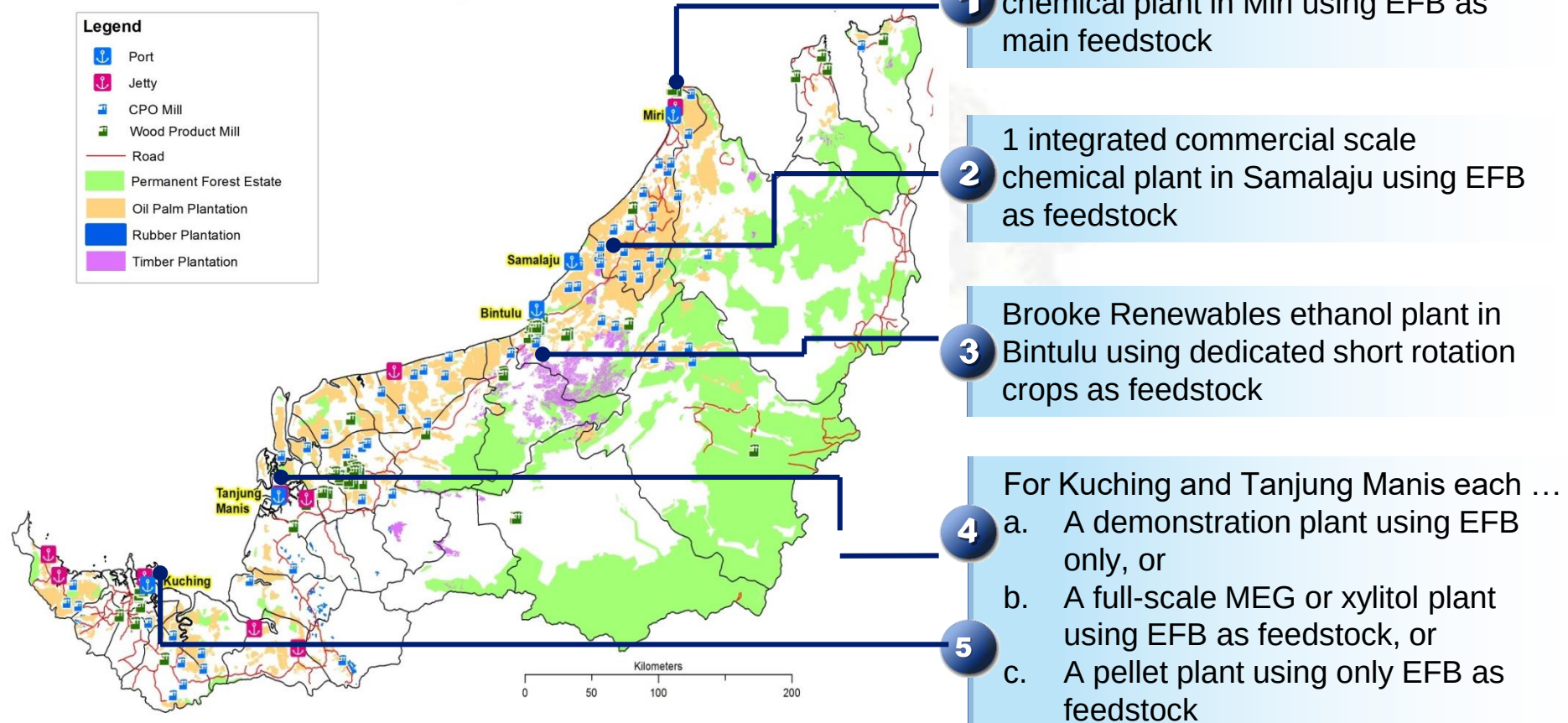
Note: The forecast is based on dedicated feedstock supply and not taking into consideration feedstock sharing/optimisation.

Sarawak can mobilise 6 million dry tonnes of biomass in 4 main clusters, Bintulu & Miri highest potential

