

 **Palcan** green Power for a green Earth



Methanol Reformed Fuel Cell in China

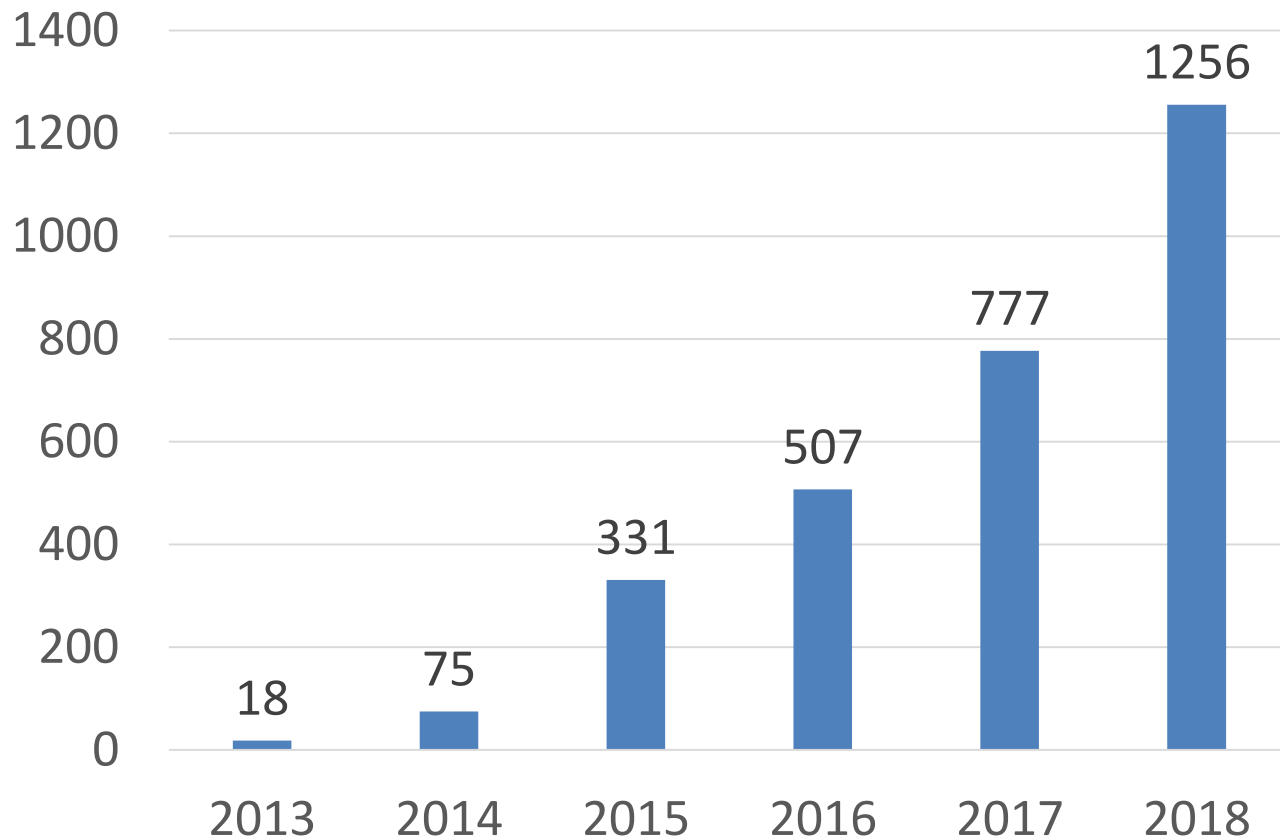
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# New Energy Vehicle development in China

