



WILL YOU DARE TO JUMP ?

PTTGC

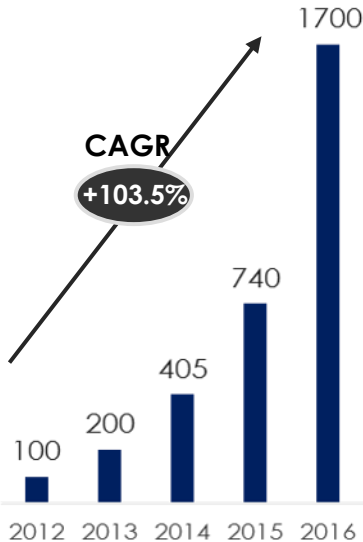


**SPECTER
CONSULTING**

Globally, electric vehicles are gaining rapid consumer adoption

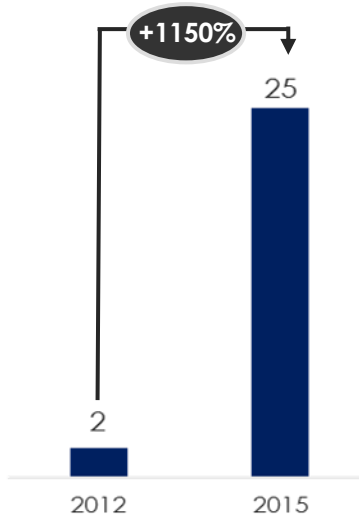
NUMBER OF EV'S IN USE ARE GROWING EXPONENTIALLY

In '1000 vehicles



...ALONG WITH NUMBER OF CHARGING STATIONS...

In '1000 stations



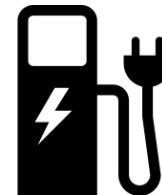
MOSTLY DUE TO STRONG GOVERNMENT SUPPORT



Tax exemption



Subsidy



Infrastructure

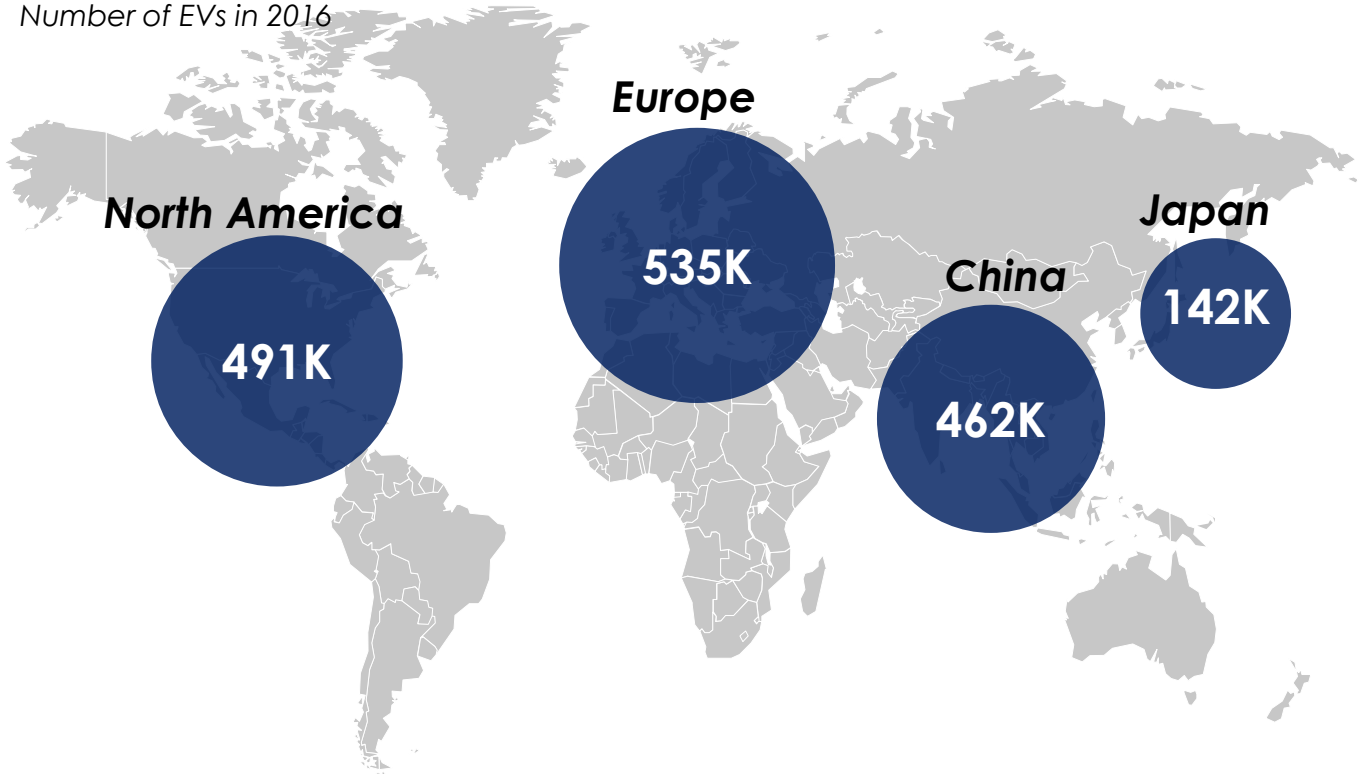


Regulations

Source: Statista, 2016, International Energy Agency, 2016, and Accenture, 2014

The world has begun to embrace this highly disruptive innovation

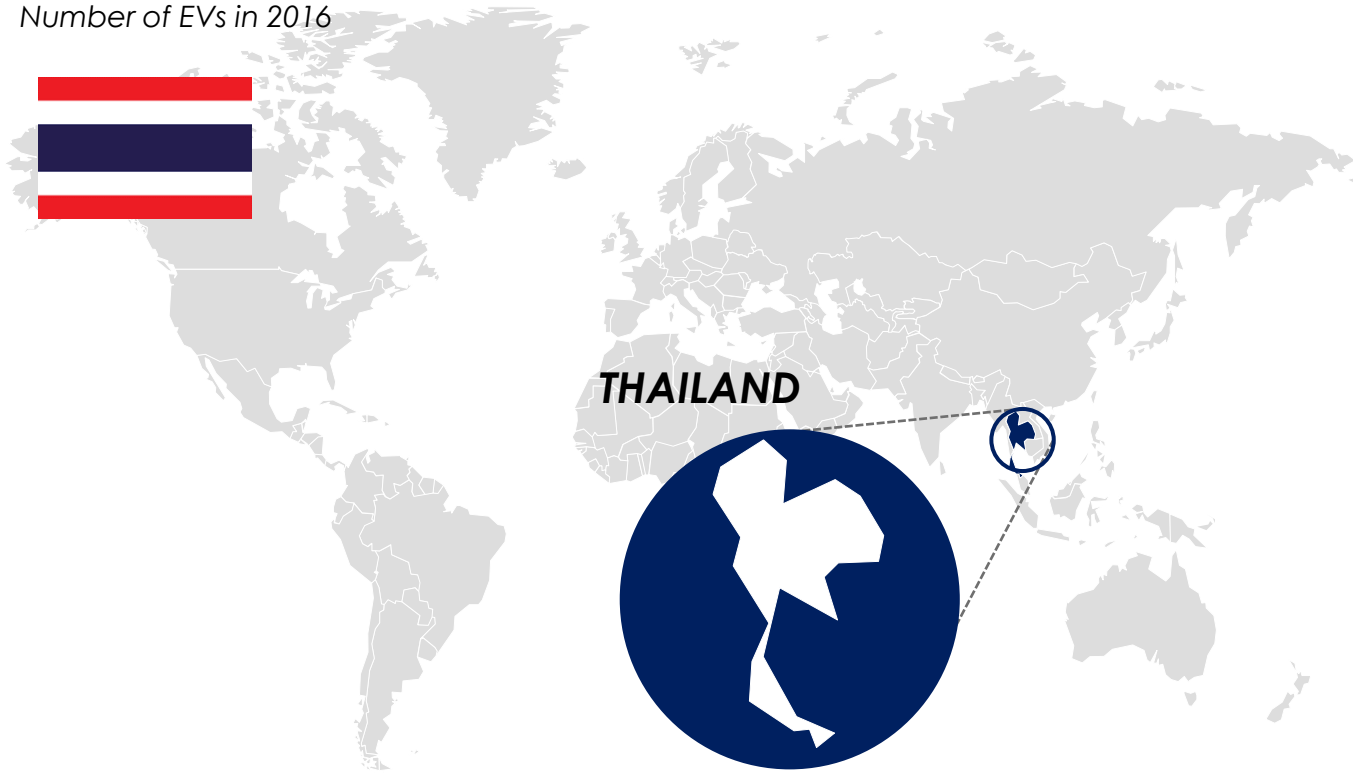
Number of EVs in 2016



Source: Evannex, 2016

The world has begun to embrace this highly disruptive innovation

Number of EVs in 2016



Source: Evannex, 2016

Both the public and private sectors are promoting EV in Thailand

GOVERNMENT INITIATIVES

PHASE 1: 2016-2017

Use 200 electric buses and develop charging facilities

PHASE 2: 2018-2020

Research and develop EV batteries and establish tax incentives and legal regulations related to EV's

PHASE 3: 2021-2036

Have 1.2 million EV's on the roads and 690 charging stations developed

PRIVATE INVESTMENTS



HONDA



TOYOTA ISUZU

Major Japanese automotive companies intend to **make Thailand their most EV important production base** in Asia

•**Nissan** plans to make Thailand its EV export hub

•**Honda** plans to make Thailand its R&D center



IMPLICATION

EV will become an unavoidable disruption
in Thailand's automotive industry

PTTGC's business units will be impacted by EV trend in Thailand



REFINERY



AROMATICS



OLEFINS



EO-BASED



GREENCHEM



POLYMER



SPECIALTY



PHENOL

PTTGC's business units will be impacted by EV trend in Thailand



REFINERY

AROMATICS

OLEFINS

EO-BASED

GREENCHEM

POLYMERS

SPECIALTY

PHENOL

THREAT AT DOOR

INSIGNIFICANT THREAT

Threat is not impactful because PTTGC will only lose 4.6% of its sales

% FUEL

95.4%

4.6%

USERS

Aviation, industrial,
& normal auto vehicles

EV

Opportunity to export to
CLMV market



PTTGC's business units will be impacted by EV trend in Thailand



REFINERY

AROMATICS

OLEFINS

EO-BASED

GREENCHEM

POLYMER

SPECIALTY

PHENOL

OPPORTUNITY AT HAND

CAPABILITY TO PRODUCE LIGHTWEIGHT EV PARTS

PTTGC currently has business units which supply plastic parts for automotive manufacturers



Source: Team Analysis



IMPLICATION

The EV trend in Thailand presents more opportunities
than threats to PTTGC

PTTGC's success can be ensured through our 20-year blueprint

| GOAL | QUESTIONS | RECOMMENDATION | IMPACT |
|---|--|---|--|
| Maintain position as Thailand's leading petrochemical company while capturing growth through the EV trend | How to achieve lightweight material? | GEAR UP Partner with composite company to commercialize materials | 2.85 Billion THB incremental net profit |
| | How to ensure sustainability of EV parts production? | GLIDE AHEAD Produce plant-based bioplastic to ensure sustainable supply | 40% of EV parts will be produced from bioplastic |