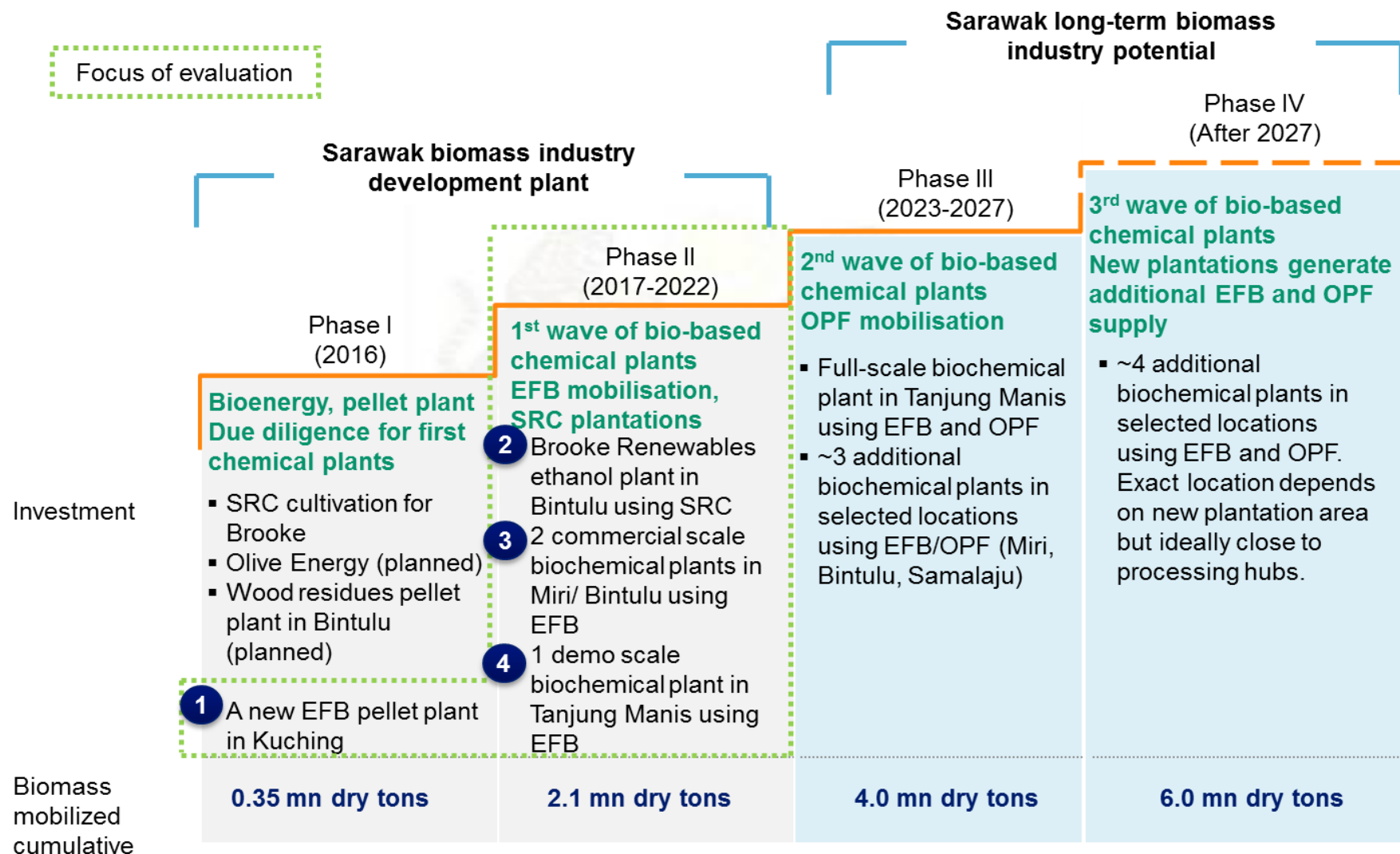


Within the next 6 years, 3 to 5 bio-based chemical plants could be established in the relevant clusters

Sarawak Biomass Industry Development: Plan Phase I and II

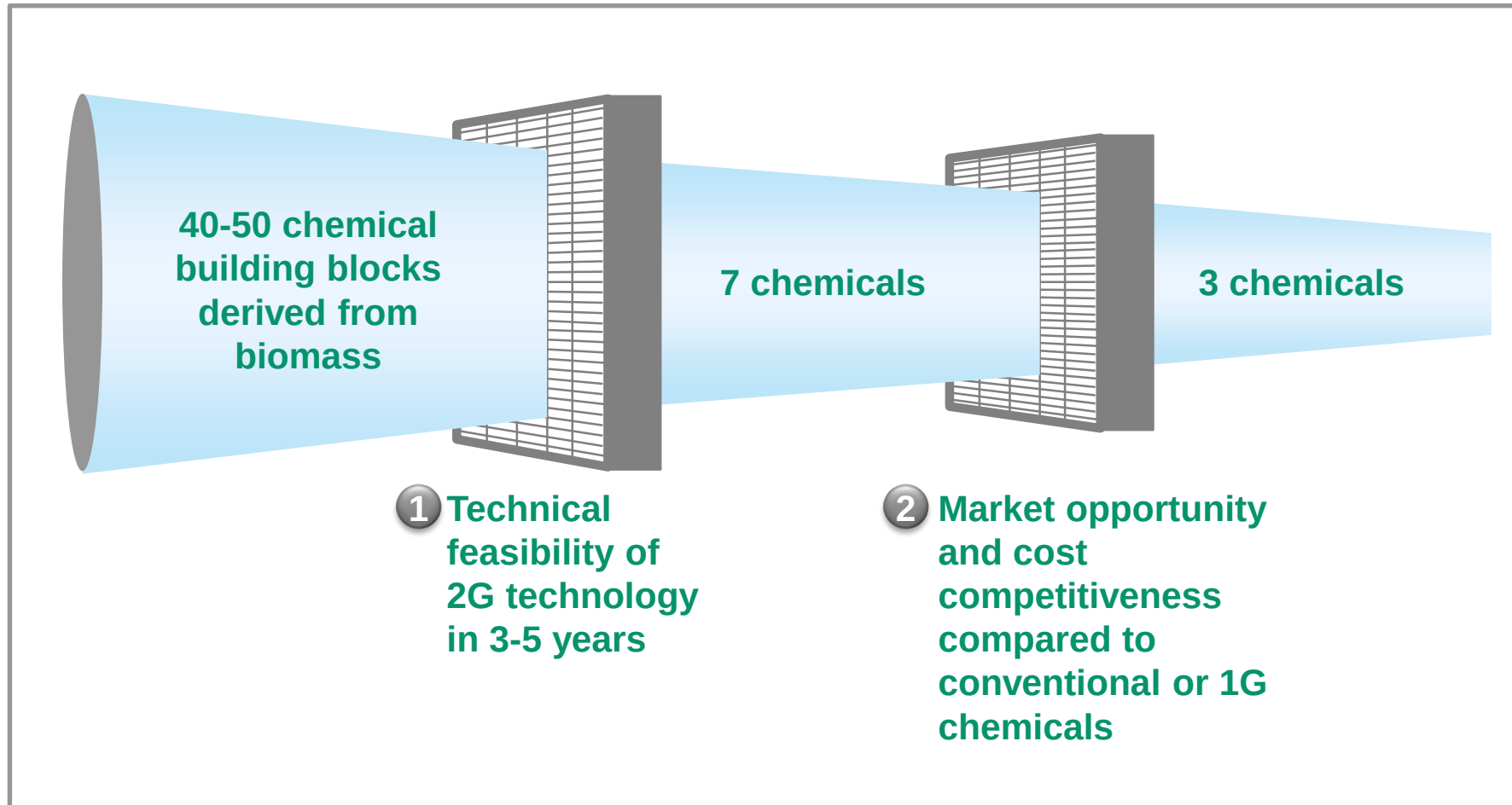


The available biomass at a competitive cost can support new investments in four phases over time

