

OVERVIEW OF BIODIESEL SPECIFICATIONS IN THE PHILIPPINES

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APEC Workshop on Guidelines toward High Biodiesel Blend Diesel
13 – 14 December 2017
Thailand

Biofuels Act of 2006



To increase the contribution of biofuels in the country's energy mix thereby reducing its dependence on imported fossil-based fuels



To enhance the quality of the environment



To create opportunities for countryside socio-economic development.

Biofuels Act of 2006

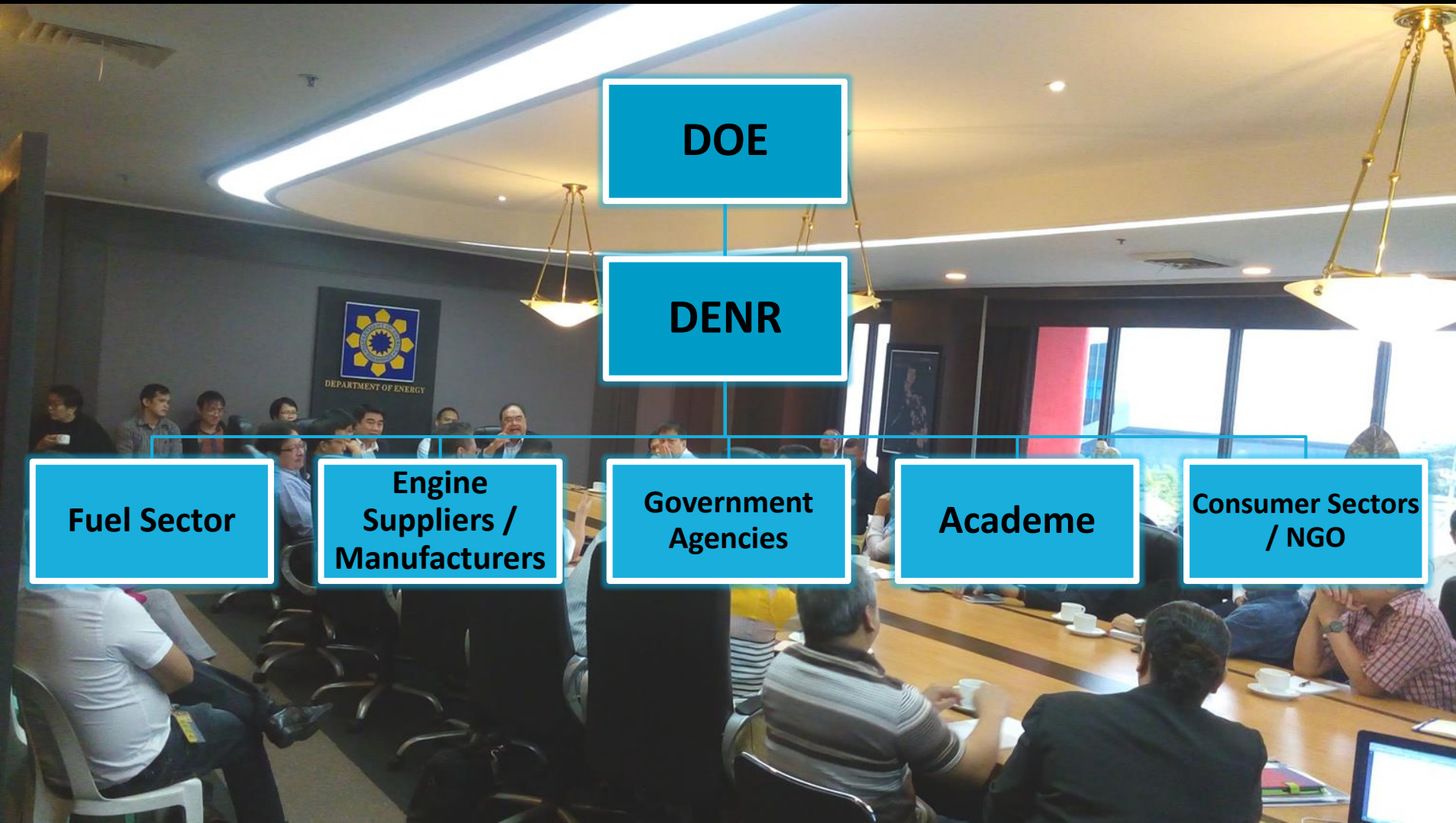
BIOFUELS MANDATE

2007 mandate
1% Biodiesel blend

2009 mandate
2% Biodiesel blend

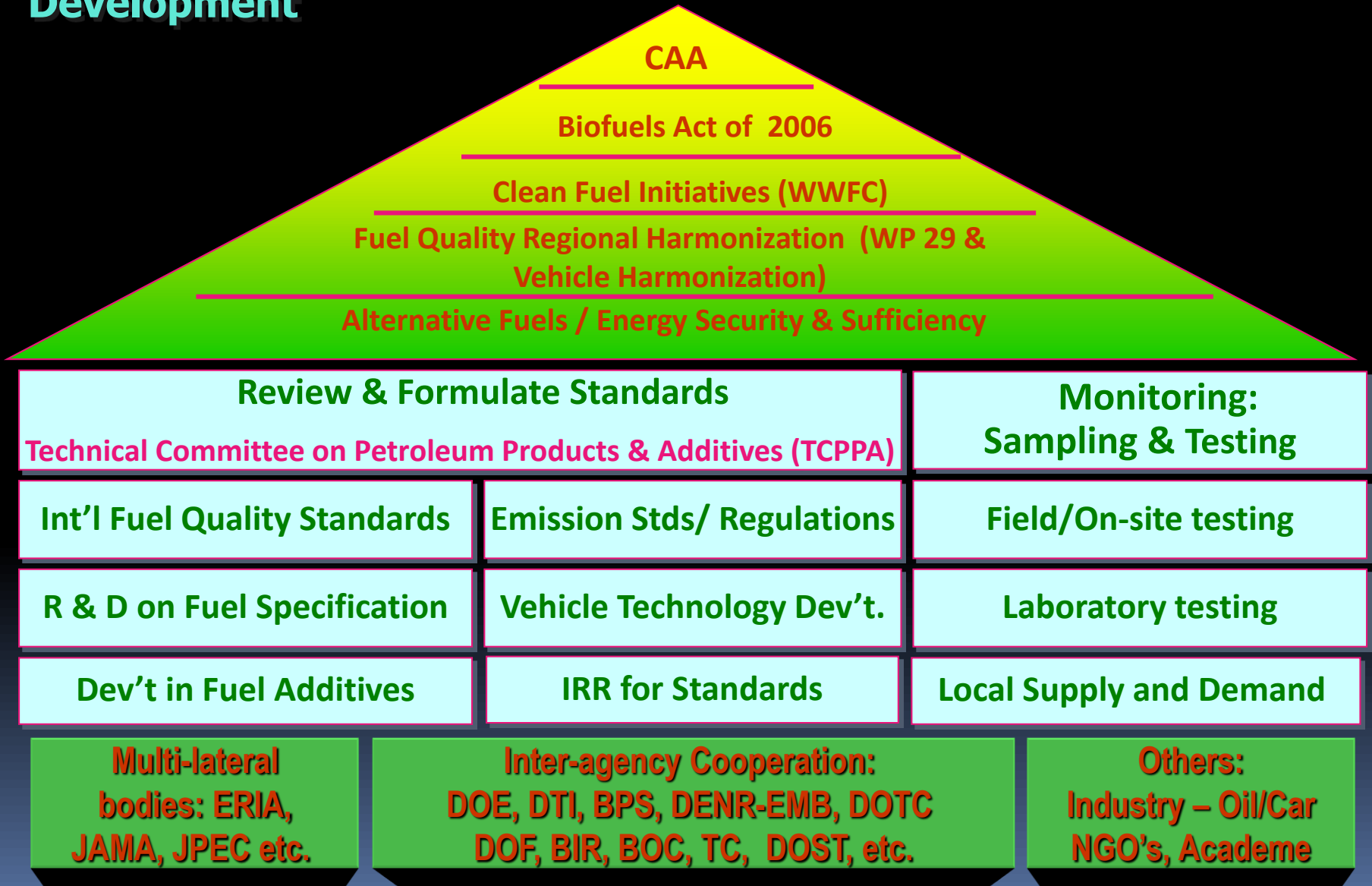
**establish technical fuel
quality standards for
biofuels and biofuel-blended
gasoline and diesel which
comply with the Philippine
National Standards (PNS)**

Standard Development (Technical Committee)



Who we work with

Fuel Quality Standard Development



Biofuels & Blends Standards:

FAME-Blended Diesel Oils (B2)

Coconut Methyl Ester (B100)

High FAME-Blended Diesel Oils (B5)

Standard Test Methods

- Determination of Ester and Lauric Acid Content in Fatty Acid Methyl Esters (FAME) by Gas Chromatography