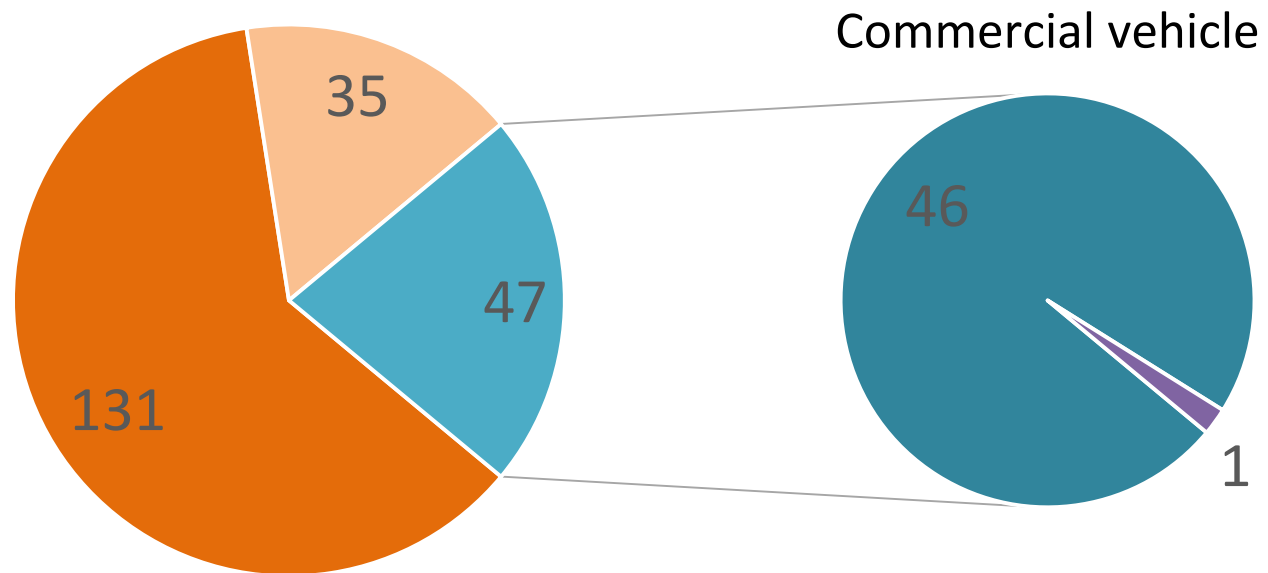
2013 -2018 New Energy Vehicle in China



1.2 Million new Energy Vehicle sold in 2018 !

## 2018 December sold new energy vehicle

Unit: thousand pcs



■ Personal Car Pure EV

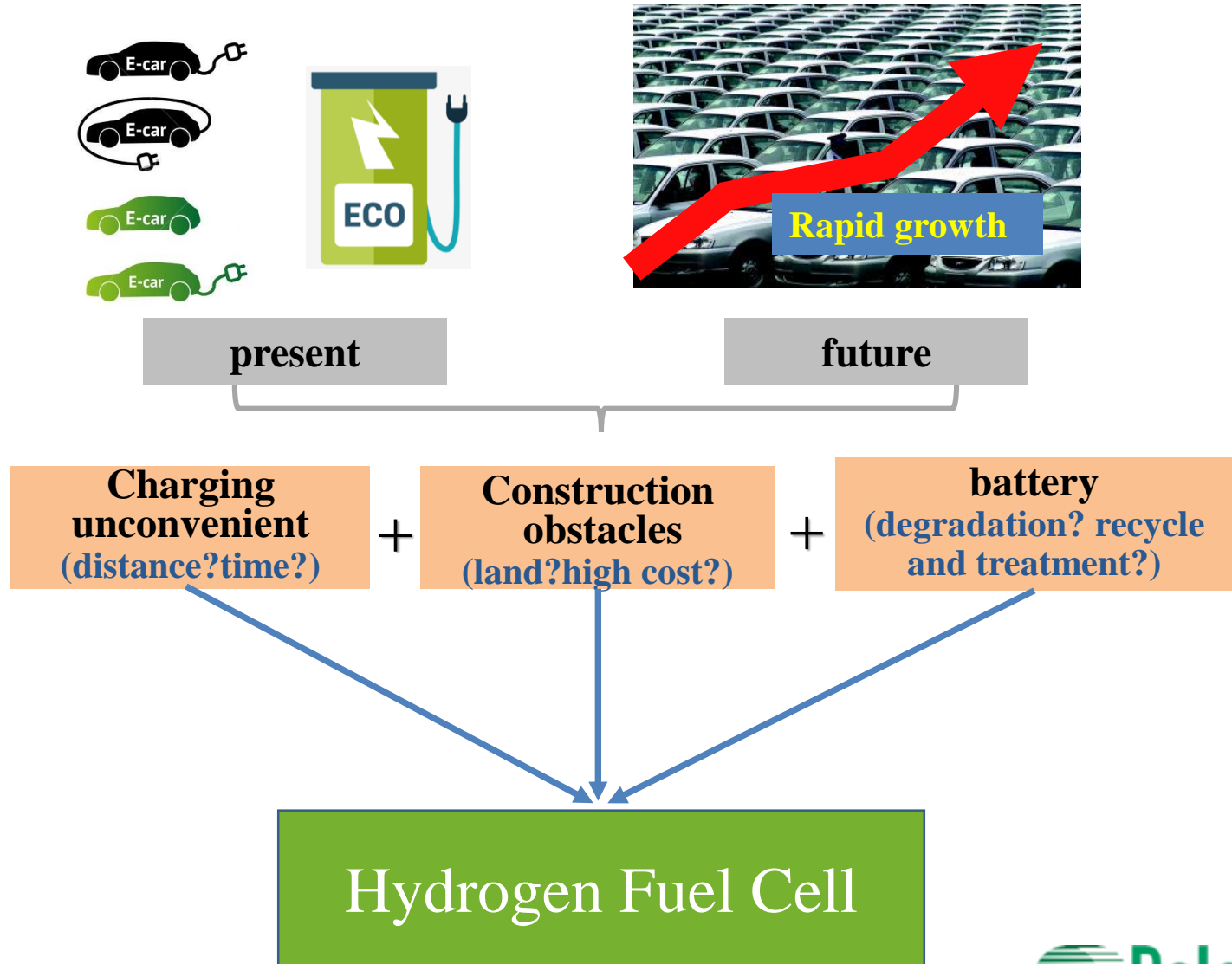
■ Personal Car PHEV

■ Commercial Truck Pure EV

■ Commercial Truck PHEV

# 1 New Energy Vehicle development in China

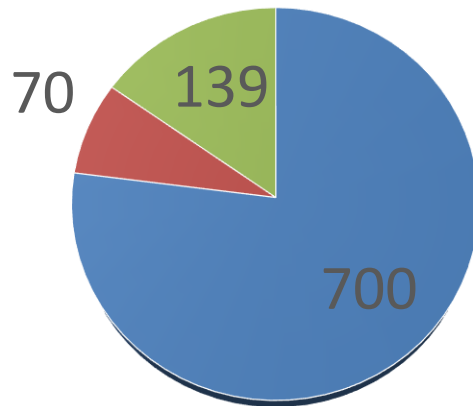
## ■ Limitations of batteries



# 1 New Energy Vehicle development in China

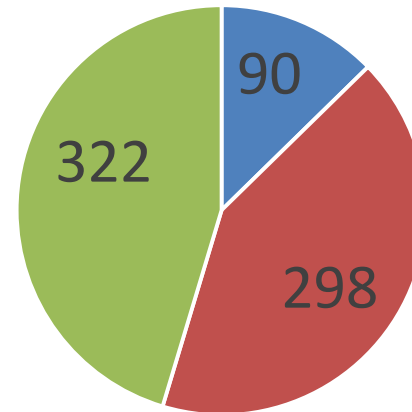
2018 in China 1619 vehicles were manufactured