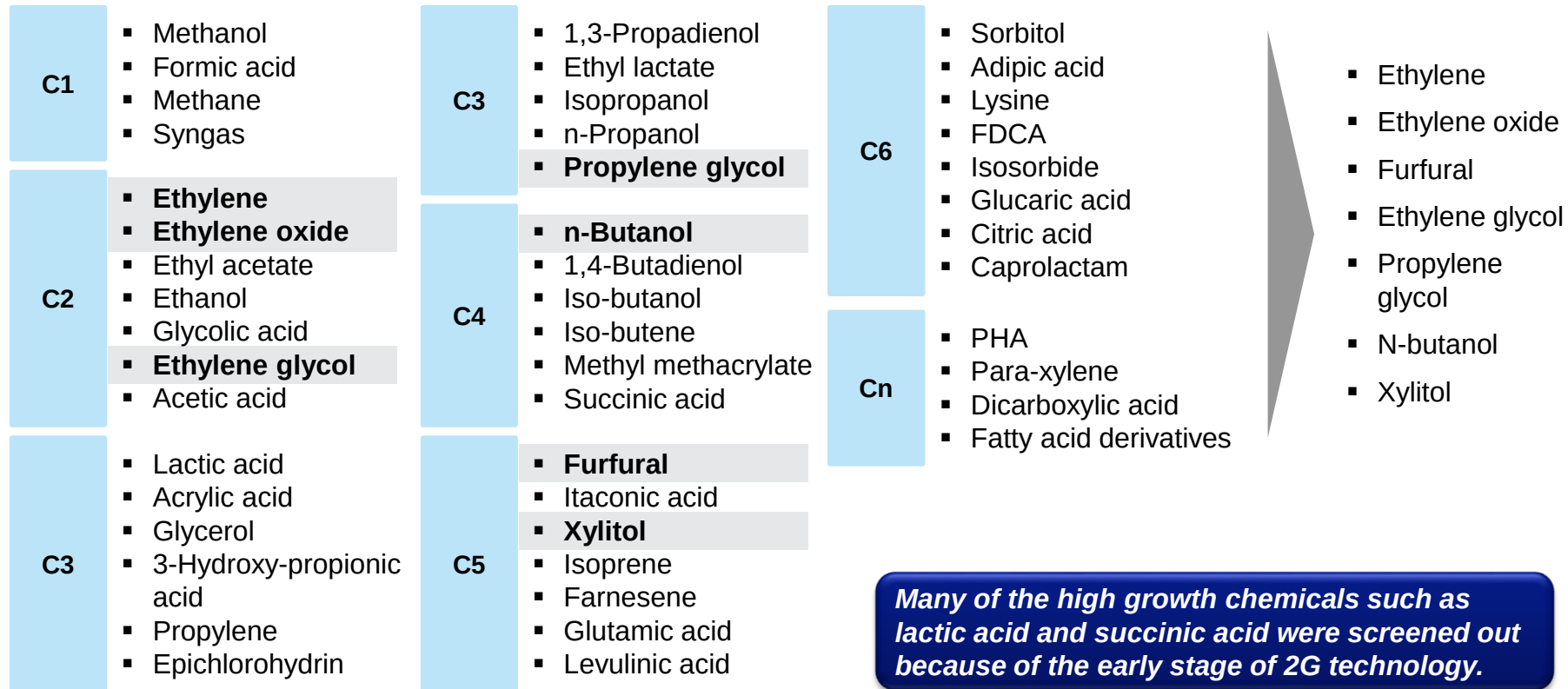


Note: The forecast is based on dedicated feedstock supply and not taking consideration of feedstock sharing/optimisation.

WHICH CHEMICALS DO WE CHOOSE? WE FOLLOW A 2-STEP APPROACH TO SELECT POTENTIAL CHEMICALS



1 SEVEN CHEMICALS PASSED THE FIRST SCREENING STEP



Many of the high growth chemicals such as lactic acid and succinic acid were screened out because of the early stage of 2G technology.

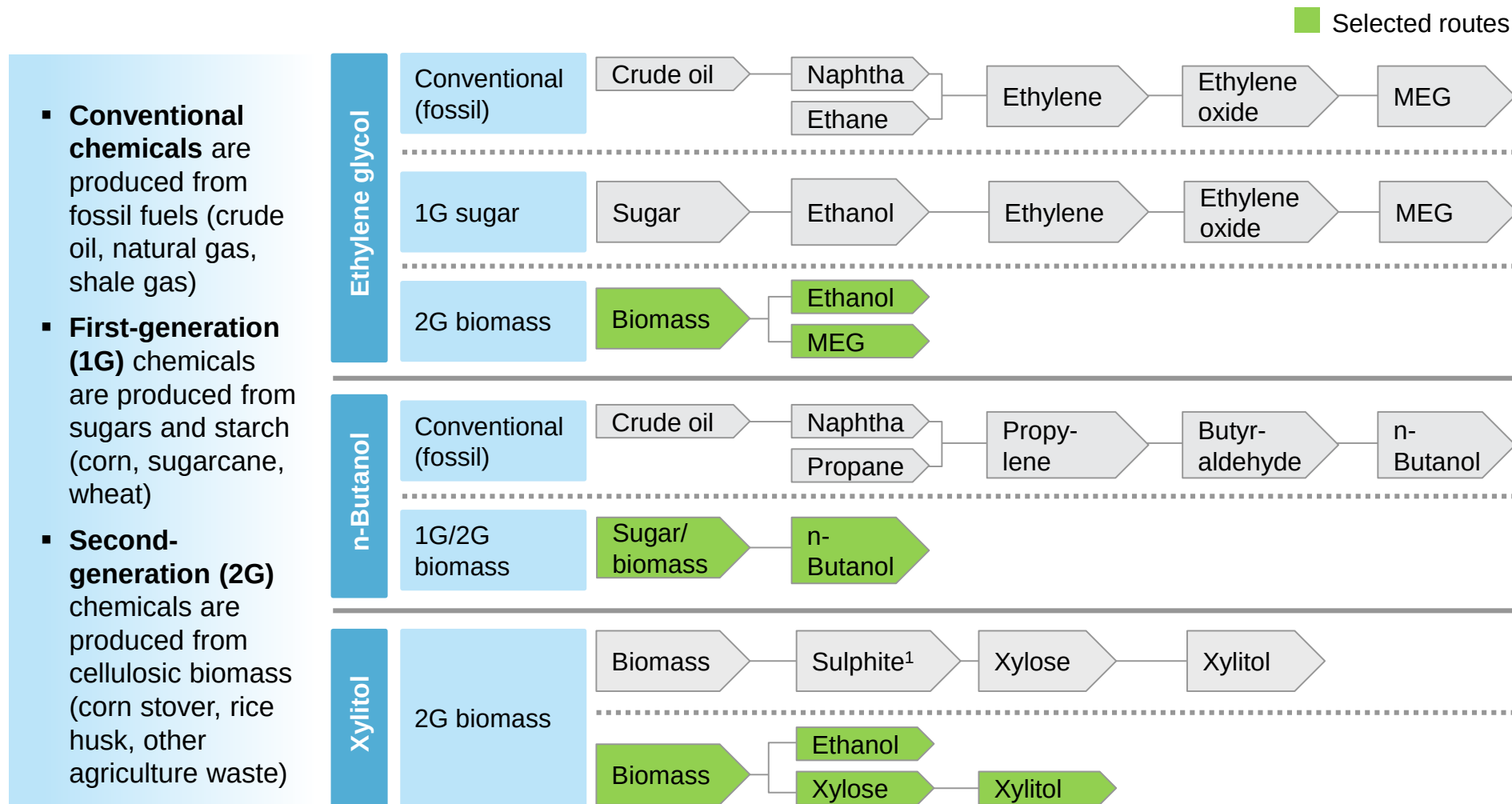
2 SECOND SCREENING PROCESS RESULTS IN 3 CHEMICALS