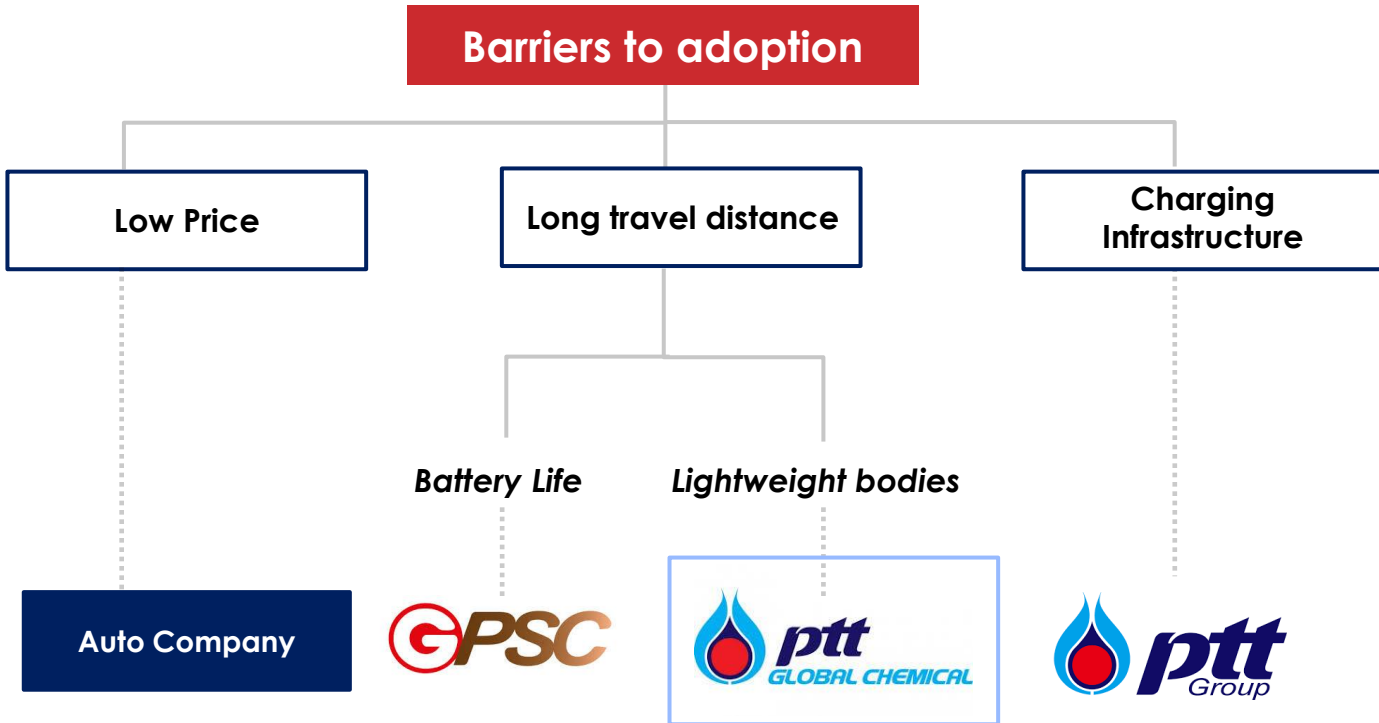
Source: Team Analysis

GEAR UP

Partner with composite
company to commercialize
materials



PTTGC has opportunities to capture growth in EV market



Source: Team Analysis



PTTGC has opportunities to supply lightweight plastic materials used in EV production

PTGTC can provide raw materials used in EV production



Engine Cover
Polyethylene
Terephthalate (PET)

Display Board
Polystyrene (PS)



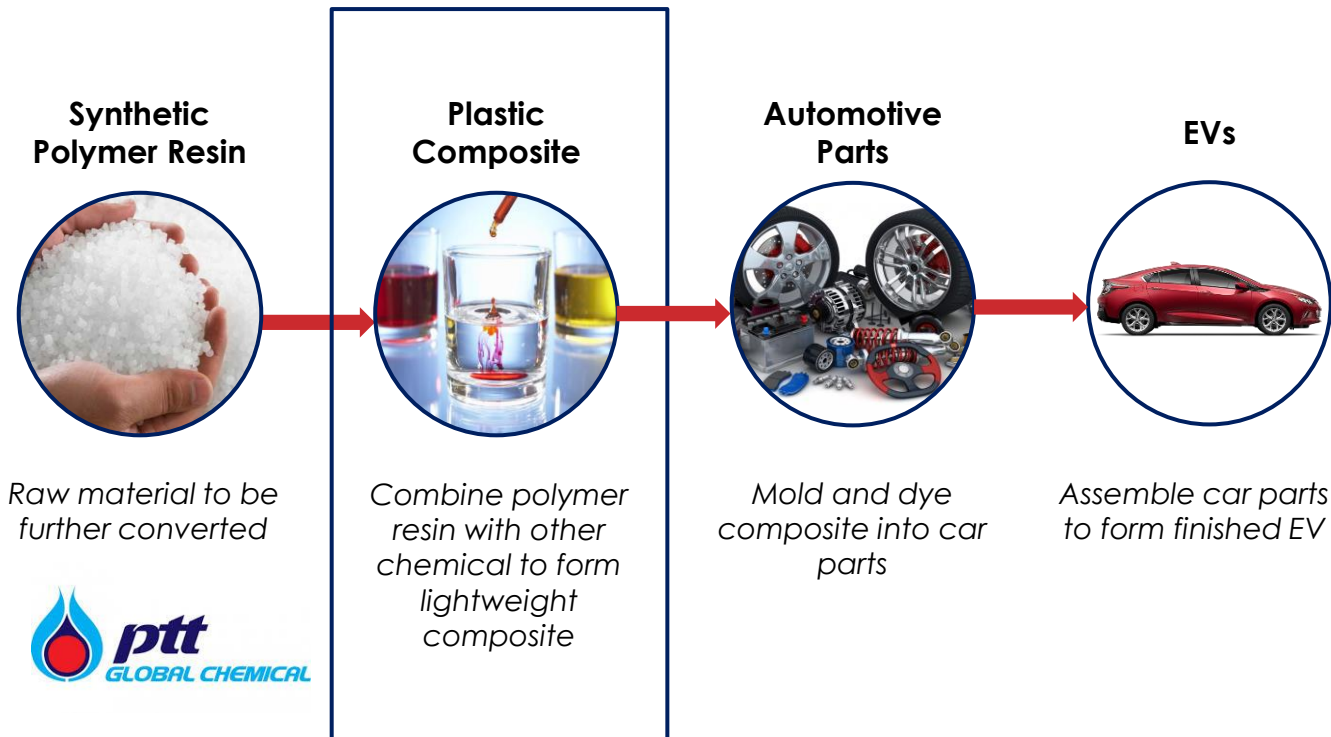
Wheel Cover
Acrylonitrile Butadiene Styrene (ABS)

Bumper
Polypropylene (PP)



Source: PTGTC, Craft Industries

PTTGC must capture knowledge in lightweight plastic



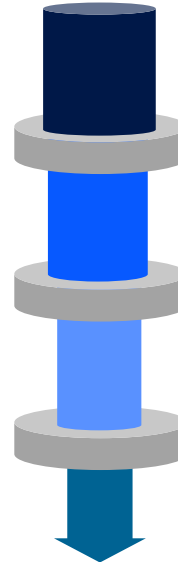
Source: PTTGC Annual Report 2015

PTTGC must partner with CSPH to introduce lightweight plastic

POTENTIAL PARTNERS

- 1 AKSA**
Products to the automotive industry and aftermarket companies
- 2 Continental Structural Plastic**
Lightweight advanced composite materials
- 3 Formosa Plastics Corporation**
Supplier of plastic resins and petrochemicals
- 4 Crosby Composite**
Carbon fiber engineering company supplying customers worldwide

SELECTIVE CRITERIA



Product Portfolio:
R&D and knowhow in lightweight plastic

Company Performance:
Market share and revenue contribution from lightweight plastic

Strategic Alignment:
Parallel vision, mission, and strategic positioning



“ Continental Structural Plastics ”

EV production partnership will benefit both PTTGC and CSP

PARTNERSHIP WITH CSPH



WHO

Continental Structural Plastics

Full-service supplier creating lightweight advanced composite materials

WHY

Exceptional R&D

50 patents and 120 materials formulations
TCA Ultra Light Technology

Source: GPSC

VALUE PROPOSITION

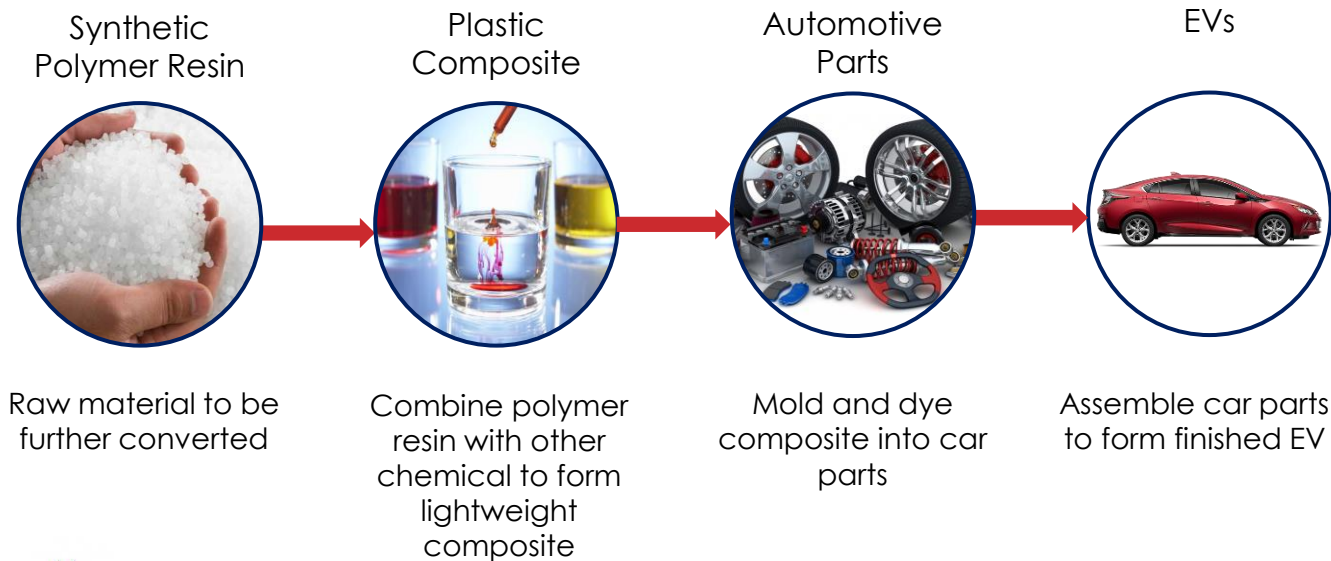
Benefit to PTTGC:

- 1 Knowhow in lightweight plastic composite production
- 2 Further integration of value chain
- 3 Capability to capture EV trend

Benefit to CSP:

- 1 New revenue stream
- 2 Access to new market
- 3 Increased global presence

PTTGC must commercialize products to automotive companies



Source: PTTGC Annual Report 2015

PTTGC must commercialize products to automotive companies

Synthetic
Polymer Resin



Raw material to be
further converted



Plastic
Composite



Combine polymer
resin with other
chemical to form
lightweight
composite



Automotive
Parts



Mold and dye
composite into car
parts



EVs



Assemble car parts
to form finished EV



Decision-making Power

PTTGC must capture automotive companies

COMMERCIALIZE TO AUTOMOTIVE COMPANIES



Who they are:

- Automotive company with substantial investment in Thailand
- Production in Thailand
- Nissan, Chevrolet, BMW

What they seek for:

- Mass production of EV car
- Wide adoption by end customers
- Enhance eco-friendly image

PROPOSED VALUE

TCA Ultra Light

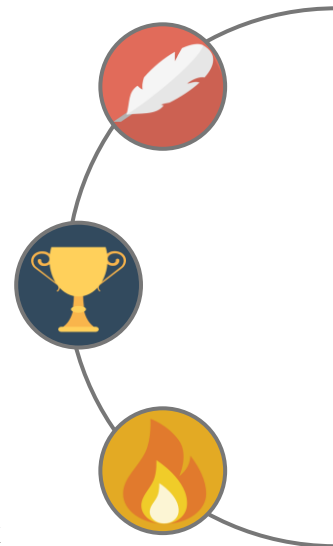
Reduce weight by at least 9 kilograms per vehicles

Enhanced Plastic Performance

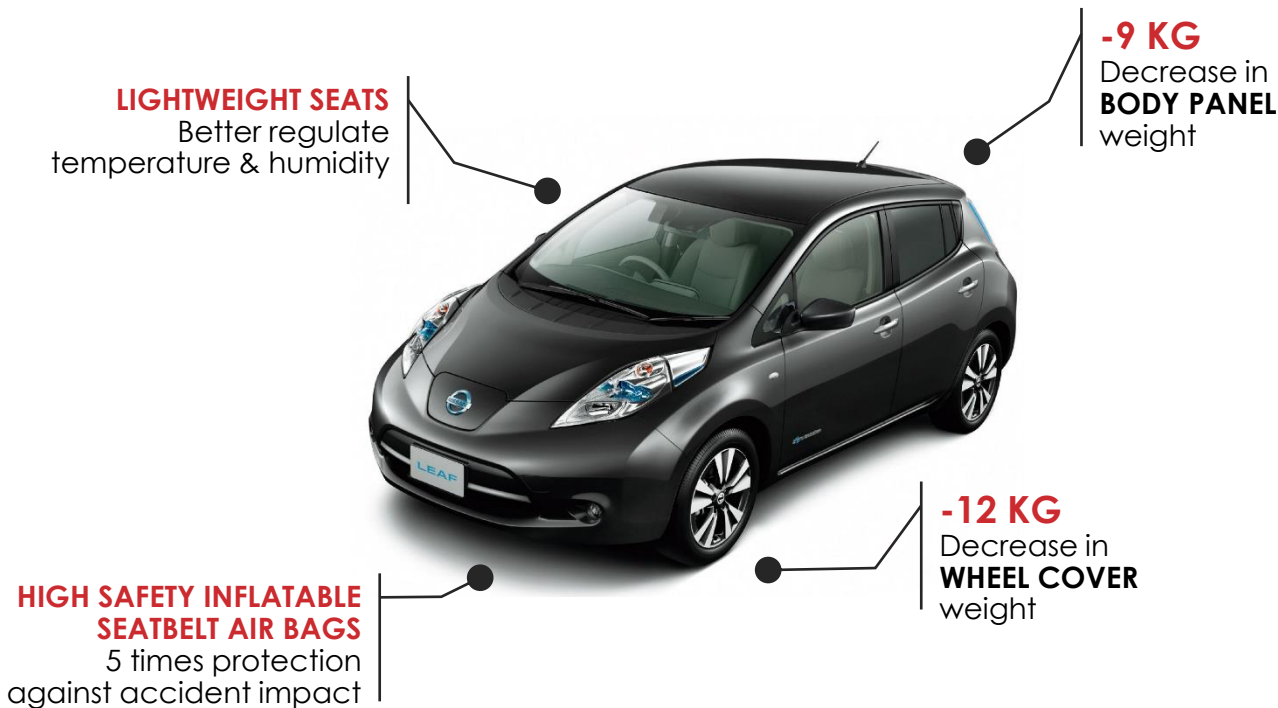
Better quality and product feature

Strong Supply Source

Thailand's largest producer of feed stock used in plastic production



Weight of EV will reduce by up to 21 KG with lightweight plastic



Source: PlasticsEurope, 2014



KEY TAKEAWAY

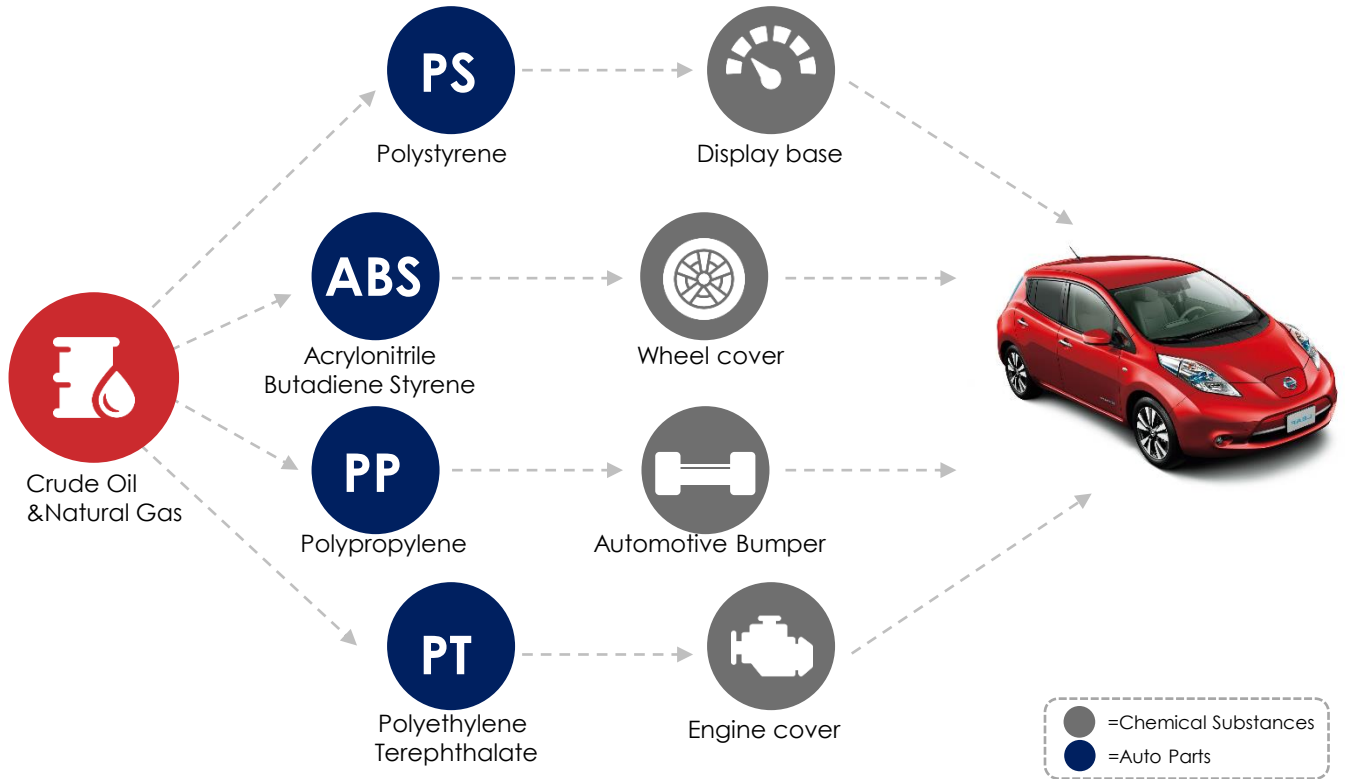
By partnering with CSP, PTTGC will be able to capture EV trend through commercialization of lightweight plastic

GLIDE AHEAD

Produce plant-based
bioplastic to ensure
sustainable supply



Auto parts still rely heavily on crude oil and natural gas



Source: PTTGC annual report 2015, Craft Industrial

Where else can PTTGC find a sustainable feedstock for producing EV parts?

There are 2 types of plastic production

SYNTHETIC PLASTIC



WHAT

Produce plastic using synthetic substances from non-renewable sources



Coal



Natural Gas



Crude Oil

Source: National Institute of Chemistry, Ljubljana 2012

BIOPLASTIC



WHAT

Produce plastic using natural materials, which are bio-degradable



Plant



Tree



Animal



Insect

Plant is the most attractive natural plastic raw material

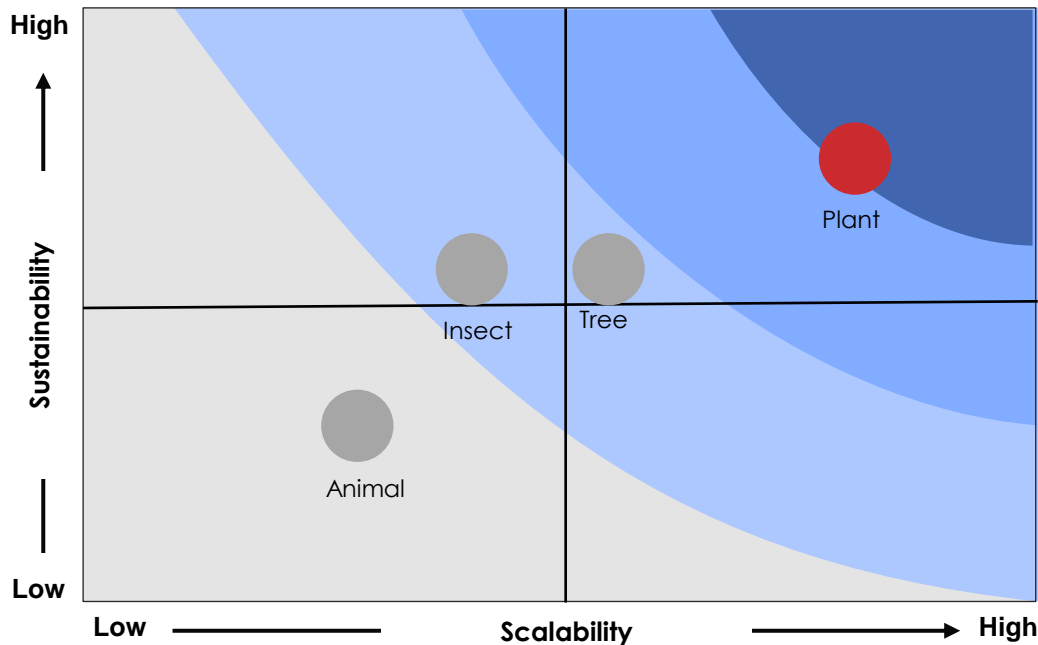
Key criteria for growth:

1 SUSTAINABILITY WEIGHT: 40%

- Social Responsibility
- Environmentally Friendly

2 SCALABILITY WEIGHT: 60%

- Availability
- Profitability
- Ease of Procurement



Car parts still rely heavily on crude oil and natural gas

PLANT-BASED BIOPLASTIC



WHAT

Polybutylene Succinate

Transform plants to PS, which is an initial base for lightweight EV parts

WHY

Variety of Benefits

- 5-15% Weight Saving
- 20% Reduction in CO2 emission
- Bio-degradable

RAW MATERIAL TYPES



Soybean

- 0.052 million tons/ year
- 30 THB/ kg



Cassava

- 31.36 million tons/ year
- 5.60 THB/ kg



Sugar Cane

- 111.95 million tons/ year
- 0.97 THB/ kg



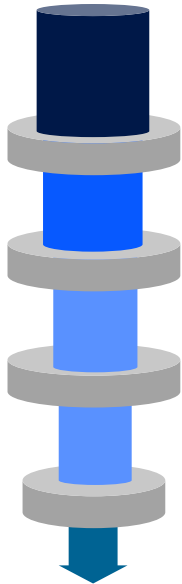
Corn

- 5.1 million tons/ year
- 7.94 THB/ kg

Source: Office of Agricultural Economics 2015

PTTGC should partner with leading Thai sugar manufacturer

CRITERIA



- 1 Production Capacity**
Tons of sugar cane harvest per year
- 2 Strategic Location**
Ease of transport to PTTGC plant
- 3 Knowhow**
Expertise in sugar by-product
- 4 Supplier Reliability**
Credit and financial health

POTENTIAL PARTNERS



WHAT | Partnership to **share knowledge** and **produce bioplastic** from sugar cane

WHY | Partners can commercialize their **byproducts**, and PTTGC can find a **sustainable feedstock** for plastics



KEY TAKEAWAY

By partnering with sugar manufacturers, PTTGC will be able to ensure sustainable EV part productions from upstream to downstream

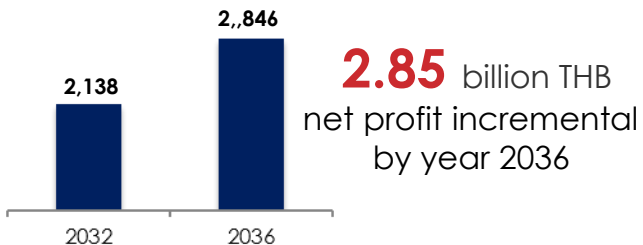


FINANCIALS

Implementation timeline
and financial justifications

Key Impacts validate strategic success

INCREMENTAL IN NET PROFIT



NATION INCOME GENERATION

140 billion THB
national income
generation



CARBON DIOXIDE REDUCTION



11,402 tons
of CO₂ reduced



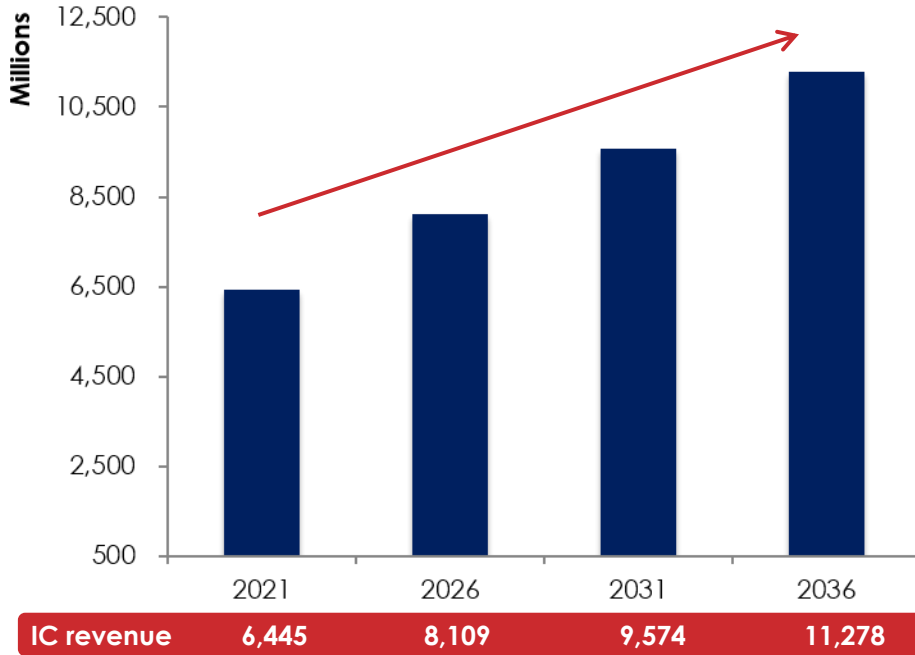
77,340 tons
of CO₂ reduced



103,398 tons
of CO₂ reduced

Incremental revenue is expected to reach 11.27 billion by 2036

Incremental revenue incurred



Key Assumption

- 1 **2 %** Car sales growth
- 2 Average **5%** Ethanol capacity growth
- 3 **0.0015** ton/ liter bio-plastic production ratio
- 4 Expected constant bio plastic price

Expected total costs stand at 10.8 billion THB

INVESTMENT COSTS

GEAR UP

R&D investment 2,400 million

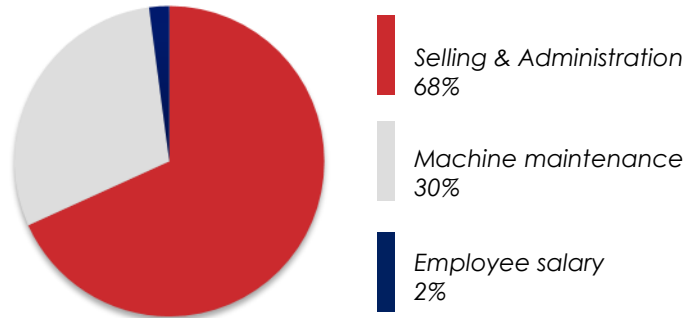
JUMP AHEAD

Factory investment 6,500 million

Due diligence 50 million

Land purchase 1,000 million

RECURRING EXPENSES



INVESTMENT 9,950 million

EXPENSES 912 million

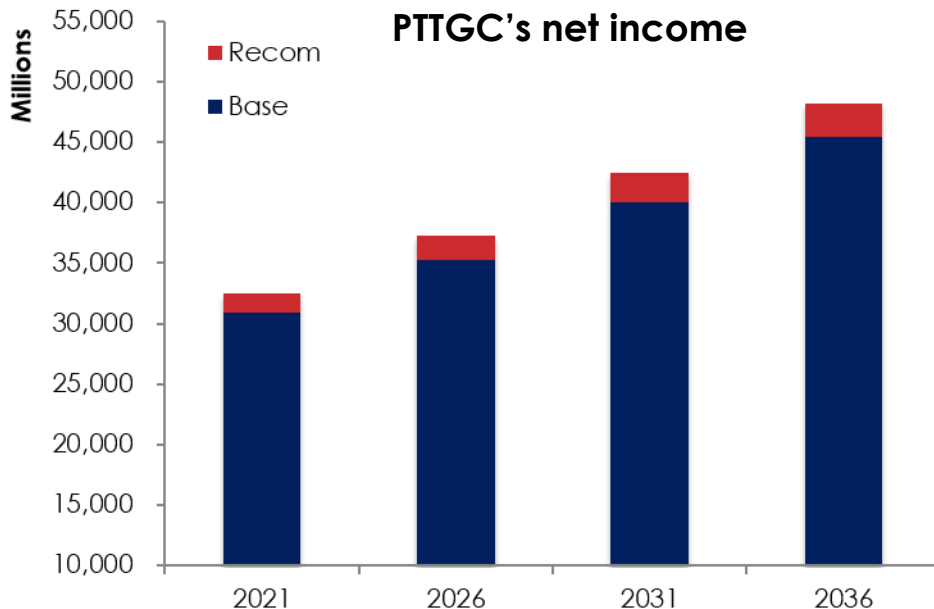
Source of Fund

Cash on hand

Short-term debt

Long-term debt

Total net income is expected to reach 48.2 billion in 20 years



: Million THB

| | | | | |
|--------------|---------------|---------------|---------------|---------------|
| Base | 30,893 | 35,251 | 40,063 | 45,374 |
| Recom | 1,639 | 2,059 | 2,423 | 2,846 |