FC-Truck



- Zhongtong
- Feichi
- Others

FC-Bus



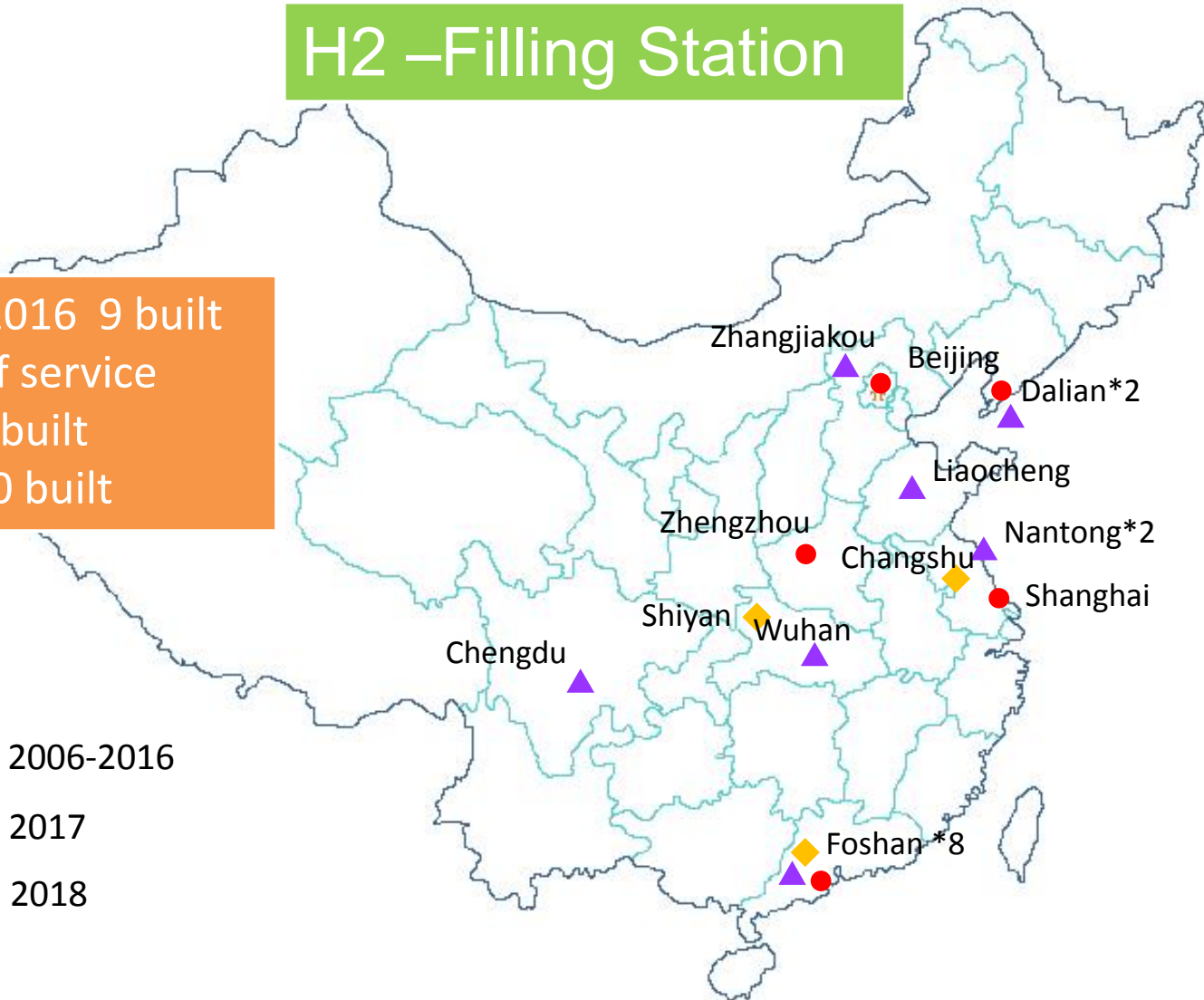
- Zhongtong
- Feichi
- Others

## 2 Energy Safety/Structure

### H2 –Filling Station

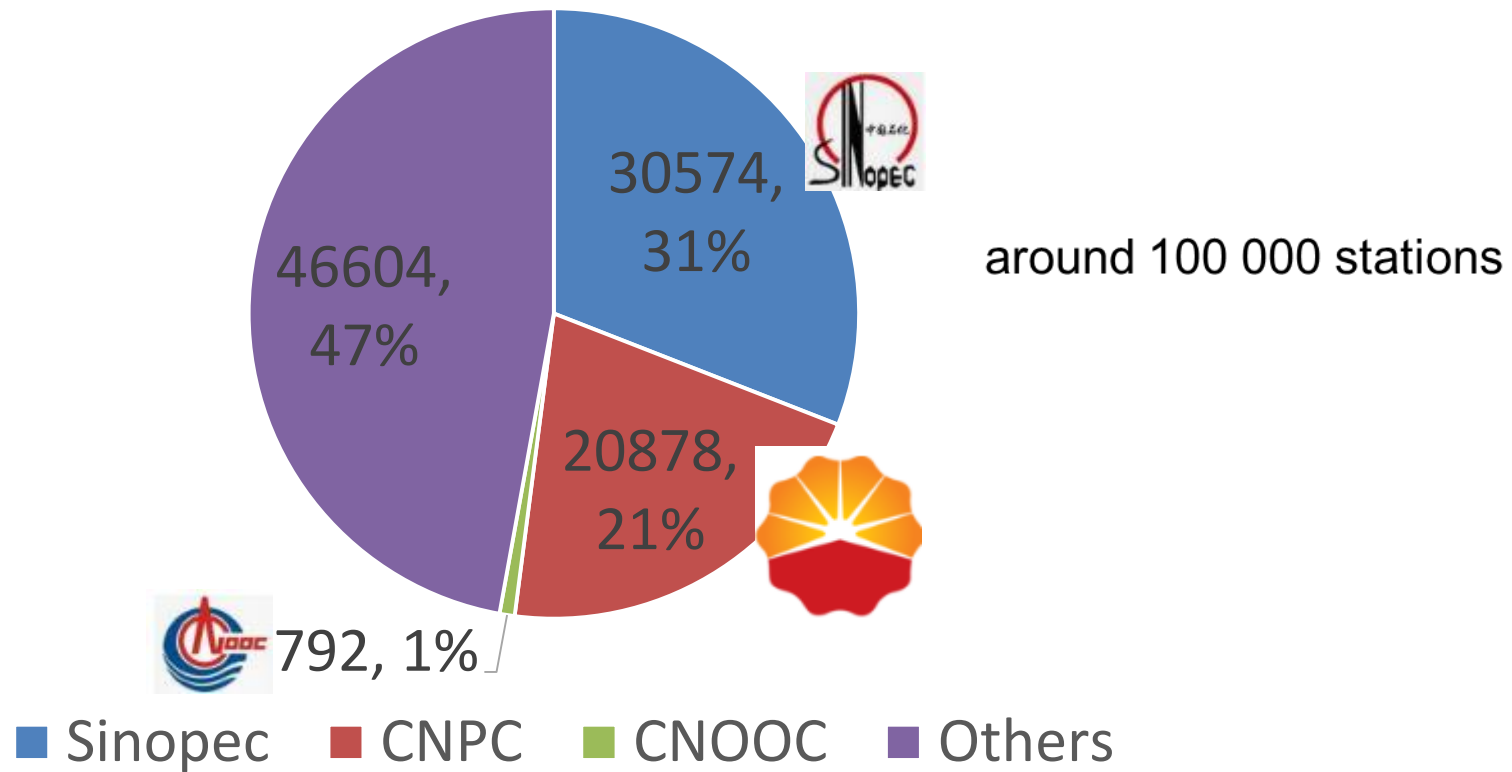
2006 -2016 9 built  
3 out of service  
2017 5 built  
2018 10 built

- 2006-2016
- ◆ 2017
- ▲ 2018



## 2 Energy Safety/Structure

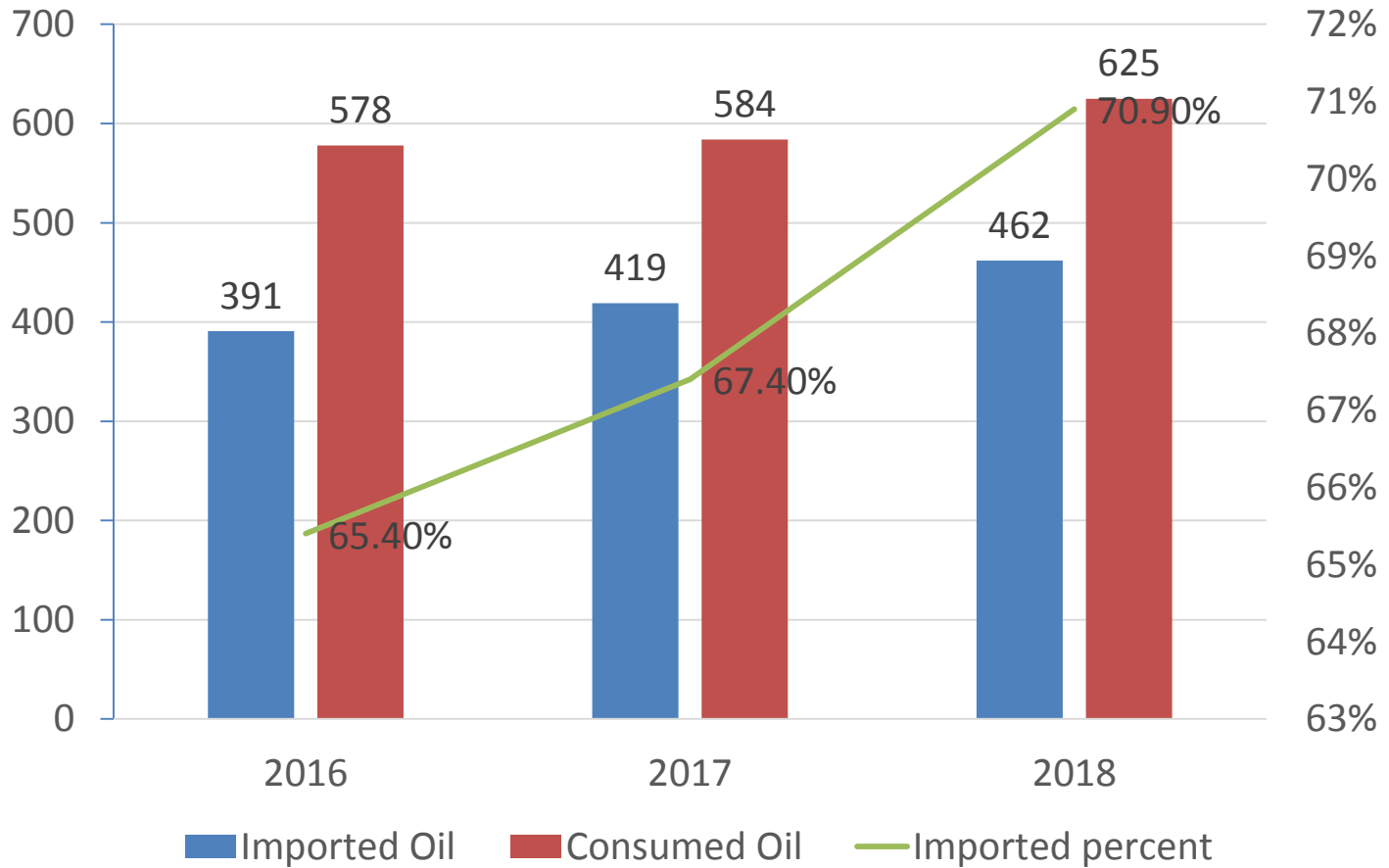
Fueling station in China/ Gasoline,  
Diesel, natural gas