Selected chemicals

Market opportunities and cost competitiveness

Ethylene	Strong demand for bio-alternative from brand-owners but there is a major cost disadvantage compared to shale-gas based ethylene. The competitiveness of 2G to 1G ethanol as feedstock defines the cost position of ethylene from 2G sugars to sugarcane-based ethylene.
Ethylene oxide	Ethanol derivative, see above
Furfural	Current production consists of a large amount of small capacity plants concentrated in China. There are limited new projects and a fear of overcapacity. Pulp mills could produce furfural as a side product but there is not enough demand for such new volumes.
Ethylene glycol	One of the fastest growing sugar-based chemicals. Strong demand from consumer brands, particularly for 2G feedstocks. Direct conversion of 2G sugars is a much shorter production route than the commercial sugarcane ethanol or fossil ethylene based technologies.
Propylene glycol	Same technology with ethylene glycol but lacking as strong demand from consumer brands. Bio-based market is still limited in size with only few commercial producers.
N-butanol	Bio-based production route shorter than conventional fossil based process, and may benefit from the recent shale-gas boom. N-butanol is a commodity chemical but also potential biofuel component. Market opportunities in chemical applications will be determined by the competitiveness with fossil-based n-butanol.
Xylitol	Growing market as a sweetener and interesting potential as a chemical building block. Xylitol is a natural sweetener with less side-effects as artificial sweeteners, benefits for dental health, and lower calorific value than regular sugar.

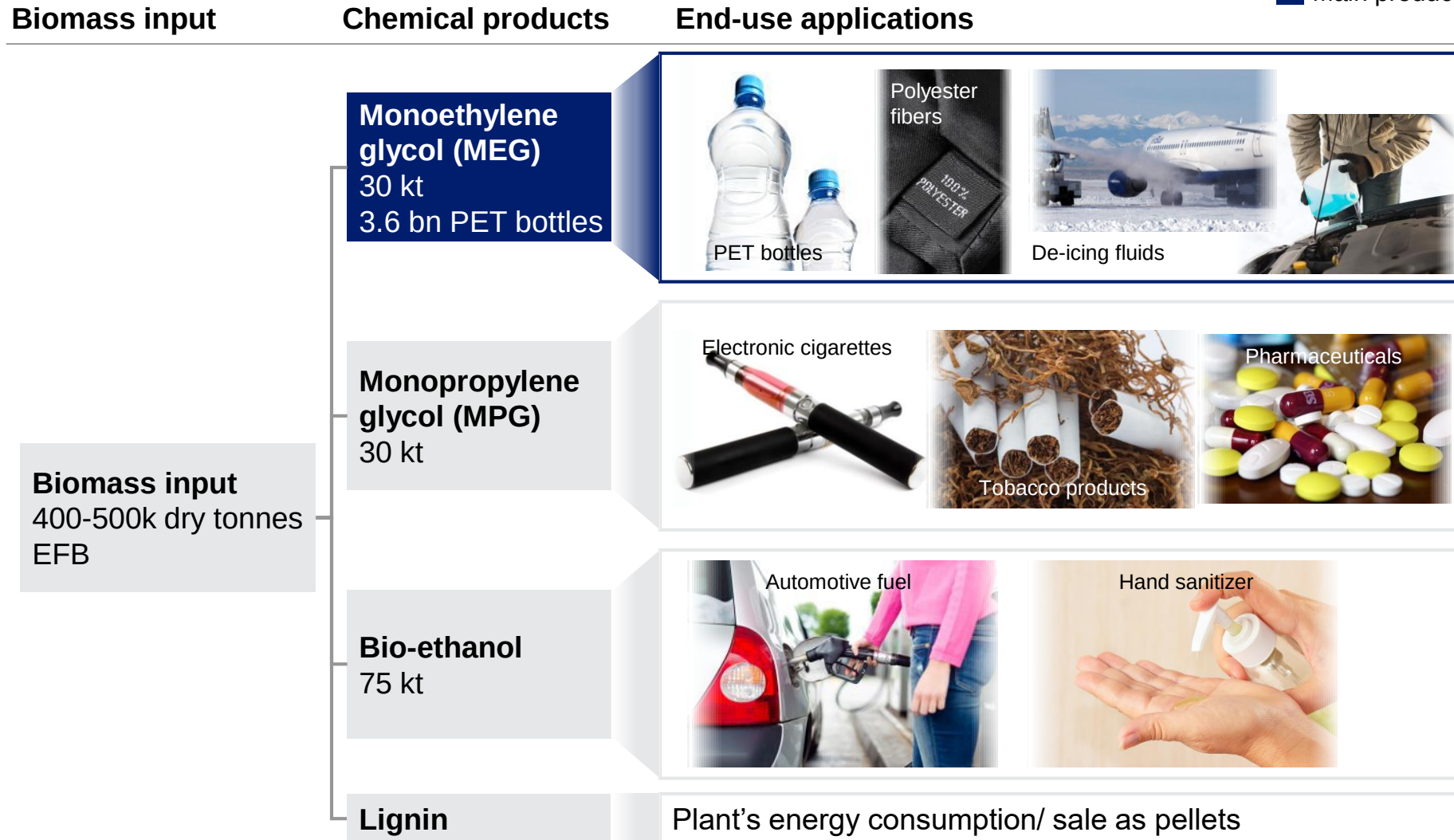
2 2G PRODUCTION ROUTES ARE MUCH SHORTER COMPARED TO 1G PRODUCTION ROUTES FOR THE SELECTED CHEMICALS