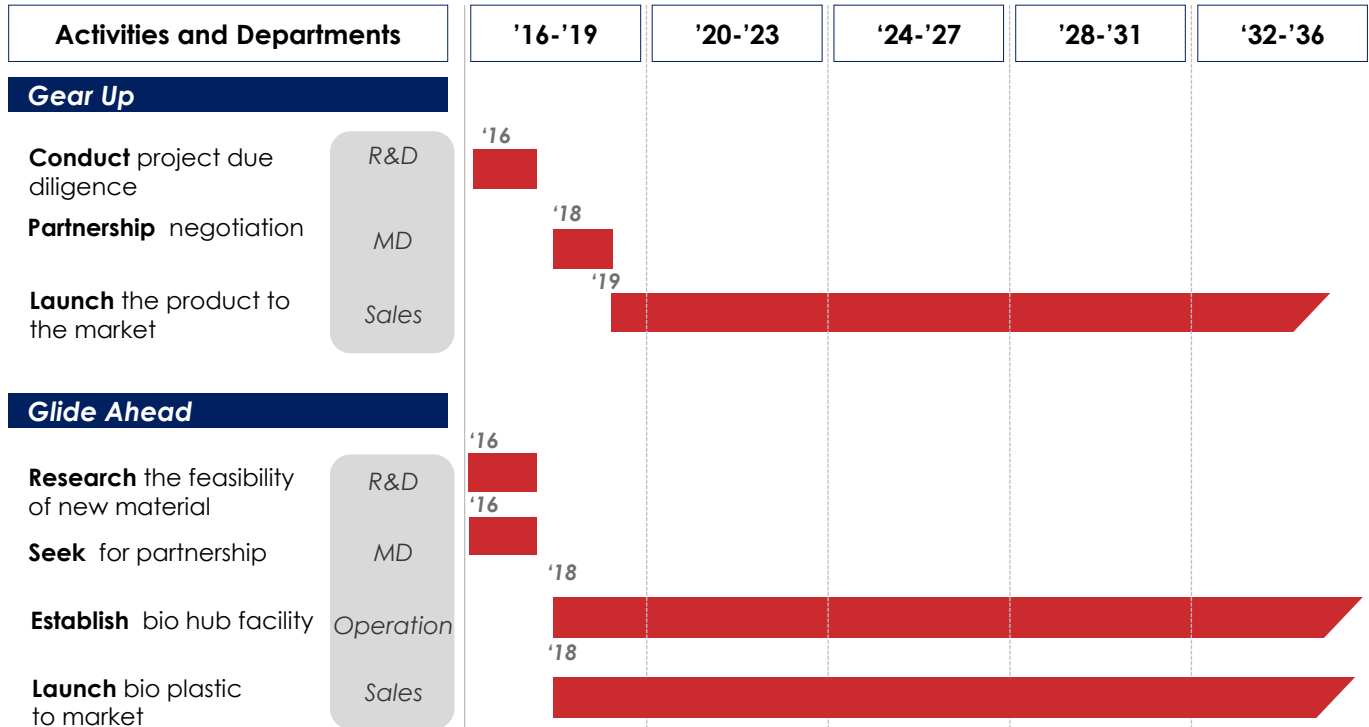
Net income contribution

6.27 %

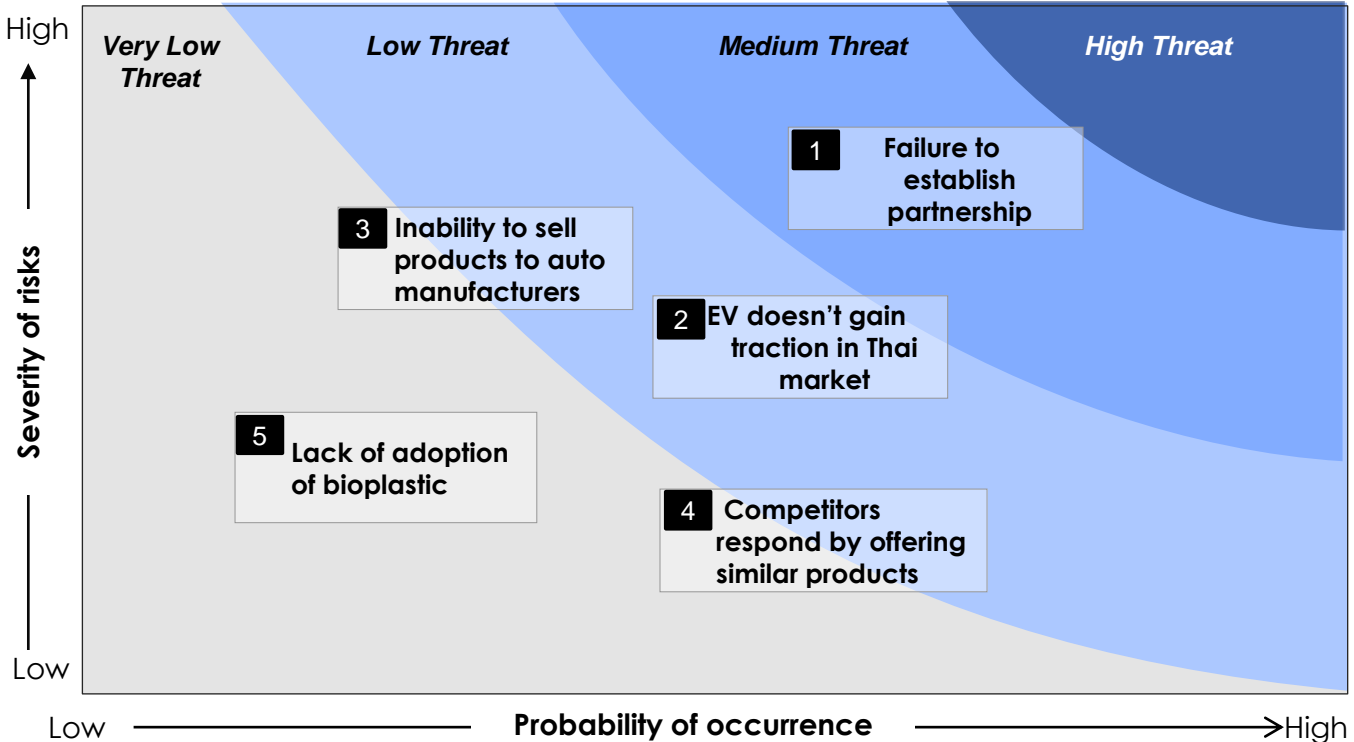


5.30 %

PTTGC should follow the timeline to ensure smooth implementation








Risks are prioritized based on severity and probability of occurrence



Source: Team Analysis

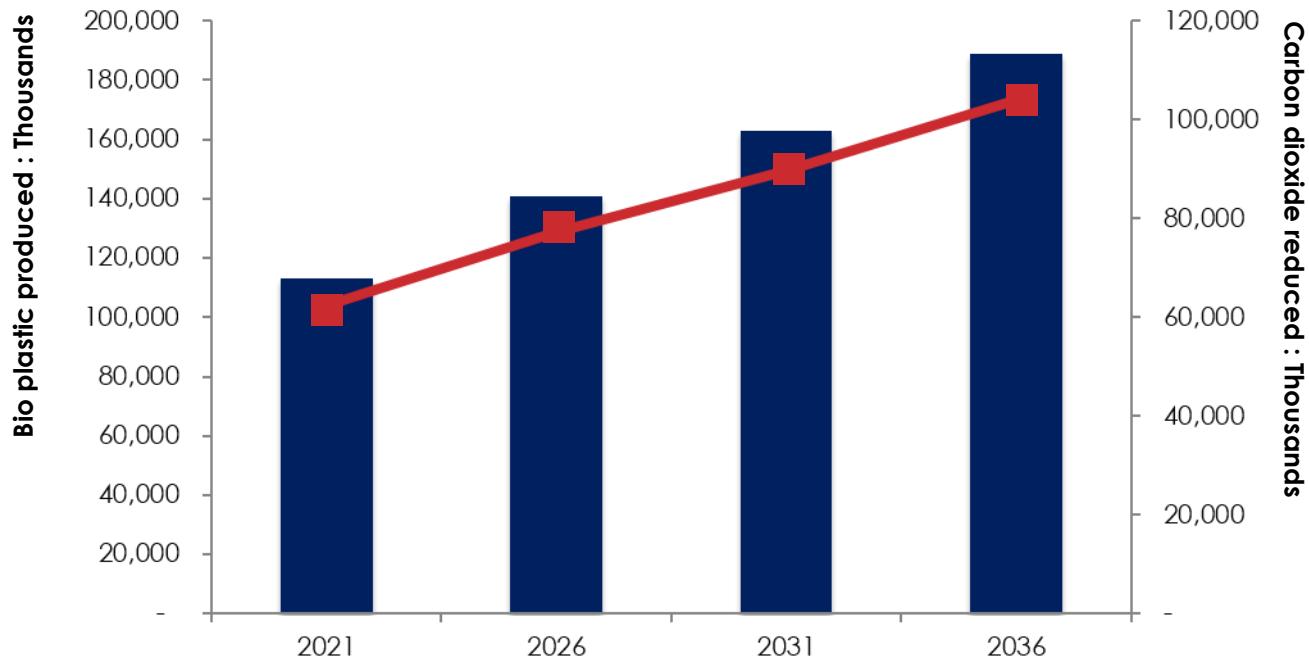
Risks have been prioritized and mitigation plan is laid out

| Risk | ABILITY TO MITIGATE | MITIGATION ACTIONS |
|---|---|---|
| 1 Failure to establish partnership |  | <ul style="list-style-type: none"> ▪ Reanalyze potential partners' needs and renegotiate ▪ Consider another partner who meets the same set criteria |
| 2 EV doesn't gain traction in Thai market |  | <ul style="list-style-type: none"> ▪ Sell lightweight plastic and bioplastic materials to regular automotive companies to improve fuel efficiency instead |
| 3 Inability to sell products to auto manufacturers |  | <ul style="list-style-type: none"> ▪ Reanalyze customers' needs and modify communications |
| 4 Competitors respond by offering similar products |  | <ul style="list-style-type: none"> ▪ Leverage on first-mover advantage and promote indirect benefits and core values to customer |
| 5 Lack of adoption of bioplastic |  | <ul style="list-style-type: none"> ▪ Communicate the benefits of application to customers and educate them in usage |

Source: Team Analysis

Encouraging bio plastic will reduce carbon dioxide production

Bio plastic produced VS Carbon Dioxide production



“There is a positive correlation between bioplastic production and Carbon Dioxide used”

Plastic business unit & Bio Hub will enhance country's economics

NATIONAL INCOME INCREASED



Generated income of
140 Billion THB

*from foreign and local
bio plastic investment*

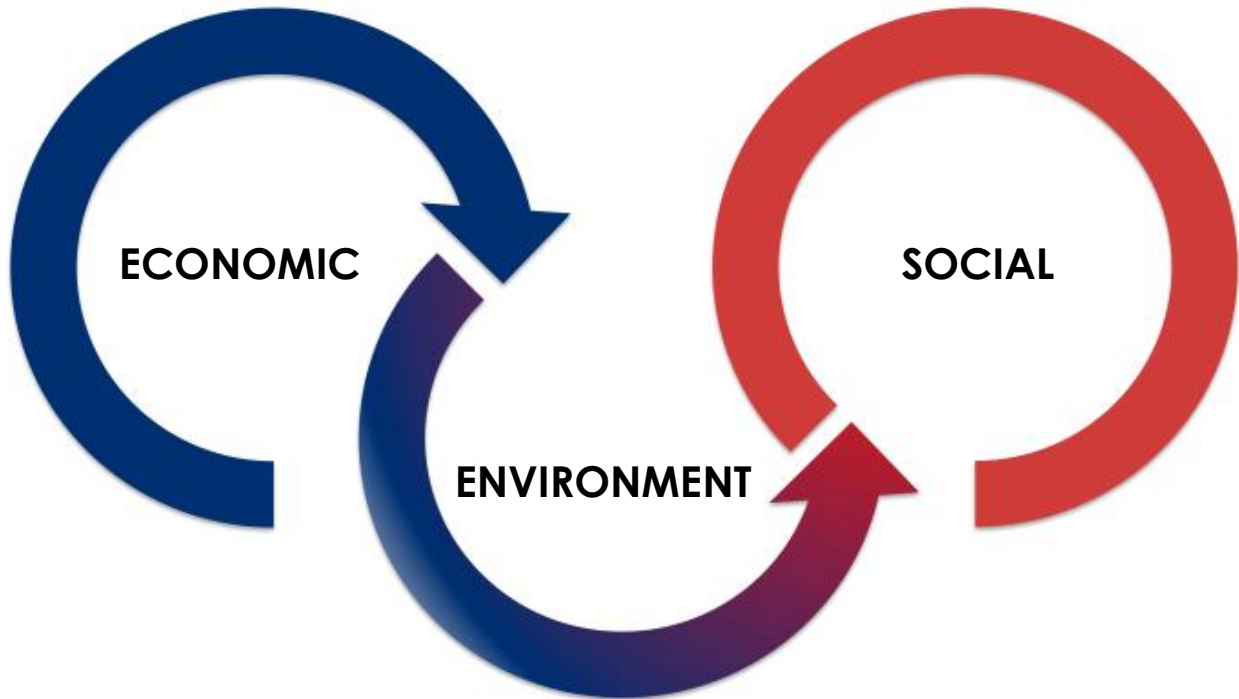
JOB CREATION



Created
28,000 Jobs

*from Bio business and plastic
production industry*

PTTGC will be able to enhance value in triple bottom line





WILL YOU DARE TO JUMP ?