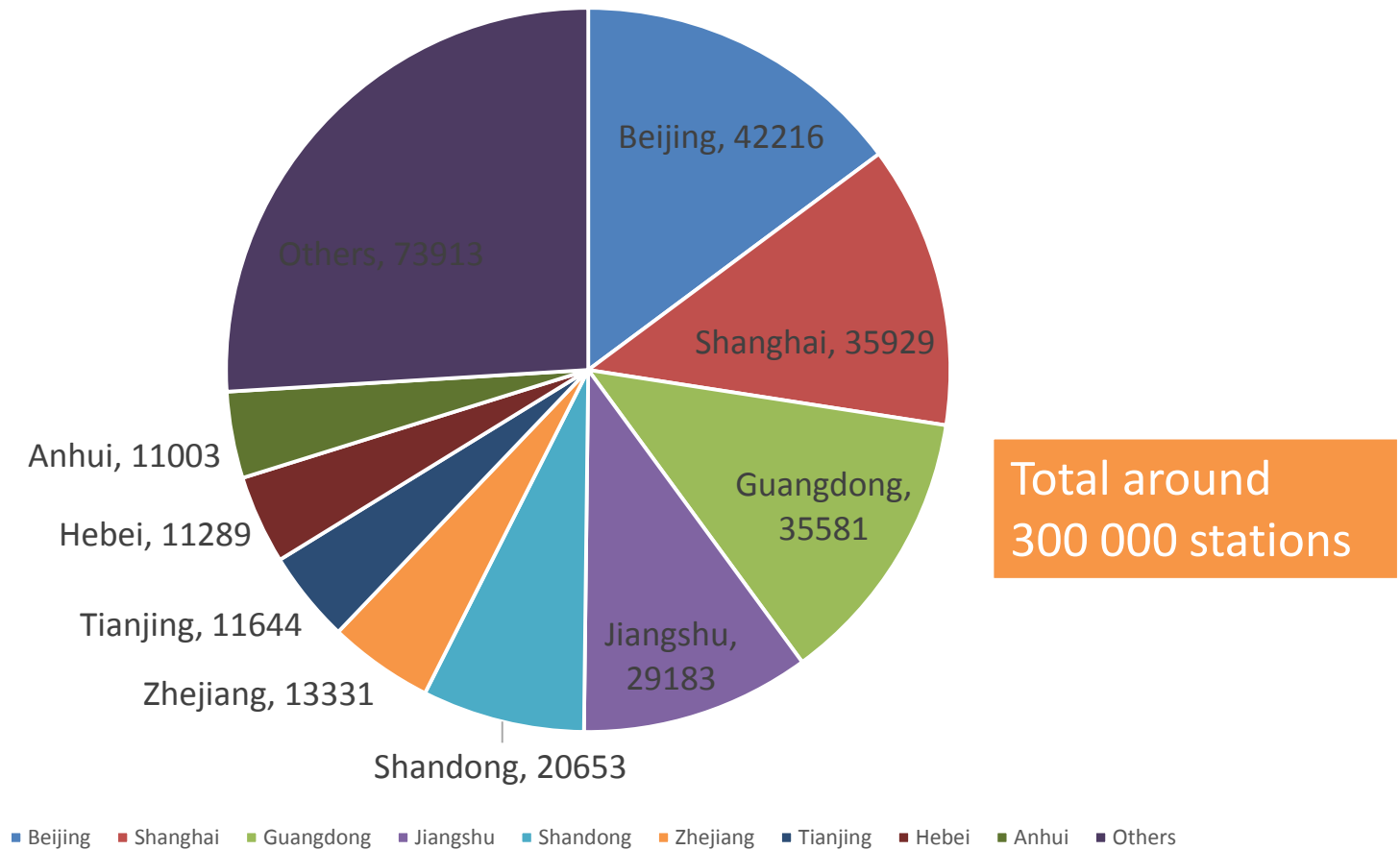
## 2 Energy Safety/Structure

Chinese Oil Consumption and Structure  
Mio. Ton



## 2 Energy Safety/Structure

### Public Charge Station for E-Vehicle



## 2 Energy Safety/Structure



E-Bus

E-Taxi

E-Light  
Truck

E-Heavy  
Truck

**Blue Sky action: public  
transportation switch to E-Vehicle**



## 2 Energy Safety/Structure

Hybrid is the  
Tendency!