¹ Pulp mill side-streams

A COMMERCIAL SCALE MEG PLANT REQUIRES 400-500KT OF BIOMASS AND CAN BE INTEGRATED TO **ETHANOL** PRODUCTION

■ Main product



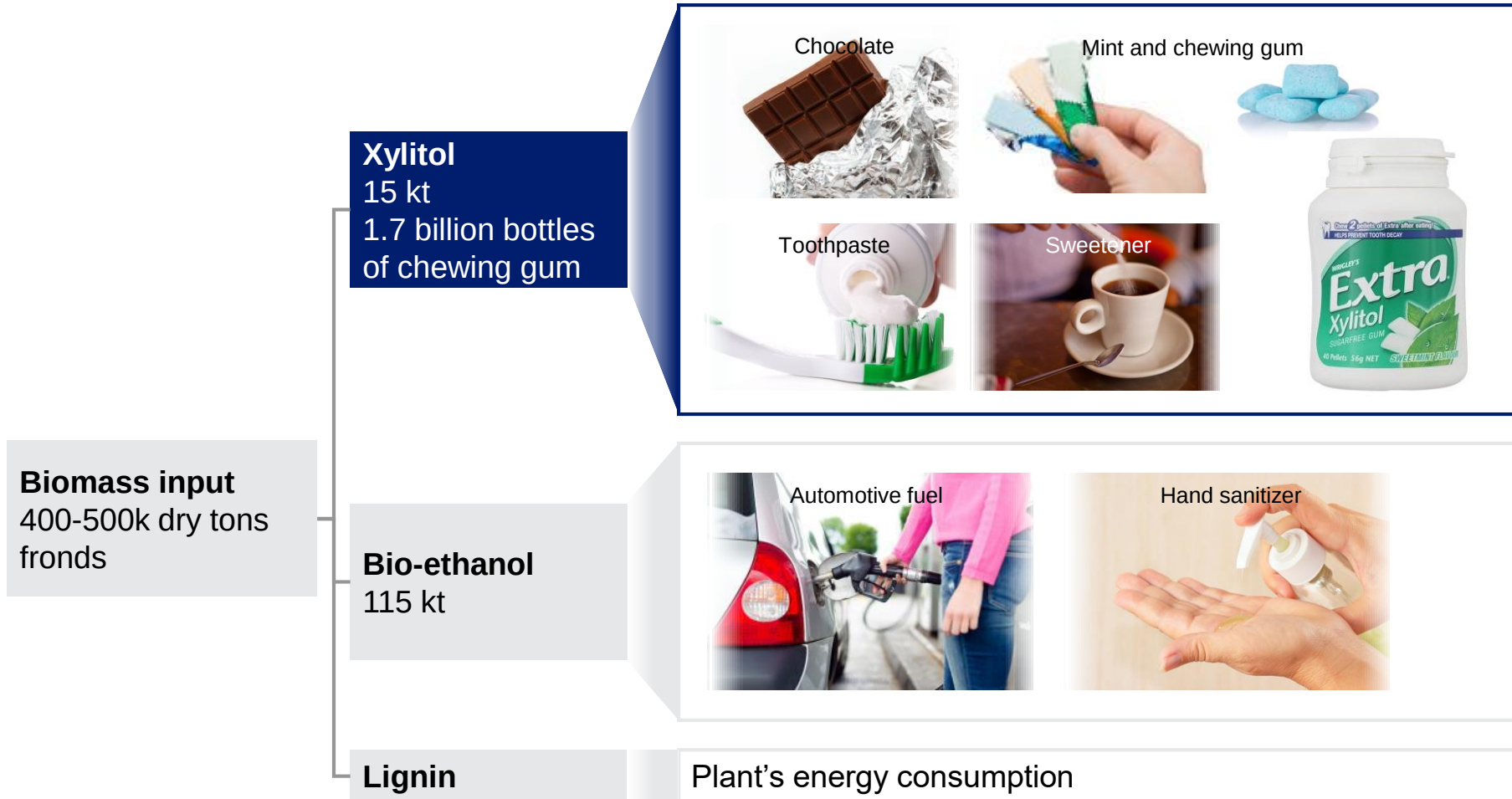
XYLITOL IS USED AS A SWEETENER AND IS TYPICALLY INTEGRATED TO ETHANOL PRODUCTION