PTTGC



**SPECTER
CONSULTING**

Slide Navigator

Analysis

Global EV Trend

Global EV Units

Thailand Future Outlook

Threat for Refinery

Opportunity for polymer, specialty, and phenol

Executive summary

Gear Up

EV Adoption Barrier

Plastic component in EV

EV Supply Chain

Strategic Partnership

Partnership with CSPH

Commercialization of material

Commercialization of material

Selling to automotive companies

Benefits from light weight plastic

Glide Ahead

Car parts come from crude oil

Synthetic Plastic VS Bioplastic

Prioritization map

Plant-based bioplastic

Strategic partnership

Financials

Key Financial Impact

Revenue forecast

Cost Breakdown

Economic Impact

Timeline

Risk Prioritization

Risk & Mitigation Plan

Environment Impact

Social Impact

Triple bottom line

Slide Navigator (Cont.)

BACKUP-General

Effect of driverless car on PTTGC

Tesla in Thailand

Plastic Usage in Vehicles

BACKUP-Gear Up

EV marketing campaign

Inability to promote EV

Inability to produce EV cars

EV in public transportation

EV boom in Thailand

BACKUP-Glide Ahead

Usage of Bioplastic

Value Proposition

Reason for sugar cane

Reason to enter bioplastic market

Decision Matrix

Synthetic and bioplastic

BACKUP-Financials

20 year Timeline

Finance- Base case projection (brief)

Finance- Recom1 (brief)

Finance- Recom2 (brief)

Finance- Recom1 (Initial investment)

Finance- Recom2 (Initial Investment)

Bio plastic production & Carbon Dioxide reduction

CO2 emission reduction from Bio plastic

Bio plastic selling price

Bio plastic production rate

Social Impact from Bio hub

Alternative supply

Fuel for electricity generation

Oil price effect on stock

**END OF
PRESENTATION**

GENERAL BACKUP

Will driverless car affect PTTGC

1

Driverless car depends on distance travel

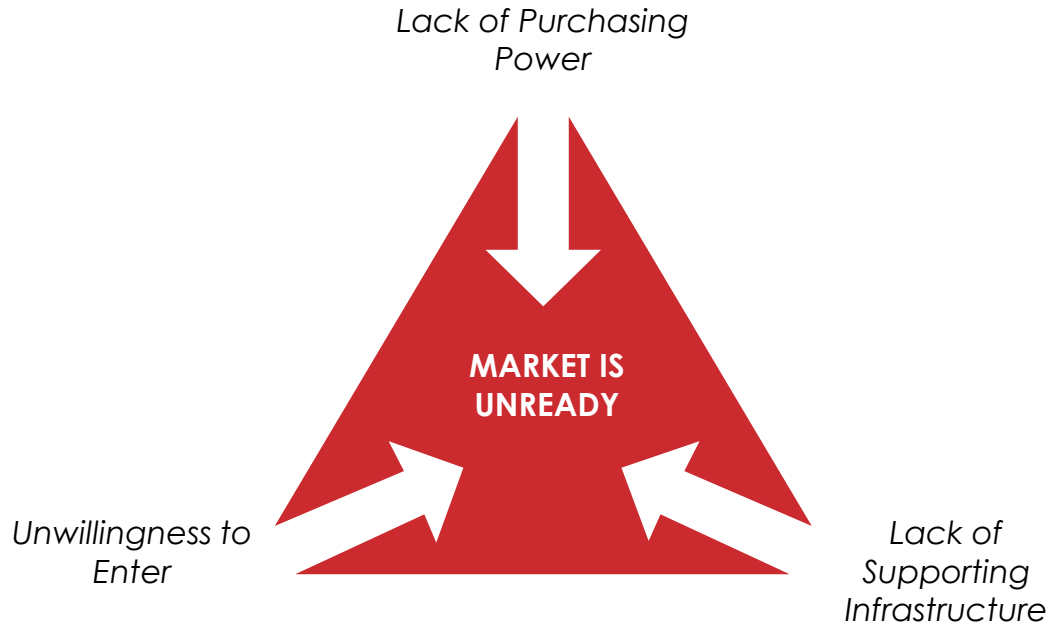
2

Does not create much difference in energy consumption whether human or AI is driving

3

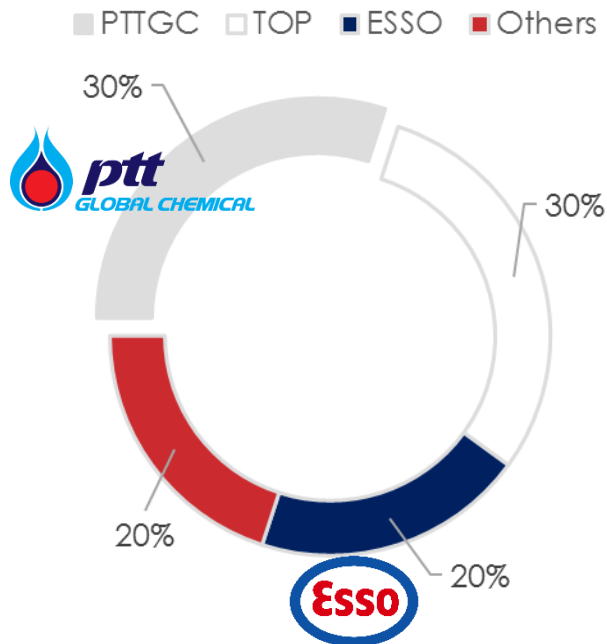
Depends on whether driverless car is an internal combustion or EV

Why don't PTTGC introduce Tesla in Thailand?



PTTGC is one of the largest petrochemical companies in Thailand

OLEFIN REFINERY MARKET



Source: Department of Industrial Economics, 2012

BIOPLASTIC MANUFACTURING MARKET



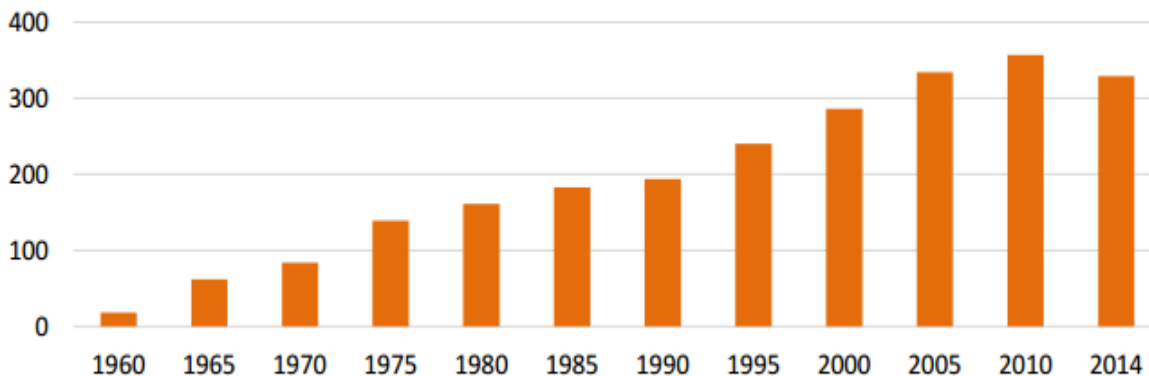
- 1 **PURAC**
Organic Chemistry Manufacturer,
Distributor, Importer and Exporter



- 2 **PTTGC**

Plastic Usage in auto vehicles has grown over the past years

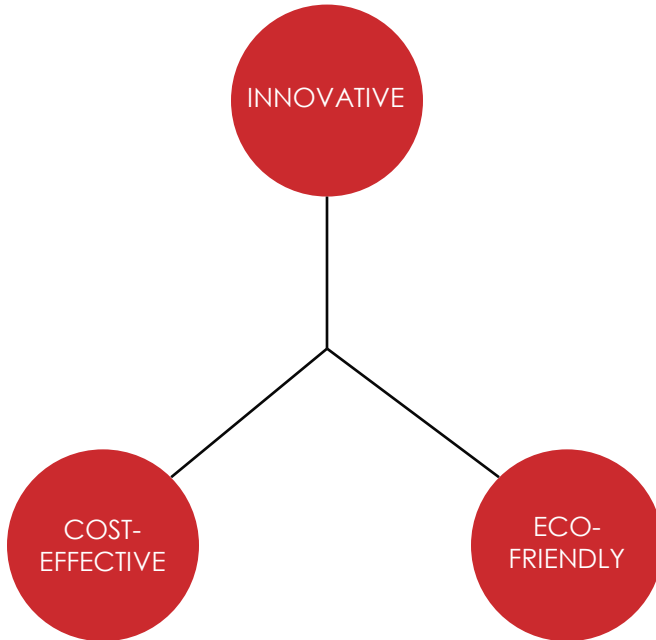
Figure 2
Long-Term Trends in Light Vehicle Plastics & Polymer Composites Use (pounds/vehicle)



**GEAR UP
BACKUP**

Marketing campaign can be used to promote EV in Thailand

CORE VALUES



Source: Team Analysis

EXECUTION PLAN



Storyline

Family commute around Bangkok city in an electric vehicle

Communication Channel

- Facebook, LINE, LINE TV
- Series of Viral Videos on Youtube

Why don't PTTGC promote EV?

1

PTTGC deals B2B business not B2C

2

Investment is not directly related to core business

3

This is an industry effort not PTTGC alone

Why don't PTTGC produce EV cars?

1

PTTGC is not recognized by consumers as an automotive company

2

PTTGC does not have the knowhow in automotive manufacturing

3

EV manufacturing is not the core competency of PTTGC

Why don't PTTGC encourage EV public transportation

1

Lack of charging stations and infrastructure

2

Low ROIC

3

Lack of adoption by consumers

Why will EV boom in Thailand?

GOVERNMENT INITIATIVE

PHASE 1: 2016-2017

- Use 200 electric buses and develop charging facilities

PHASE 2: 2018-2020

- Research and develop EV batteries and establish tax incentives and legal regulations related to EV's

PHASE 3: 2021-2036

- Have 1.2 million EV's on the roads and 690 charging stations developed

OTHER BENEFITS

1

TAX BENEFITS

0% tax on imported EV

2

PRIVATE INITIATIVE

Nissan hopes to enhance Thailand as the hub for producing EV in Asia

3

GROWING ECO-FRIENDLY TREND

Consumers are more aware of environmental changes and crude oil effect

**GLIDE AHEAD
BACKUP**

Bioplastic using natural feedstock

PLANT

- Cellulose can be extracted
- Include soy beans, cassava, sugar cane, corn

ANIMAL

- Horn and milk can be obtained
- Use in glue making for plastic

TREE

- Latex, amber and resin can be extracted
- Large grown trees

INSECT

- Shellac can be obtained
- Use in making polish

Source: National Institute of Chemistry, Ljubljana 2012

Value Proposition for bioplastic partnership

PTTGC

- 1 Obtain sustainable resource to be used as plastic feed stock
- 2 Reduce reliance on crude oil which is impacted by oil price volatility
- 3 Lower cost of production compared to crude oil

SUGAR MANUFACTURER

- 1 Ability to commercialize by-product
- 2 Enhance waste management scheme
- 3 Increase opportunity to explore new business area

Why sugar cane?