Tesla



Fuel  
Cell  
Hybrid

Oil +  
Battery  
Hybrid

Pure  
Battery  
EV

Fuel Cell  
EV

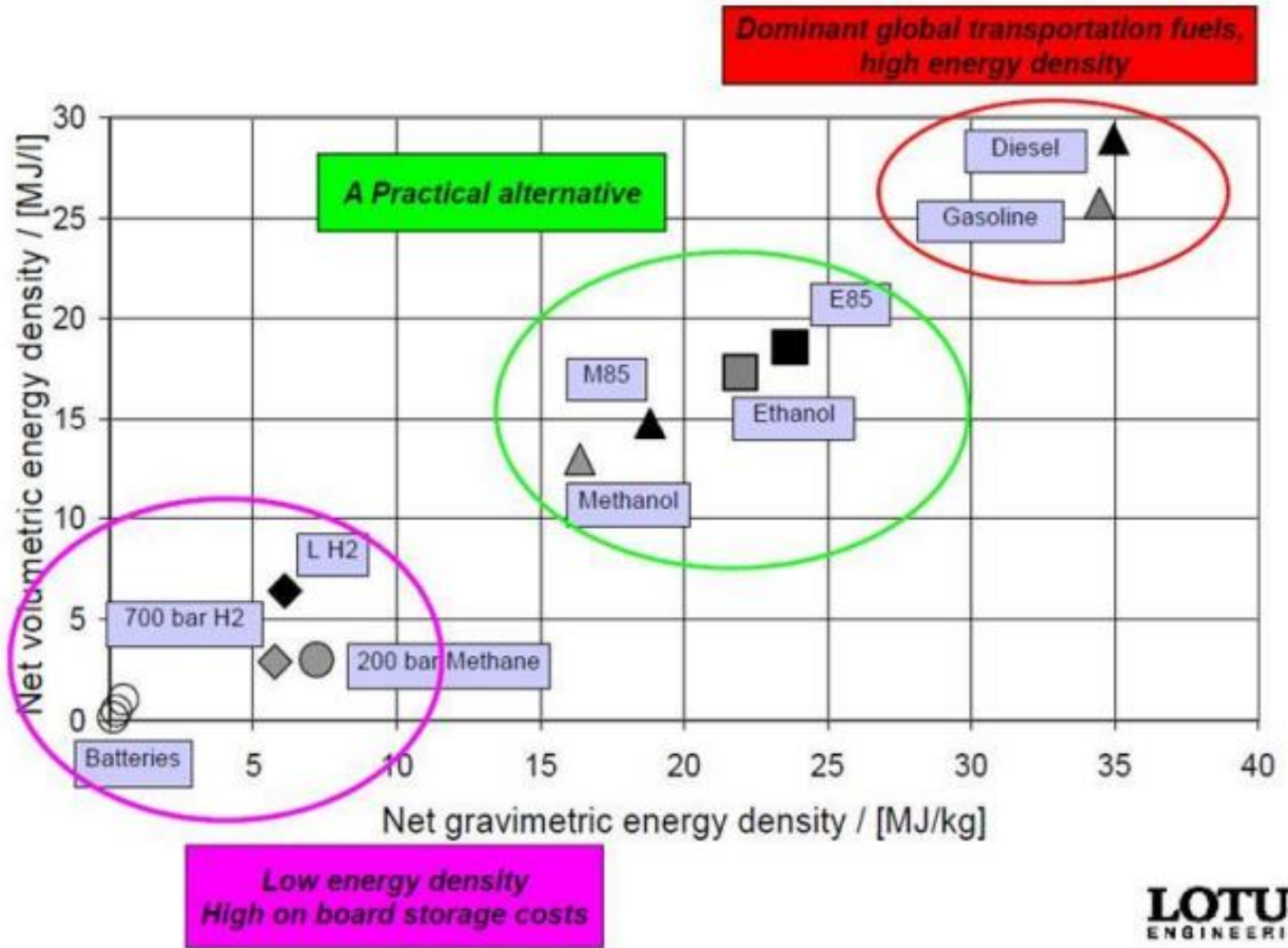
Prius



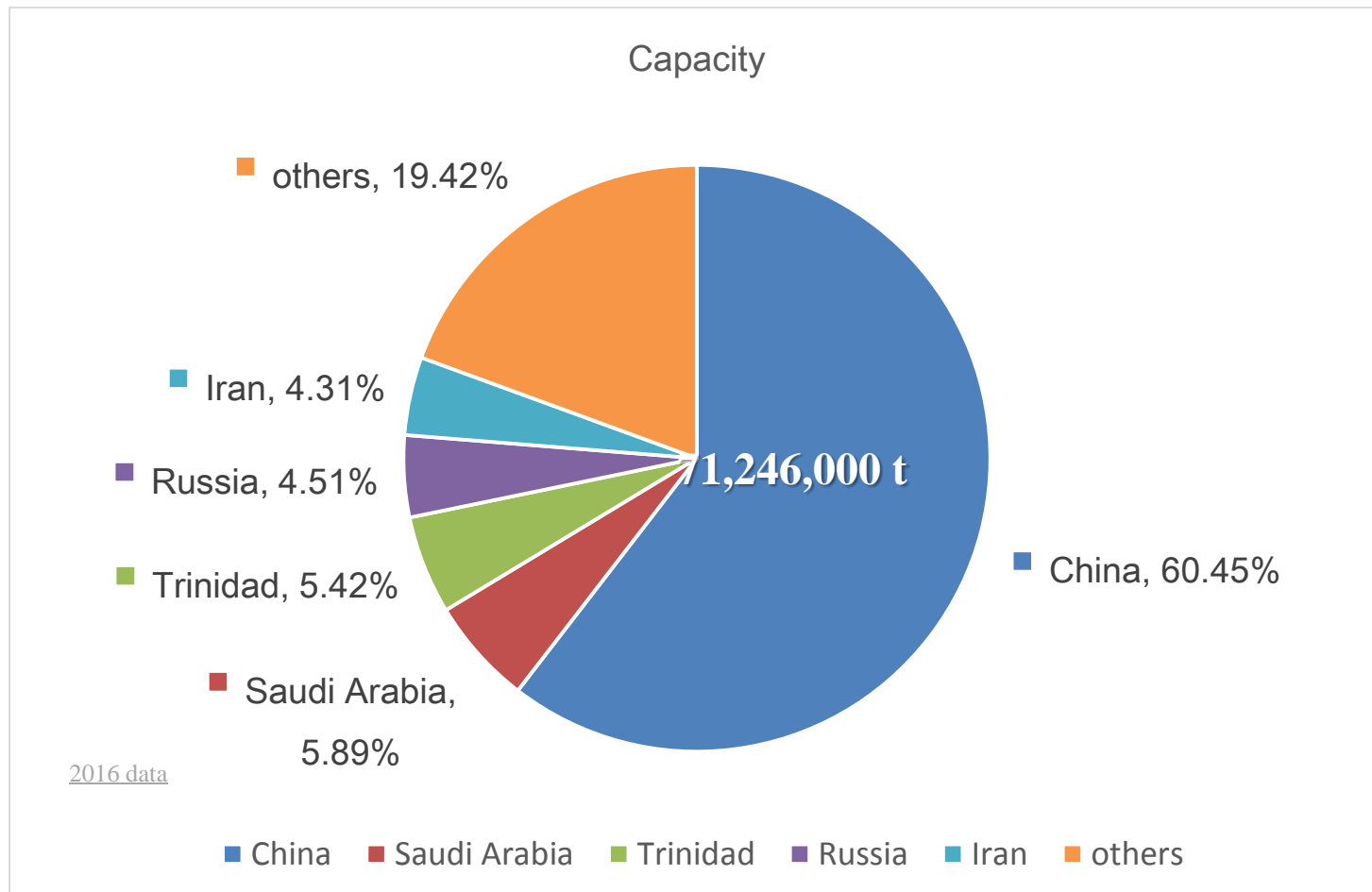
Miria



### 3 Methanol as liquid fuel

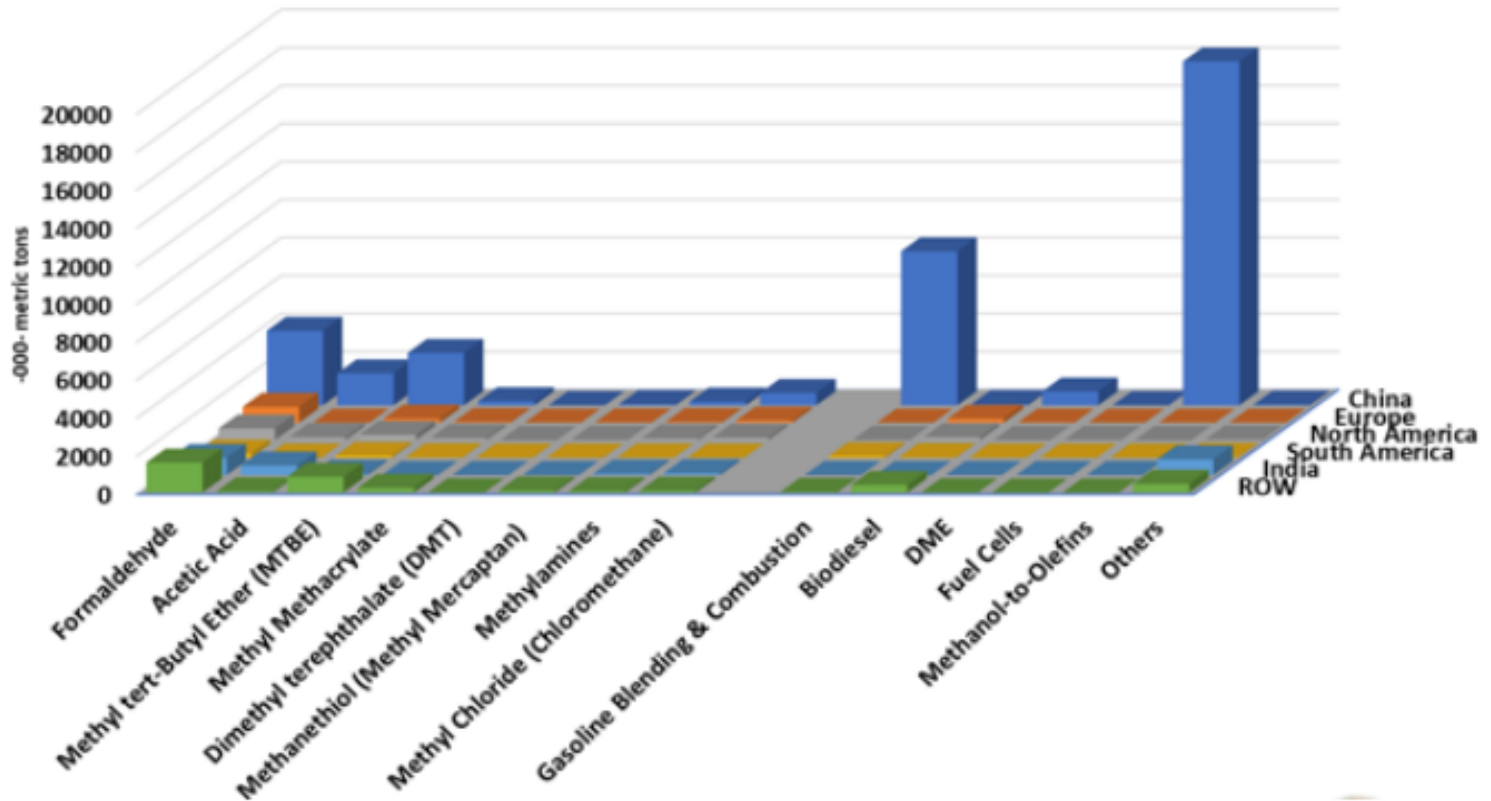


## Global methanol productivity distribution



### 3 Methanol as liquid fuel

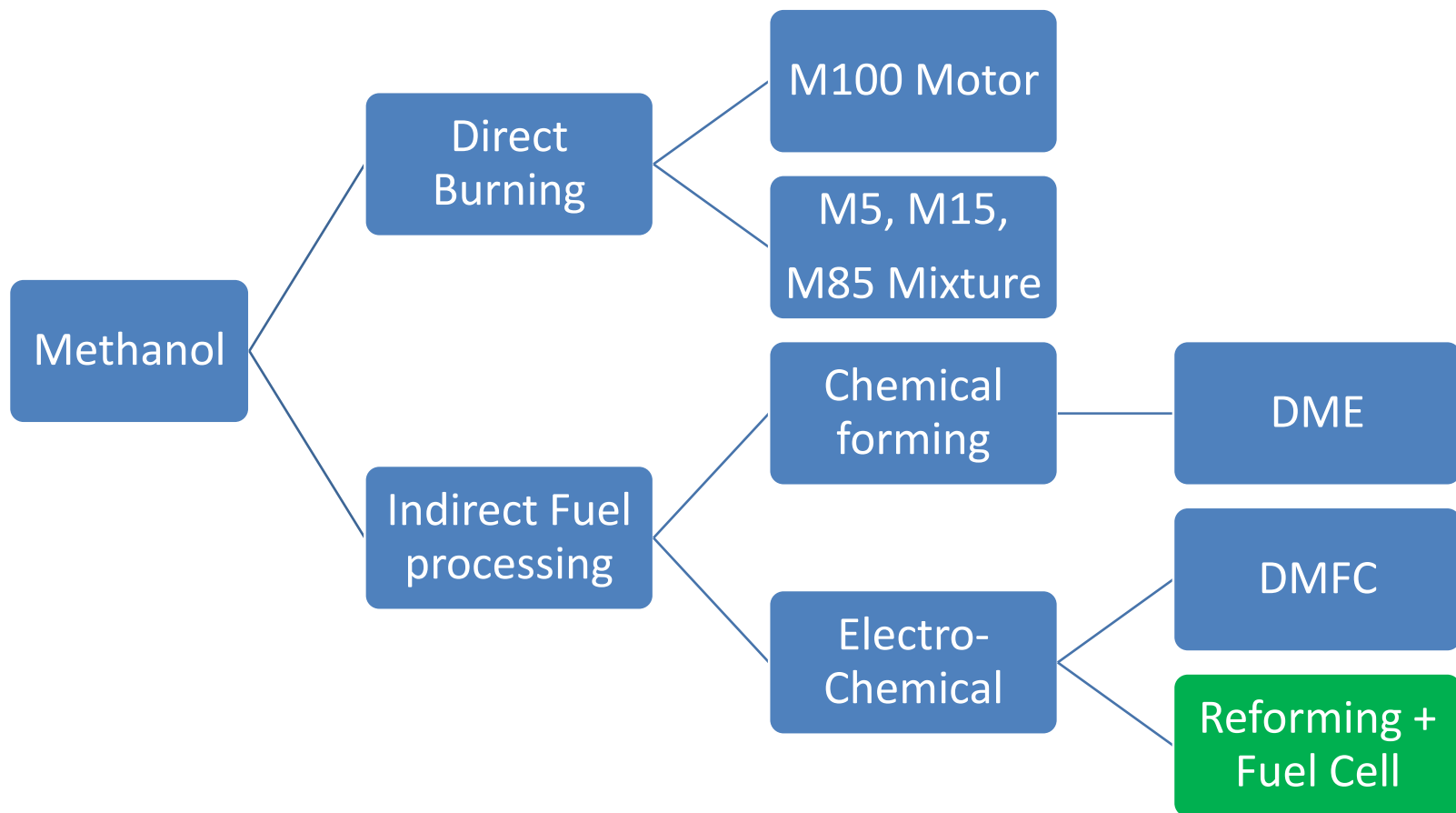
Projected Methanol Demand Growth, by Product & Region  
2017– 2027E