■ Main product

Biomass input

Chemical products

End-use applications



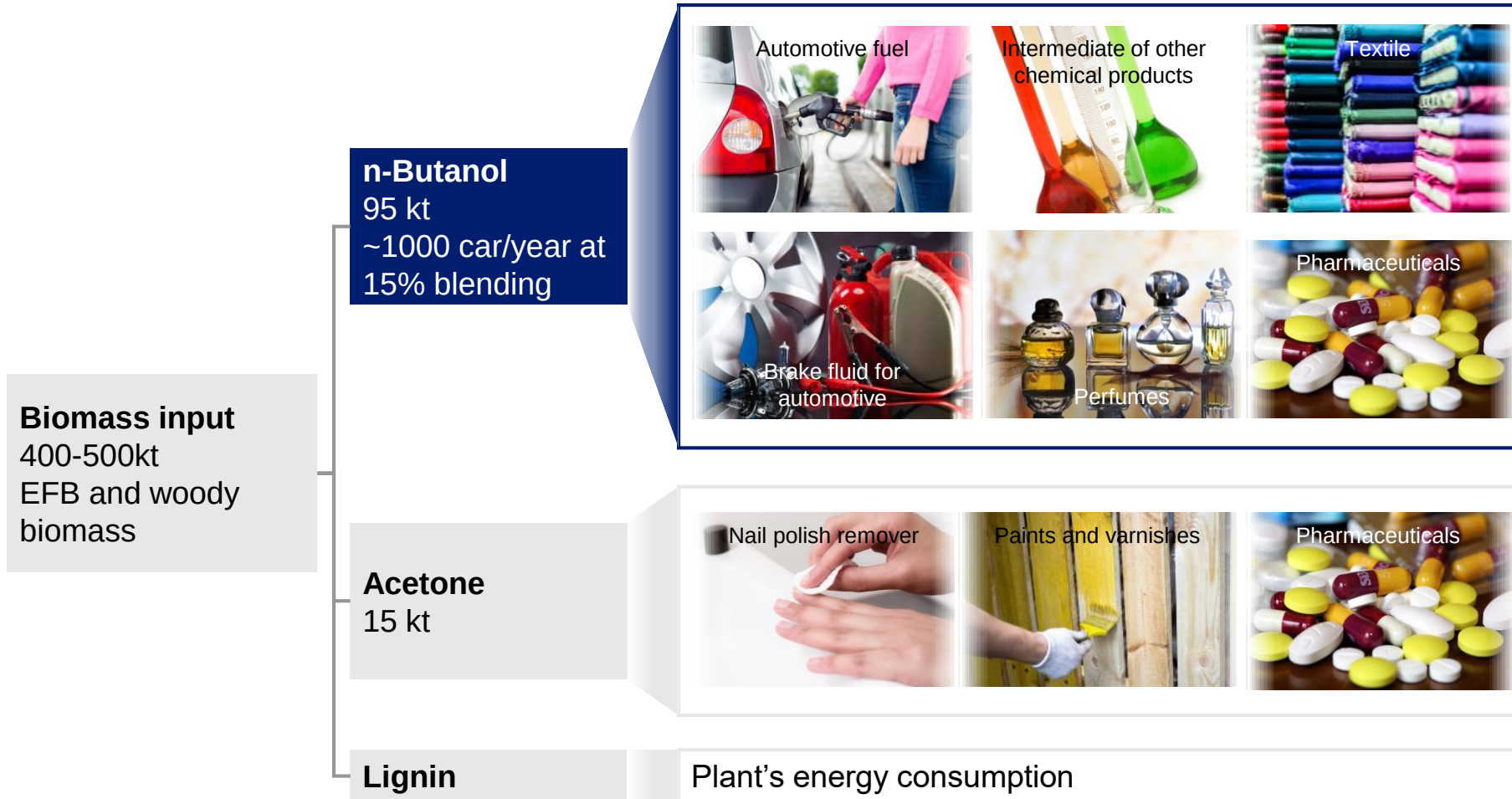
N-BUTANOL HAS VARIOUS APPLICATIONS IN FUELS/ CHEMICALS AND REQUIRES SIMILAR BIOMASS INTAKE FOR COMMERCIAL SCALE PLANTS

Biomass input

Chemical products

End-use applications

■ Main product



KEY CONSIDERATIONS FOR BUILDING COMPONENTS TO MAXIMISE POTENTIAL

- Cost Competitiveness of Production in in respective States based on Market Pricing compared to Petrochemical Means of Production
- Inclusiveness of the entire value chain and participation opportunities for local companies of all sizes
- Products that have regional demand and mass market appeal
- Sustainability issues addressed upfront

Malaysia has already implemented a wide number of incentives to facilitate further industry development

1	Feed-In Tariff (FiT)	Incentive	5	Techno Fund	Grant	9	Investment Tax Allowances (ITA)	Incentive
2	Domestic Investment Strategic Fund (DISF)	Grant	6	Intellectual Property Financing Scheme (IPFS)	Grant	10	Business Start-up Fund (MTDC)	Grant
3	Green Technology Financing Scheme (GTFS)	Grant	7	Pioneer Status	Tax Incentive	11	EPP 6 Developing Oleo Derivatives	CAPEX Incentive
4	Commercialisation of Research & Development Fund	Grant	8	BioNexus Status	Incentive	12	Credit Guarantee Corporation (CGC)	Financing Support

Catalyst Project 1: Commercial Biohub & Bioport (Sabah)

The Gateway For Biobased Industry In South East Asia



The Sabah's BIOBASED Industry Opportunity ...

1st Certified Sustainable Forest

1st Multi-feedstock 2G BioHub

1st Bio-port

1st Wood Biorefinery

1st Dedicated Circular Economy and Waste Park

Could help Sabah capture:

~ **2500** new Green jobs

~**RM12 billion** in investments

SIPITANG: The Location



Identified as the Most Strategic location due to:

- Ability to anchor hub on Sustainable Forest and expansion to other feedstock options
- Strategic location and components to catalyze the BioHub model:
- Ownership of Strategic Assets SFI (Sabah Forest Industries); allowing possibility of integrated play
- Interest from International Companies and Support from Foreign Governments