1

Extensive supply
with production
over 111.95
million tons
annually

2

Low procurement
cost of 970 THB
per ton

3

Ability to convert
by-product to
Polybutylene
succinate

Why do we enter bioplastic market?

1

Obtain sustainable resource to be used as plastic feed stock

2

Reduce reliance on crude oil which is impacted by oil price volatility

3

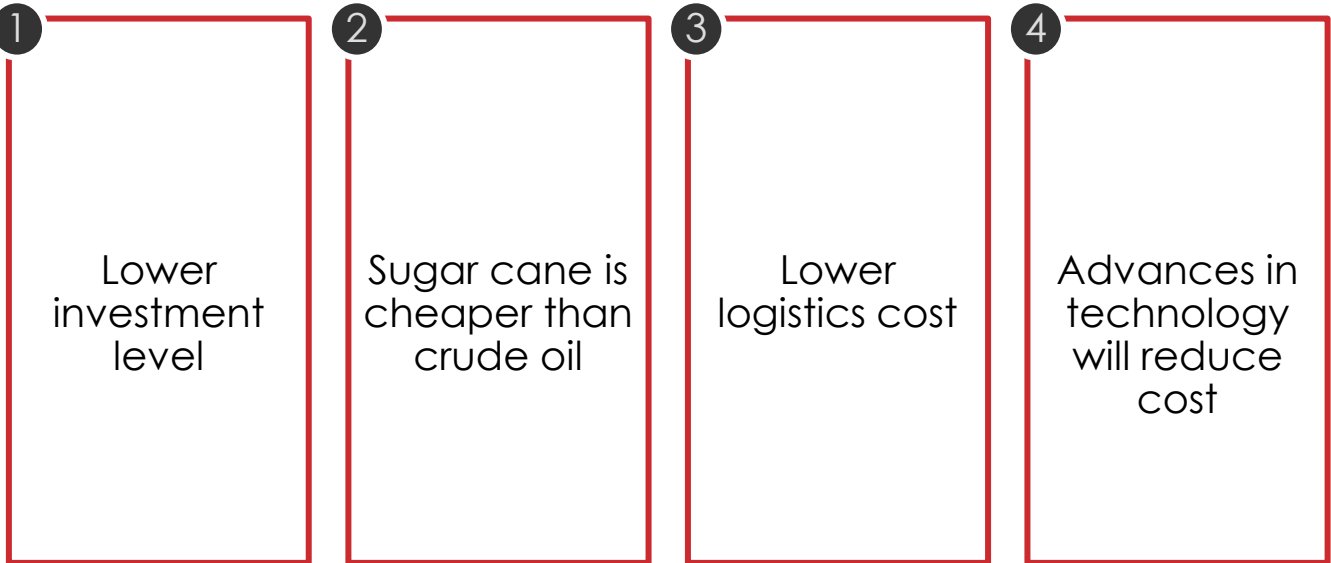
Lower cost of production compared to crude oil

Why must PTTGC use plant as a feedstock?

3=High, 1=Low

| | SUSTAINABILITY(40%) | | SCALABILITY(60%) | | | | |
|--------|-----------------------|-------------------|------------------|---------------|------------------------|------------|----------|
| | Social Responsibility | Environ. Friendly | Availability | Profitability | Ease of Implementation | | |
| | 20% | 20% | 20% | 20% | 20% | | |
| Tree | 2 | 1 | 2 | 2 | 1 | | |
| Plants | 3 | 3 | 3 | 3 | 3 | | |
| Animal | 1 | 1 | 1 | 1 | 1 | | |
| Insect | 1 | 2 | 1 | 1 | 2 | | |
| | SUSTAINABILITY(40%) | | SCALABILITY(60%) | | | | |
| Score | Social Responsibility | Environ. Friendly | Availability | Profitability | Ease of Implementation | Sustain(y) | Scale(x) |
| Tree | 0.4 | 0.2 | 0.4 | 0.4 | 0.2 | 0.6 | 1 |
| Plants | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 1.2 | 1.8 |
| Animal | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 | 0.6 |
| Insect | 0.2 | 0.4 | 0.2 | 0.2 | 0.4 | 0.6 | 0.8 |

Bioplastics will be cheaper than synthetic plastic in the long run



Source: Team Analysis

FINANCE BACKUP

Why 20 years timeline?

GOVERNMENT INITIATIVE

PHASE 1: 2016-2017

- Use 200 electric buses and develop charging facilities

PHASE 2: 2018-2020

- Research and develop EV batteries and establish tax incentives and legal regulations related to EV's

PHASE 3: 2021-2036

- Have 1.2 million EV's on the roads and 690 charging stations developed

MARKET READINESS

1

Lack of market adoption due to low purchasing power

2

Lack of supporting infrastructure with only 6 charging stations currently

3

Inability to see benefit of EV by local consumers

Base case projection

| | 2021 | 2026 | 2031 | 2036 | Assumption |
|--|-----------------------|-----------------------|-----------------------|-----------------------|---------------|
| Revenue from sale of goods and rendering of services | 454,339,224,965 | 501,627,216,425 | 553,836,980,018 | 611,480,777,740 | 1.02 |
| Cost of sale of goods and rendering of services | -408,905,302,468.93 | -451,464,494,782.64 | -498,453,282,015.90 | -550,332,699,965.79 | -0.9 |
| Gross profit | 45,433,922,497 | 50,162,721,643 | 55,383,698,002 | 61,148,077,774 | |
| Investment income | 1,255,595,297 | 1,255,595,297 | 1,255,595,297 | 1,255,595,297 | 1,255,595,297 |
| Other income | 1,522,145,991 | 1,522,145,991 | 1,522,145,991 | 1,522,145,991 | 1,522,145,991 |
| Selling expenses | (1,363,017,675) | (1,504,881,649) | (1,661,510,940) | (1,834,442,333) | (0.003) |
| Administrative expenses | (10,506,788,727) | (10,506,788,727) | (10,506,788,727) | (10,506,788,727) | |
| Loss from impairment of assets | (843,634,963) | (843,634,963) | (843,634,963) | (843,634,963) | |
| Provisions for business restructuring | (746,384,347) | (746,384,347) | (746,384,347) | (746,384,347) | |
| Net derivative gain | 2,646,141,923 | 2,646,972,705 | 2,646,946,743 | 2,646,947,554 | |
| Net foreign exchange gain (loss) | - | - | - | - | |
| Finance costs | (5,447,582,983) | (5,447,582,983) | (5,447,582,983) | (5,447,582,983) | |
| Share of loss of investments in joint ventures | - | - | - | - | |
| Share of profit of associates | 569,112,258 | 569,112,258 | 569,112,258 | 569,112,258 | |
| Profit before income tax expense | 32,519,509,271 | 37,107,275,224 | 42,171,596,331 | 47,763,045,521 | |
| Income tax expense | (1,625,975,464) | (1,855,363,761) | (2,108,579,817) | (2,388,152,276) | (0.05) |
| Profit for the year | 30,893,533,807 | 35,251,911,463 | 40,063,016,514 | 45,374,893,245 | |

Recommendation 1 projection

| Revenue | 2021 | 2026 | 2031 | 2036 | Asumptom |
|-------------------------------------|-------------|-------------|-------------|-------------|------------|
| Number of car produce | 2,097,754 | 2,316,089 | 2,557,150 | 2,823,300 | 1.02 |
| Percentage of car that used plastic | 5% | 6% | 8% | 10% | |
| EV car used | 104,888 | 138,965 | 204,572 | 282,330 | |
| Car weigt (KG) | 1,050 | 1,050 | 1,050 | 1,050 | |
| percentage of plastic in EV car | 12% | 12% | 12% | 12% | |
| Total plastic used | 13,215,847 | 17,509,636 | 25,776,070 | 35,573,581 | |
| PTTGc market capture | 60% | 70% | 70% | 70% | |
| Total plastic used | 7,929,508 | 12,256,745 | 18,043,249 | 24,901,506 | |
| Total plastic use from line | 2,265,971 | 5,225,825 | 9,892,486 | 15,452,538 | |
| Plastic bead price | 45 | 45 | 45 | 45 | 45 baht/kg |
| Total revenue from selling plastic | 101,968,715 | 235,162,138 | 445,161,881 | 695,364,218 | |
| Cost | | | | | |
| Plastic material cost (COGS) | 76,476,536 | 176,371,603 | 333,871,411 | 521,523,163 | 75% |
| Transaportation cost | 2,039,374 | 4,703,243 | 8,903,238 | 13,907,284 | 2% |
| Selling and administation | 2,345,280 | 5,408,729 | 10,238,723 | 15,993,377 | 2.30% |
| Machine maintenance | 632,206 | 1,458,005 | 2,760,004 | 4,311,258 | 0.62% |
| Net operating profit | 20,475,318 | 47,220,557 | 89,388,506 | 139,629,135 | 20.00% |

Recommendation 2 projection

| Revenue | 2021 | 2026 | 2031 | 2036 | Asumptom |
|--|---------------|---------------|----------------|----------------|-----------------|
| Ethanol production | 77,671,363 | 96,424,043.1 | 111,781,893.26 | 129,585,850.83 | 5% |
| Total bio plastic production capacity | 113,271 | 140,618 | 163,015 | 188,979 | 0.0015 |
| Total bio plastic production capacity (Kg) | 113,270,738 | 140,618,396 | 163,015,261 | 188,979,366 | 1000 |
| Vehicle part | 5,663,537 | 7,030,920 | 8,150,763 | 9,448,968 | 5% |
| Body part bio plastice | 79,289,516 | 98,432,877 | 114,110,683 | 132,285,556 | 70% |
| Other bio plastic | 22,654,148 | 28,123,679 | 32,603,052 | 37,795,873 | 25% |
| Price for bio plastic | 56,000 | 56,000 | 56,000 | 56,000 | 56000 |
| Total bio plustic hub revenue | 6,343,161,310 | 7,874,630,183 | 9,128,854,616 | 10,582,844,484 | |
| Cost | | | | | |
| Material cost | 4,507,069,397 | 5,595,239,184 | 6,486,415,725 | 7,519,533,585 | 71% |
| Selling & Administration | 145,892,710 | 181,116,494 | 209,963,656 | 243,405,423 | 2.30% |
| Machine maintenance | 63,431,613 | 78,746,302 | 91,288,546 | 105,828,445 | 1.00% |
| Employees salary | 7,500,000 | 7,500,000 | 7,500,000 | 7,500,000 | 300 |
| Net operating profit | 1,619,267,590 | 2,012,028,204 | 2,333,686,689 | 2,706,577,031 | |