Source: MMSA

### 3 Methanol as liquid fuel

#### ■ Methanol as “Clean Energy”





### 3 Methanol as liquid fuel

#### Transport industry chain



Technology maturity  
2000 stations (Sinopec Group)



### 3 Methanol as liquid fuel

#### ■ Widespread use of methanol



With more than 10 years push from Geely, there are hundreds M100 cars as taxis running in China. To refill is not a difficult issue.



### 3 Methanol as liquid fuel



Geely, car manufacturer, Spent more than 10 years on research and developing methanol combustion engine and has now mature product on the market as Taxis etc.

### 3 Methanol as liquid fuel



cooking food

Pure Methanol Fuel  
(99.99%)  
For Hot-Pot, car,  
Motocycle, etc.

Not for drink!

Price: 12 RMB/4L



The distribution nets are already well developed for the consumers.

In compare to natural gas, the cost saved could up to 30%!

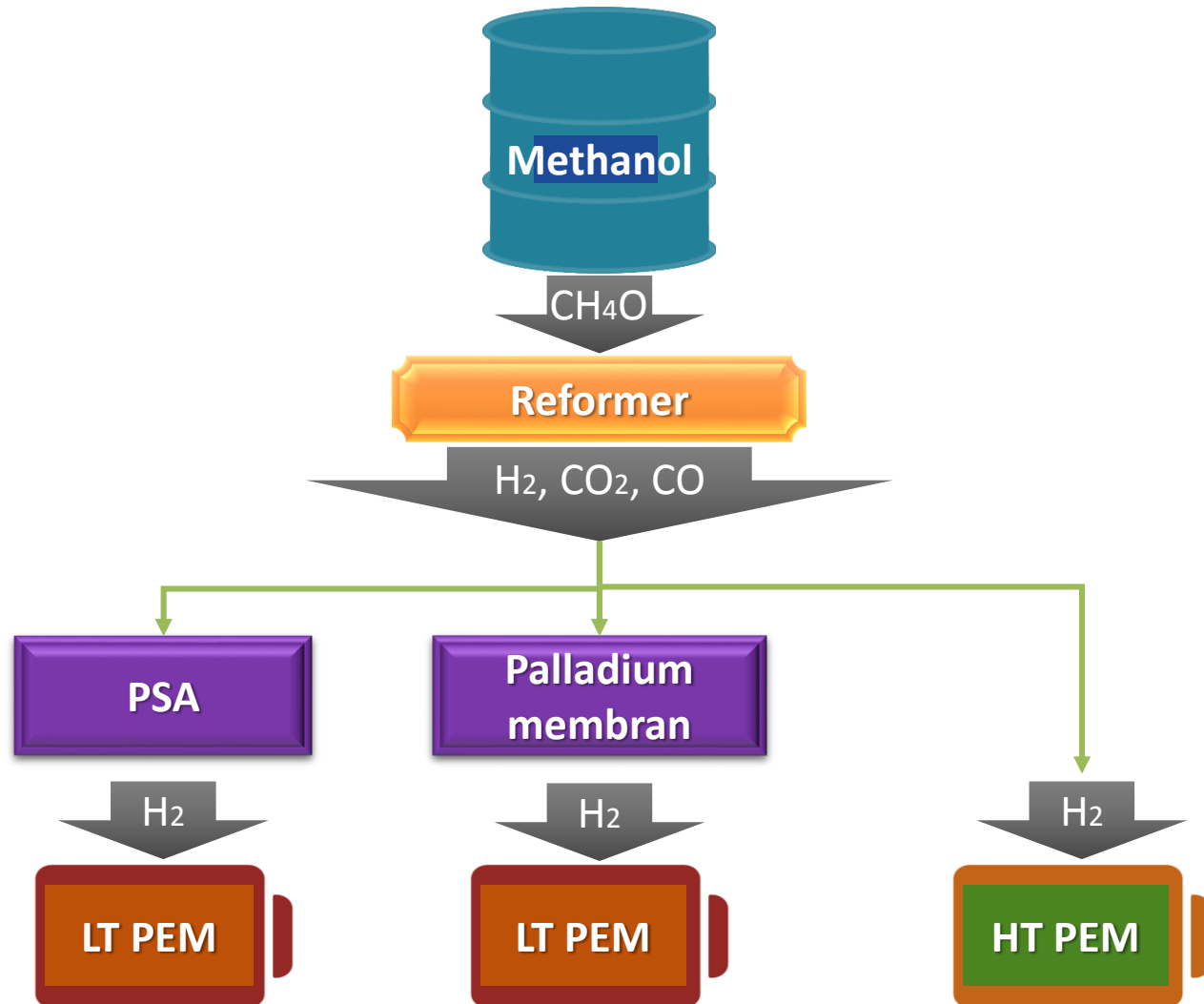


1.6 Euro/ 4L,  
0.4 Euro/L  
0.5 Euro/ kg

heating homes

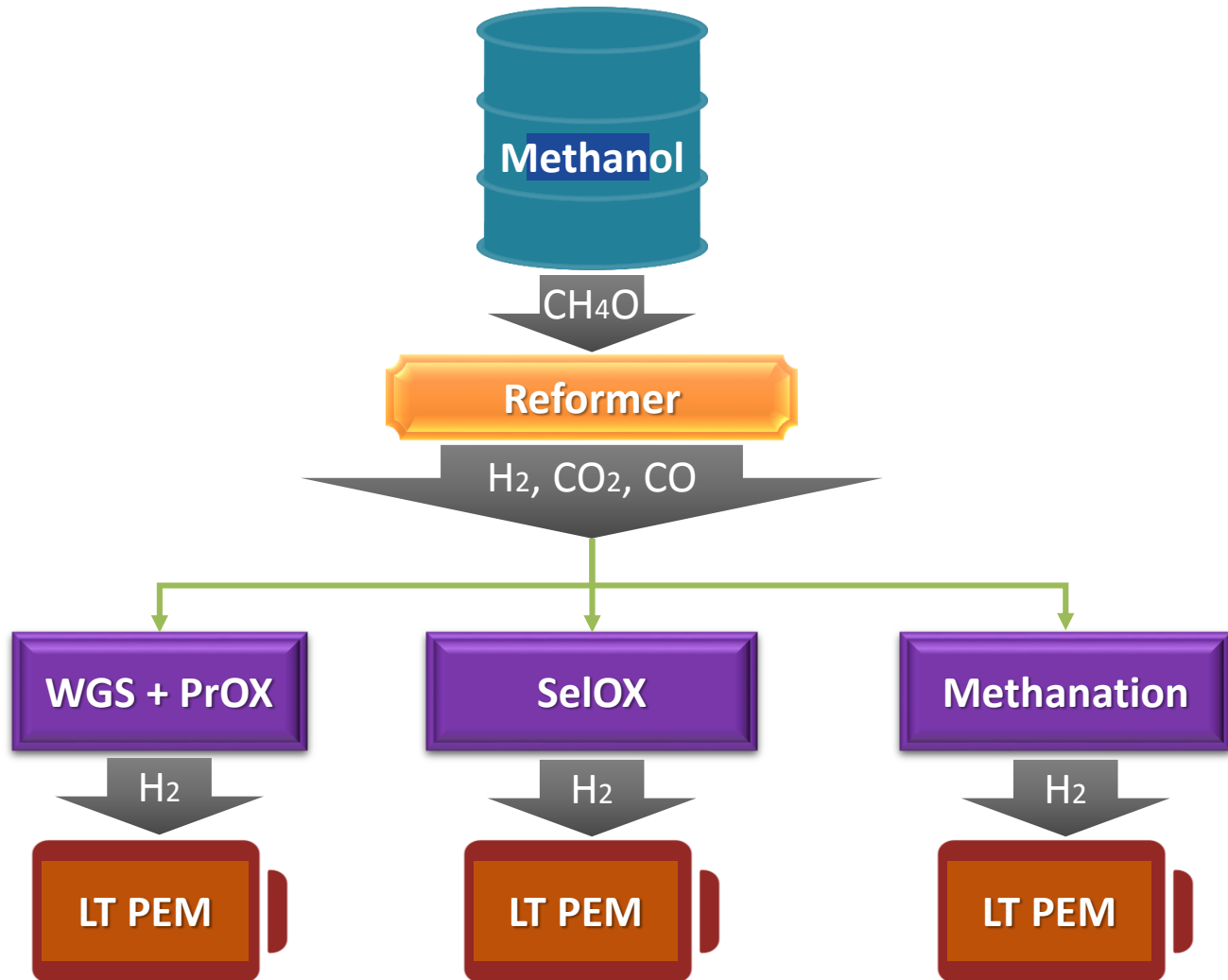
## 4 Methanol Fuel Cell

### ■ Methanol reformer



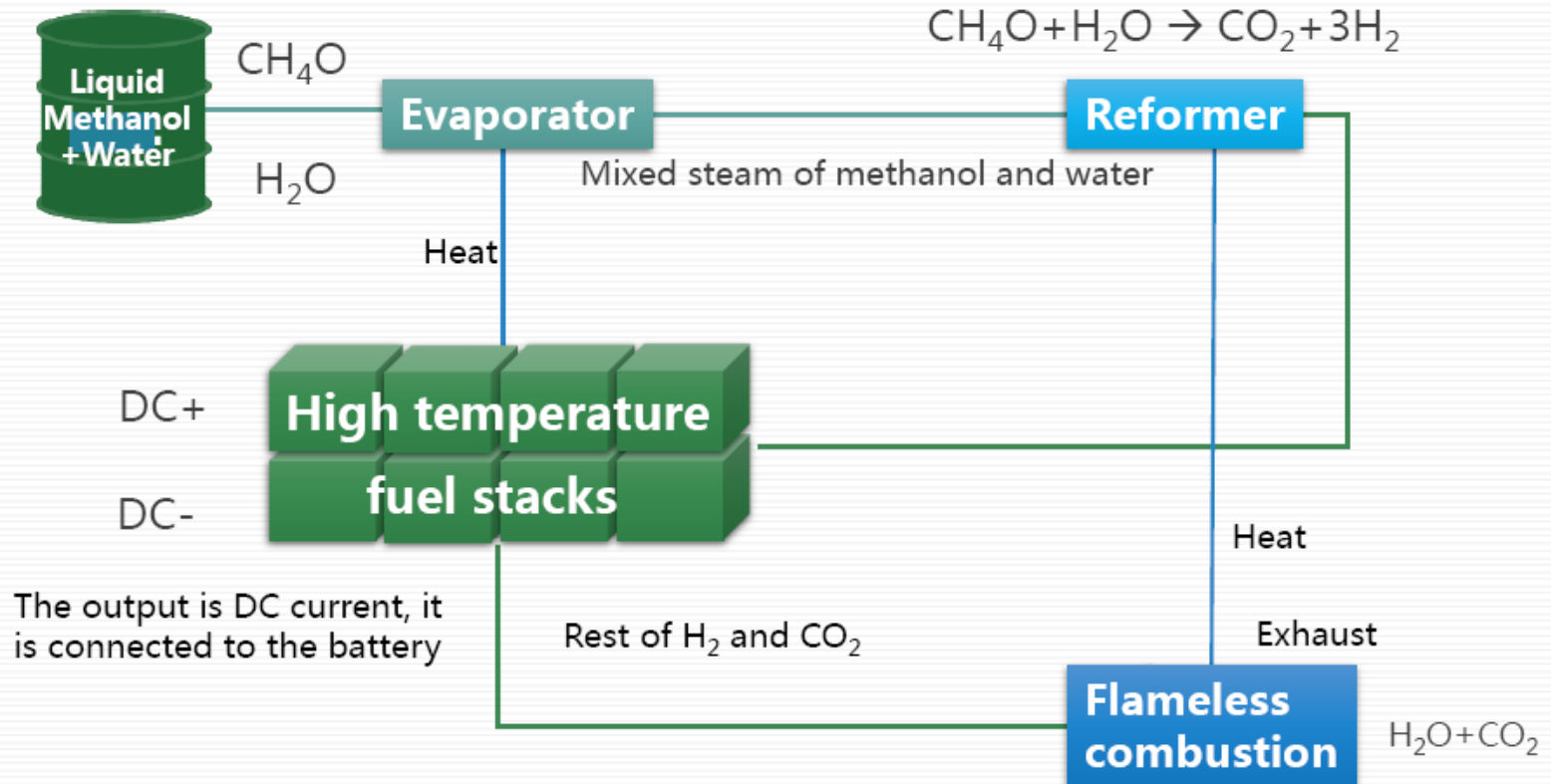
## 4 Methanol Fuel Cell

### ■ Methanol reformer



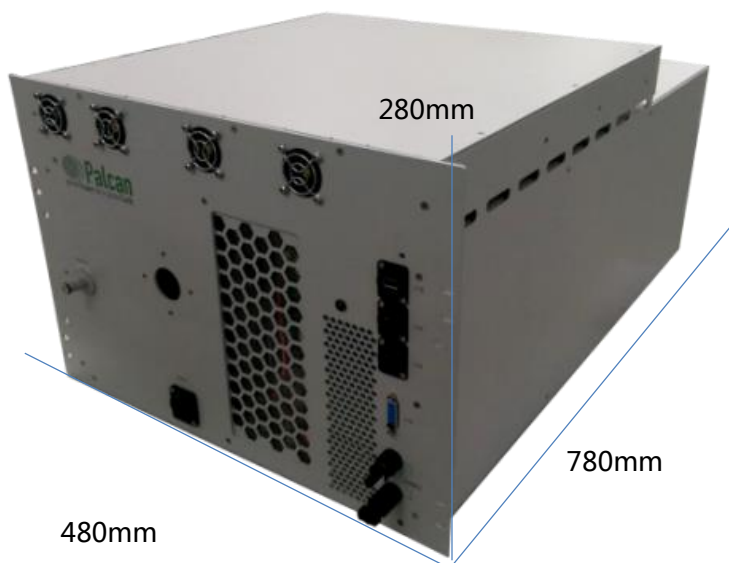


## 4 Methanol Fuel Cell



**No hydrogen storage, safe and reliable!**



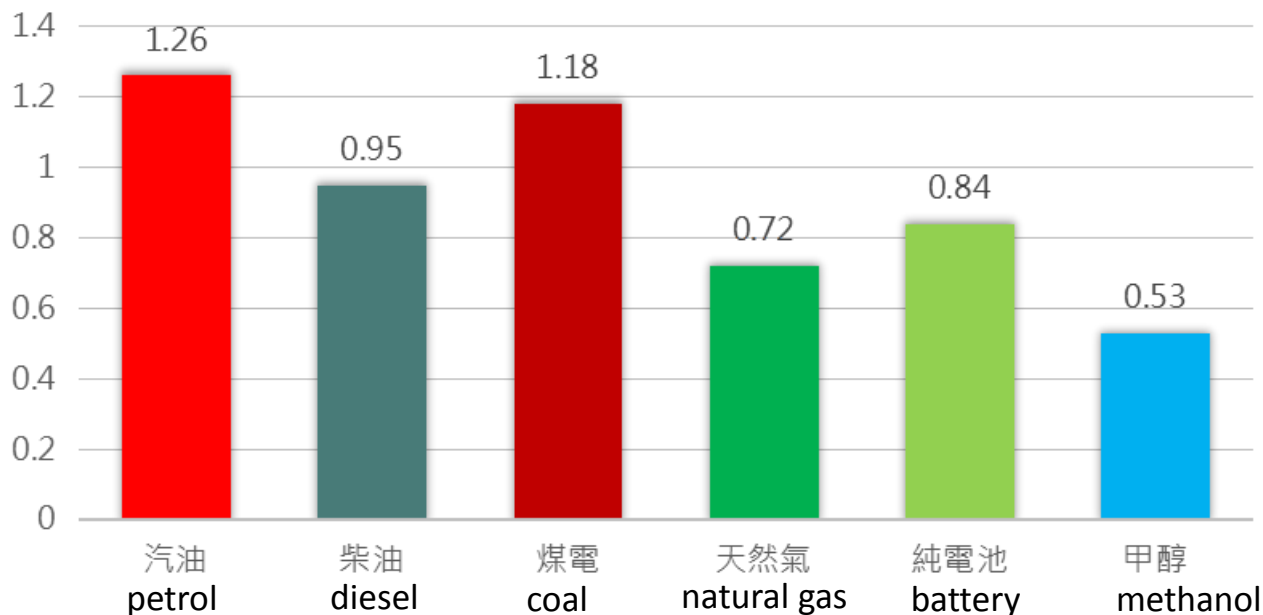


Power : 5 kW  
Weight : 80kg



## CO<sub>2</sub> Emissions per 1kwh

每输出1kWh能量对应的CO<sub>2</sub>排放量  
(单位: kg/kWh)



► **CO<sub>2</sub> emission is lower than current pure electric emission!**

To make the current level of electricity average emission reach the level of methanol, it needs to reduce the proportion of coal thermal power generation to below 45%!