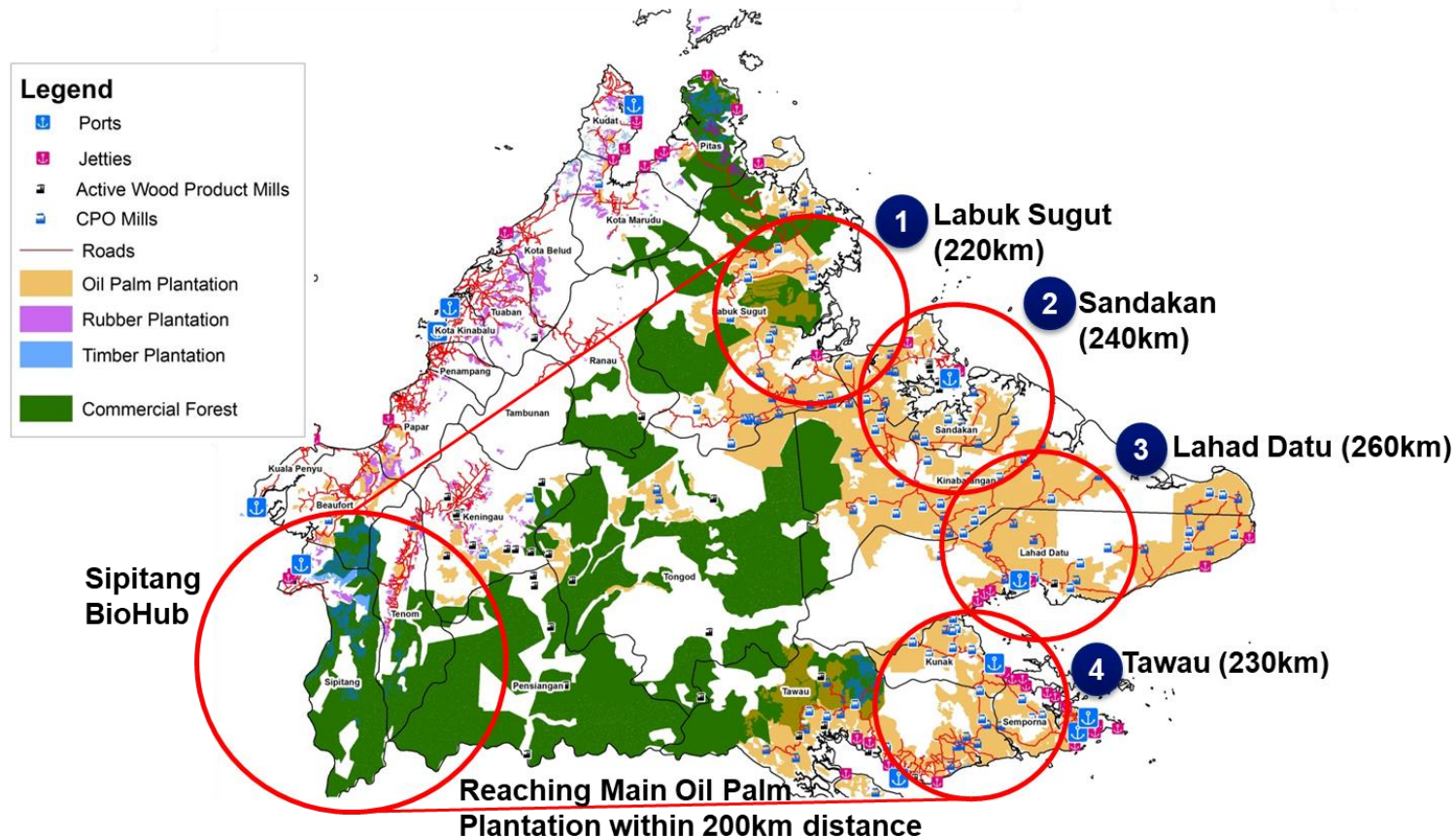
ACQUISITION OF DISTRESSED SFI ASSET

***RM 1.2 Billion (SPA signed) ex. Reinvestment
-10% paid***

SUPPLEMENTARY FEEDSTOCK STRENGTHENS BIOHUB DEPLOYMENT

SABAH HAS GREAT BIOMASS AND WASTE RESOURCES FROM OIL PALM

THE BIOMASS CLUSTERS IDENTIFIED FROM LABUK SUGUT, SANDAKAN, LAHAD DATU, AND TAWAU WILL PROVIDE SUPPLY FOR SIPITANG BIOHUB WITHIN 200-260KM DISTANCE

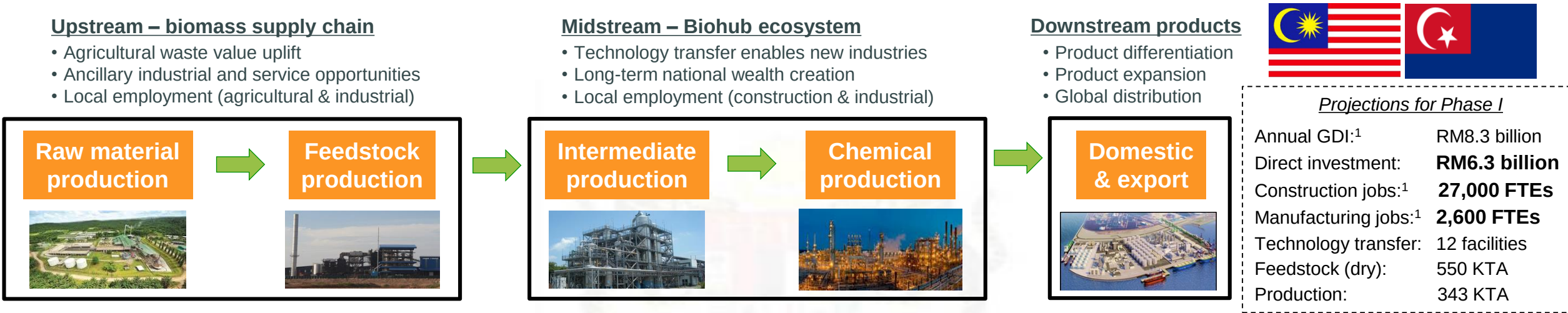


- **23 million** (dry tonnes) of Palm Oil Waste throughout Sabah across 4 major clusters and more >100 mill operations*
- Decentralised production of intermediate products) allowing a Centralised Hub in Sepitang to high value added biomanufacturing
- Sabah's opportunity maximised despite Security Concerns by Investors in the East Coast

**huge biochemical and downstream applications require around 500,000 dry tonnes of biofeedstock thus creating opportunity for multiple biorefineries in Sabah*

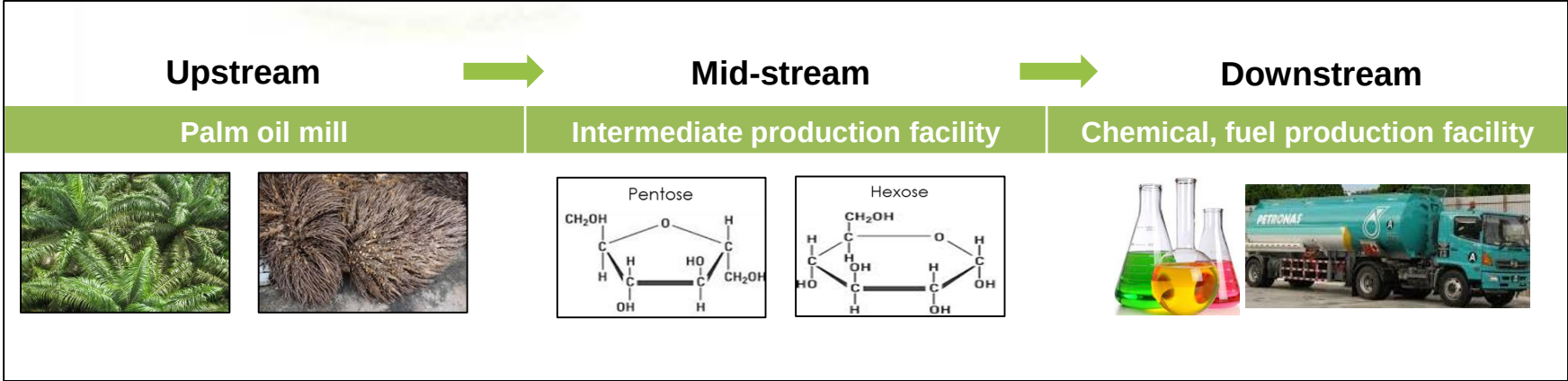
Catalyst Project 2: 2g Sugar Biorefinery And Biohub (Johor)