Recommendation 1 projection

| Revenue | 2016 | 2017 | 2018 | 2019 | 2020 |
|-------------------------------------|-----------------------|---------------------|---------------------|------------------|------------------|
| Number of car produce | 1,900,000 | 1,938,000 | 1,976,760 | 2,016,295 | 2,056,621 |
| Percentage of car that used plastic | 0.50% | 1% | 3% | 3% | 3% |
| EV car used | 9,500 | 19,380 | 59,303 | 60,489 | 61,699 |
| Car weight (KG) | 1,050 | 1,050 | 1,050 | 1,050 | 1,050 |
| percentage of plastic in EV car | 12% | 12% | 12% | 12% | 12% |
| Total plastic used | 1,197,000 | 2,441,880 | 7,472,153 | 7,621,596 | 7,774,028 |
| PTTGc market capture | 10% | 20% | 30% | 40% | 50% |
| Total plastic used | 119,700 | 488,376 | 2,241,646 | 3,048,638 | 3,887,014 |
| Total plastic use from line | 119,700 | 488,376 | 1,205,058 | 913,268 | 587,866 |
| Plastic bead price | 45 | 45 | 45 | 45 | 45 |
| Total revenue from selling plastic | 5,386,500 | 21,976,920 | 54,227,616 | 41,097,045 | 26,453,978 |
| Cost | | | | | |
| Plastic material cost (COGS) | 4,039,875 | 16,482,690 | 40,670,712 | 30,822,784 | 19,840,484 |
| Transportation cost | 107,730 | 439,538 | 1,084,552 | 821,941 | 529,080 |
| Selling and administration | 123,890 | 505,469 | 1,247,235 | 945,232 | 608,442 |
| Machine maintenance | 33,396 | 136,257 | 336,211 | 254,802 | 164,015 |
| Net operating profit | 1,081,609 | 4,412,966 | 10,888,905 | 8,252,287 | 5,311,959 |
| Initial investment | | | | | |
| R&D | 800,000,000 | 800,000,000 | 800,000,000 | | |
| Machine adjustment | 200,000,000 | | | | |
| deal due diligence | 50,000,000 | | | | |
| Net profit | -1,048,918,391 | -795,587,034 | -789,111,095 | 8,252,287 | 5,311,959 |

Recommendation 2 projection

| Revenue | 2016 | 2017 | 2018 | 2019 | 2020 |
|--|-----------------------|-----------------------|-----------------------|--------------------|--------------------|
| Ethanol production | 67,000,000 | 69,010,000 | 71,080,300 | 73,212,709 | 75,409,090 |
| Total bio plastic production capacity | | | 20,732 | 42,707 | 65,983 |
| Total bio plastic production capacity (Kg) | | | 20,731,754 | 42,707,414 | 65,982,954 |
| Vehicle part | | | 1,036,588 | 2,135,371 | 3,299,148 |
| Body part bio plastice | | | 14,512,228 | 29,895,190 | 46,188,068 |
| Other bio plastic | | | 4,146,351 | 8,541,483 | 13,196,591 |
| Price for bio plastic | | | 56,000 | 56,000 | 56,000 |
| Total bio plastic hub revenue | | | 1,160,978,233 | 2,391,615,161 | 3,695,045,423 |
| Cost | | | | | |
| Material cost | | | 824,921,393 | 1,699,338,070 | 2,625,477,318 |
| Selling & Administration | | | 26,702,499 | 55,007,149 | 84,986,045 |
| Machine maintenance | | | 11,609,782 | 23,916,152 | 36,950,454 |
| Employees salary | | | 7,500,000 | 7,500,000 | 7,500,000 |
| Net operating profit | | | 290,244,558 | 605,853,790 | 940,131,606 |
| Initial investment | | | | | |
| Project due diligence | 25,000,000 | 25,000,000 | | | |
| R&D | 800,000,000 | 800,000,000 | 800,000,000 | | |
| Factory set up | 2,000,000,000 | 2,000,000,000 | 2,500,000,000 | | |
| Machine set up | 1,000,000,000 | | | | |
| Net profit | -3,825,000,000 | -2,825,000,000 | -3,009,755,442 | 605,853,790 | 940,131,606 |

Plastic and Bio plastic push

| Plastic production | 2021 | 2026 | 2031 | 2036 |
|---------------------------|-----------|-----------|-----------|------------|
| Bio plastic | 5,663,537 | 7,030,920 | 8,150,763 | 9,448,968 |
| Conventional plastic | 2,265,971 | 5,225,825 | 9,892,486 | 15,452,538 |

| CO2 reduction | 2021 | 2026 | 2031 | 2036 |
|----------------------|-------------|-------------|-------------|-------------|
| Bio plastic used | 113,270,738 | 140,618,396 | 163,015,261 | 188,979,366 |
| Carbon dioxide saved | 62,298,906 | 77,340,118 | 89,658,394 | 103,938,651 |

1kg of plastic produce 6 kg CO2
1kg of bio plastic produce 2.7 kg CO2
1 kg of bio saved 3.3 kg CO2
Save 55% of CO2

CO2 emission reduction from Bio plastic

Plastic bags and plastic bottles - CO2 emissions during their lifetime

A number of people have asked about the implications of using plastic bags on the personal carbon footprint as well as on the environment in general. There are some comparisons between paper bags and plastic bags available which clearly show that it all depends on how many times these plastic or paper bags are being used.

Littering is probably the severest problem related to plastic bags. Nevertheless let's now have a look at the carbon dioxide (CO2) emissions for the production and incineration of plastic bags.

The carbon footprint of plastic (LDPE or PET, polyethylene) is **about 6 kg CO2 per kg of plastic**. If you know the weight of your plastic bags, you can multiply it with the number of plastic bag you are using per year. Then you can easily calculate the carbon dioxide emitted by your own usage of plastic bags. See below for some background information.

Bioplastics Close in Price to Regular Plastic and Trader Joe's Coconut Packages

Michael Kanellos: February 24, 2009, 11:09 AM

Bioplastics are no longer the Cadillac option.

Cereplast, which makes biodegradable and compostable resins for food containers and industrial parts, has managed to reduce the cost of some of its resins so that they compete with regular petroleum-based plastics, said CEO Frederic Scheer in an interview at the Cleantech Forum in San Francisco. That's a big change from three years ago when bioplastics were more of a disposable status symbol.

Last summer, when oil was around \$100 a barrel, conventional petroleum-based resins sold for around \$1.00 per pound. Cereplast's compostable resins, which completely dissolve in landfills, sold for about \$1.05 a pound while the company's hybrid bioplastics, which mix conventional and renewable resins, sold for 85 cents a pound. Thus, hybrid bioplastics were cheaper. Where carbon credits applied, compostible plastics were too.

Now, conventional resins sell for 50 to 60 cents a pound, thanks to a drop in oil prices to \$35 to \$40 a barrel. Compostable resins are around 85 per pound, so still expensive, but the company's hybrid resins go for around 55 to 65 cents.

Bio plastic production rate

Making plastic from sugar can be just as cheap as making it from petroleum, says Dow Chemical. The company plans to build a plant in Brazil that it says will be the world's largest facility for making polymers from plants.

The project will begin with the construction of a 240-million-liter ethanol plant, a joint venture with Mitsui, that is set to begin later this year. By the beginning of next year, Dow will finish engineering plans for facilities that will convert that ethanol into hundreds of thousands of metric tons of polyethylene, the world's most wide

0.0015 ton/liter

The technology for converting ethanol into ethylene, the precursor for polyethylene, is not new. "The dehydration process for converting ethanol to ethylene has been known since the 1920s. The only thing that's really new here is the scale," Cirihal says. The new plant will have a polyethylene production capacity comparable to production at a petrochemical plant. Though the exact production levels aren't yet settled, they will be on the order of "what you have heard before," he says, referring to a proposed Dow project that would have made 350,000 metric tons of polyethylene from sugarcane. (That proposal relied on a partnership that ended as a result of the recession.) It will be bigger than a 200,000-ton sugarcane-to-polyethylene plant operated by Brazil-based Braskem.

Bio hub enhance social impact tremendously

The PTTGC has set the direction and strategy to be a leader in the chemicals business. Taking into account the balance in three areas: economic, social and environmental. The company is engaged in bio plastics, bio-chemical pulps by the shareholders of the company who produce bioplastics in America. And to bring such technologies to expand its production base in Asia. The country with the availability of agricultural raw materials that are used as raw materials in manufacturing. This will enhance the value of the raw materials from the agricultural sector. And raise the income of farmers in Thailand.

For today Bioplastics industry has grown significantly in the country's role in the global economy. Because consumer interest in products that are more environmentally friendly. Global demand for bioplastics will increase from the current 1 million tons per year to 3 million tons per year in 63 years, representing approximately 1% of the world's demand for plastic resins. It is expected that in the next 10-15 years Biohub project will generate total revenues over the country. 50000-140000 million baht employ over 28,000 people and reduce carbon emissions by another 227,000 tons per year.

Major alternative energy are as follow

Alternative energy production

| Alternative energy | Alternative 2012 | Alternative 2013 | Alternative 2014 | Alternative 2015 | 2036 Target |
|--------------------|------------------|------------------|------------------|------------------|-------------|
| Solar | 376.72 | 823.46 | 1,298.51 | 1,419.58 | 6,000.00 |
| Wind | 111.73 | 222.71 | 224.47 | 233.90 | 3,002.00 |
| Biomass | 1,959.95 | 2,320.78 | 2,451.82 | 2,726.60 | 5,570.00 |
| Trash | 193.40 | 265.23 | 311.50 | 372.51 | 1,280.00 |
| Small hydro plant | 42.72 | 47.48 | 65.72 | 131.68 | 550.00 |
| Large hydro plant | 101.75 | 108.80 | 142.01 | 172.12 | 376.00 |
| รวม | 2,786.27 | 3,788.46 | 4,494.03 | 7,962.79 | 19,684.40 |

หมายเหตุ:

ก) การศึกษา ประเมินด้วยกำลัง/ของเดิม และใช้พลังงาน

ข) ประเมินด้วยระบบฐานและระบบอุตสาหกรรม

พลังน้ำขนาดเล็กรวมกำลังการผลิต ≤ 12 MW และใช้ไฟฟ้าพลังน้ำทั้งหมด

พลังน้ำขนาดใหญ่เป็นกำลังการผลิตขนาดใหญ่ที่มีอยู่แล้วในปัจจุบัน

ที่มาข้อมูล: กรมพัฒนาพลังงานทดแทนและอนุรักษ์พลังงาน โดย ดร. สุทธิ ๒ เมษายน 2559

Reasons why we do not use fuel for electricity

High Cost



Cannot compete with other alternative energy which produce electricity with lower cost

Low efficient



Produce high pollution which could disturb the society

Does not fit



Jet Fuel is better suit with other using people

Effect of oil price fluctuation to the firm



PTTGC stock chart



- PTTGC stock price has a significant positive correlation with crude oil price
- Crude oil price is fluctuated and showing down trend
- Finding an alternative supply such as Bio supply could help reduce risk in supply fluctuation