## US Department of Energy - Comparison of Energy Safety

DANGER	PETROL	DIESEL	METHANAL	LPG
Leakage	3	1	2	5
Evaporation	3	1	2	4
Released to the atmosphere	5	6	3	4
Released in a closed room	2	5	4	3
Automatic ignition	6	5	4	3
Spark ignition	2	1	-	3
Flame propagation	2	1	5	3
Flash fire	5	6	1	2
Radiation from the flame	6	7	1	5
Health effects	7	5	6	4
Total	41	34	28	36

Relative risk of several fuels  
Divided in seven levels (1=low, 7=high)

## 4 Methanol Fuel Cell

Take Dongfeng T7 for example , the MFC operation costs are lowest!

1 USD = 6.9 CNY, 1CNY = 16.3 JPY

地区	90号汽油	93号汽油	97号汽油	0号柴油
北京油价	6.75 (京89)	7.48 (京92)	7.97 (京95)	7.17
上海油价	6.62 (沪89)	7.45 (沪92)	7.92 (沪95)	7.1
江苏油价	6.66	7.46	7.93	7.08

Petrol/Diesel (Hybrid) :  
**2.36 CNY/kWh**, 3kWh/L Diesel  
 18 L/100km, 129 CNY/100km

In China,  
 Public electricity price is higher than private home-use price.  
 Public electricity is 0.8 – 1.1 RMB/kWh  
 For Charge station:  
 Charging service fee is: 0.6 – 0.9 RMB/kWh

Pure Battery :  
**1.6 CNY/kWh** 50 kWh/100KM  
 80 CNY/100KM

### Price Methanol 2018.07

Shanxi	Guangdong	Shaanxi
¥ 2520	¥ 3100	¥ 2700
Aver age price :		¥ 2700

MFC:  
**1.28 CNY /kWh** 2.1 kWh/kg  
 50 kWh/ 100km 62.4 CNY/100 km



High pressure hydrogen FC:  
**2.8 CNY/ kWh**, 40 CNY/kg, 14.2kWh/kg)  
 3.5kg H2/100 km **140 CNY/100KM**

## 4 Methanol Fuel Cell

### Application

#### Passenger Transportation



#### Logistic Truck



#### Backup power



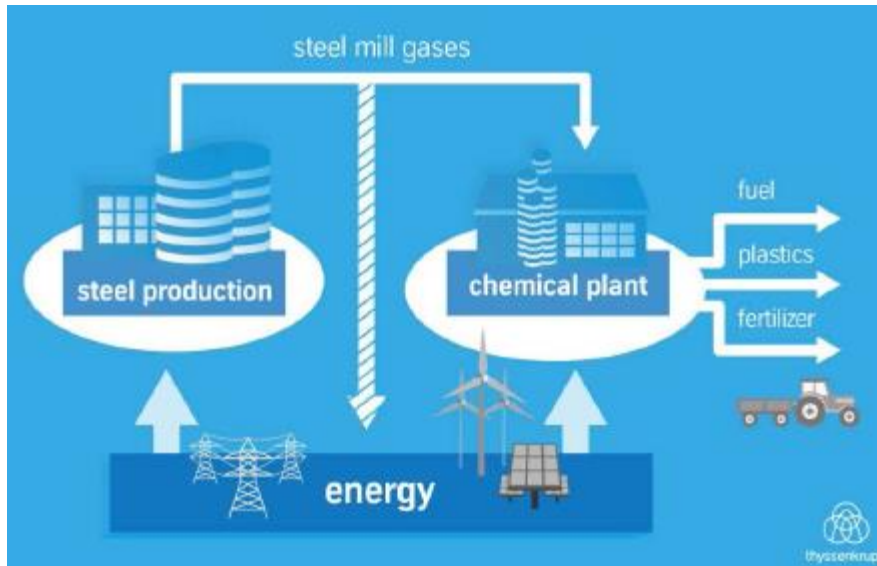
#### Engineering EV



## 5 Methanol Renewable

1.Step:

Convert the carbon-hydrogen to liquid fuel



## 5 Methanol Renewable

2.Step:

Get H<sub>2</sub> from renewable source, CO<sub>2</sub> pre-collected



## 5 Methanol Renewable

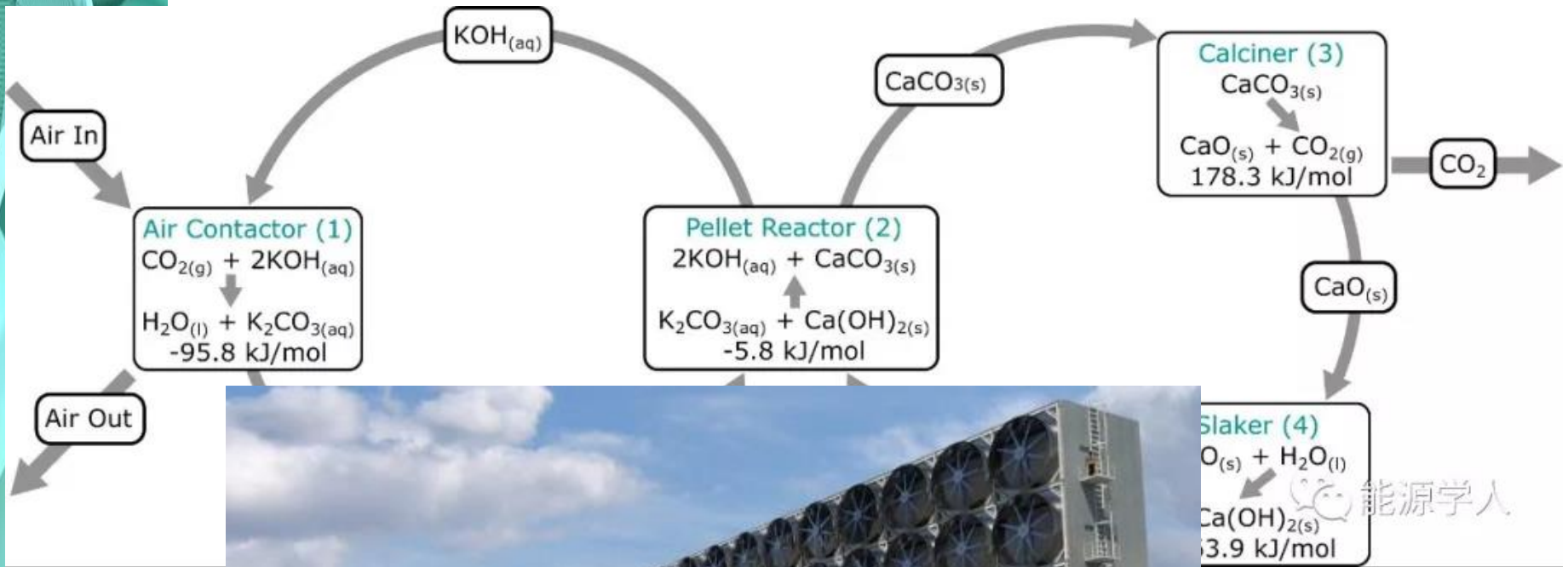
3.Step:  
From biomass/city waste to liquid fuel





## 5 Methanol Renewable

4.Step:  
CO<sub>2</sub> from air/water etc, pure sustainable solution





**Thanks for your attention**

**Cooperate sincerely, development mutually**