Biohub Development In Segamat



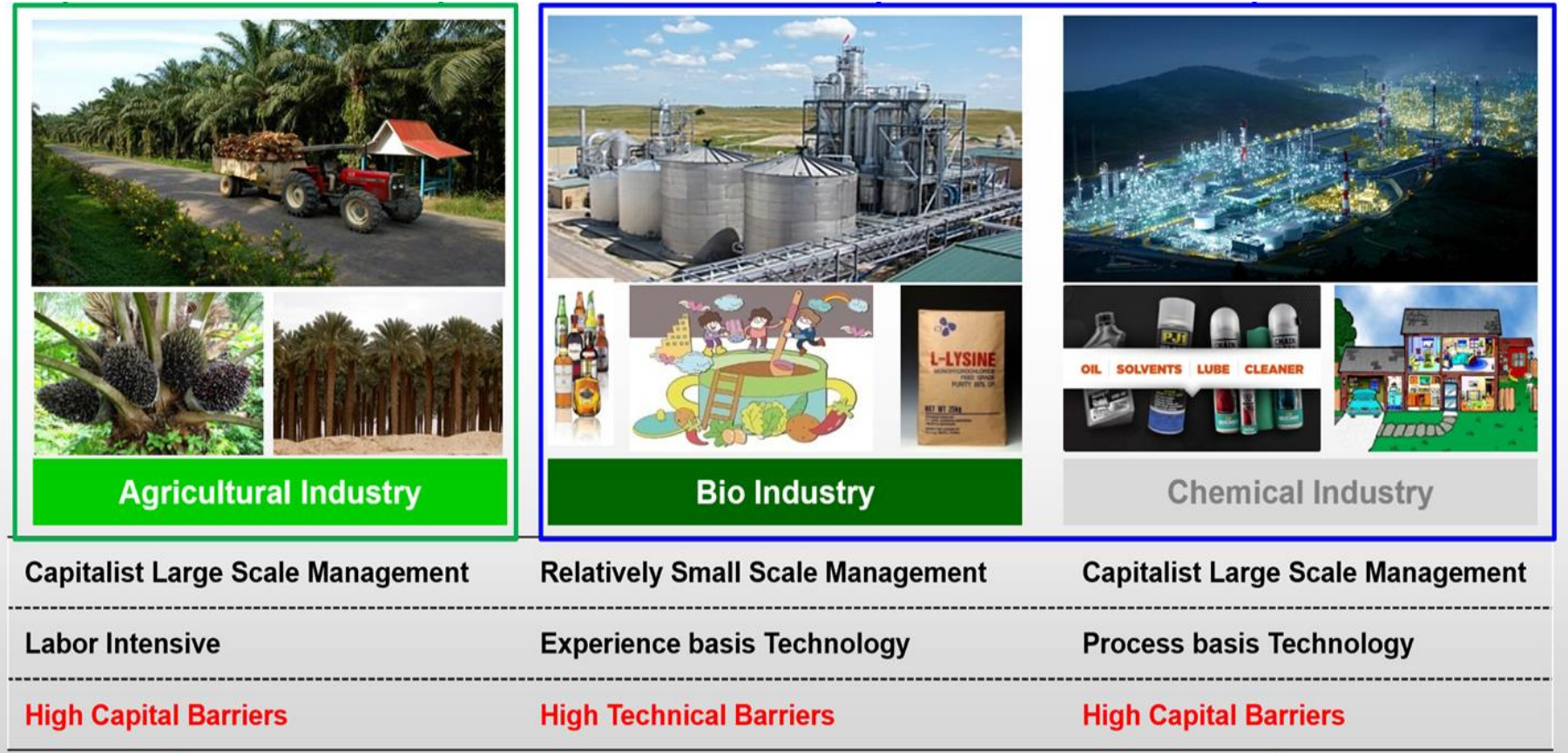
Segamat, Johor BioHub represents significant economic & social benefits...

- **Opportunity:** Transition from the current²⁷ crude oil-based economy to a more sustainable ‘green’ economy
- **Business:** Convert low value raw material (e.g. palm waste (EFB)) into high value chemical intermediates (e.g. C6, C5 sugars)
 - Ultra-clean C6, C5 sugars enable the production of even higher value, higher margin bulk and specialty chemicals



Catalyst Project 3: 2g Biobutanol Project (Sarawak)

World’s 1st Integrated 2G Biobutanol Project



Value of investment:
RM1 billion

Jobs creation:
750 jobs

Spill-over effect:
Local industry development

NEWS COVERAGE ON CURRENT PROJECTS

BioHub Projects under Development

LEAF – 2G SUGAR BIOREFINERY PLANT

US company to invest RM600mil in Segamat plant

CORPORATE NEWS

Wednesday, 14 Mar 2018



By Zazali Musa



Standing from left to right from row - Leaf Malaysia Or

TRADEWINDS GROUP - INTEGRATED BIOHUB

Ballarpur Industries to sell Malaysian unit for \$ 310 mn

PTI | Apr 6, 2018, 21:12 IST



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GS Caltex – 2G BIOBUTANOL PLANT

South Korea firm keen to invest in state's biomass industry

March 7, 2017, Tuesday

SHARE THIS



KUCHING: A leading firm in South Korea is very keen to invest in the biomass industry in Sarawak that produces biobutanol.

The Ambassador of the Republic of Korea Dr Hu Hyun-Seok said the company was already in the early stage of pursuing its interest.

"We hope to see within one or two years there would be a more concrete outcome of our feasibility studies on biomass potential.

...y said it has signed an agreement to sell
Pelangi Prestasi Sdn Bhd for USD 310
said today.

Pelangi Prestasi has already deposited 10
Ballarpur Industries said in a regulatory

companies, Malaysia, promoted by Syed
USD 1.70 billion approximately, it added.

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Q & A