- Separation of Fatty Acid Methyl Esters (FAME) Liquid Adsorption Chromatography and Blended Diesel Oils by Characterization by Gas Chromatography

SEP 1 2006

PNS/DOE QS 004:2012 – Euro IV-PH ADO (B2)

PROPERTY	EURO 4-PH ^b	Test Methods
Cetane number, min. or Derived cetane number, min.	50	PNS ASTM D 613 PNS ASTM D 6890 or PNS ASTM D 7170
Carbon residue on 10% Distillation residue, % mass, max. Conradson or Ramsbottoms or Micro	0.15	 PNS ASTM D 189 or PNS ASTM D 524 or PNS ASTM D 4530
Color, ASTM	2.5 max.	PNS ASTM D 1500
Copper strip corrosion, 3h at 50 °C, max.	No. 1	PNS ASTM D 130 or PNS ISO 2160
Density at 15 °C, kg/L	0.820-0.860	PNS ASTM D 1298 or PNS ASTM D 4052
Distillation, 90% recovered, °C, max	370	PNS ASTM D 86
FAME ^a , content, % volume.	1.7-2.2	PNS EN 14078 or PNS/DOE TM 01 or PNS/DOE TM 02
Flash point, Pensky-Martens, °C, min.	55	PNS ASTM D 93
Kinematic viscosity, mm ² /s at 40°C	2.0-4.5	PNS ASTM D 445 PNS ASTM D 7042
Lubricity, (HRFF), wear scar dia. @ 60 °C, micron, max.	460	PNS ASTM D 6079
Methyl Laurate (C12 ME), % mass, min	0.8	PNS/DOE TM 01
Sulfur, % mass, max.	0.005	PNS ASTM D 4294 or PNS ASTM D 2622 or PNS ASTM D5453
Water, % volume, max. ^b	0.05	PNS ASTM D 6304 or PNS ISO 12937 or PNS ASTM E 203
Water and sediment, % volume, max.	0.10	PNS ASTM D 2709

^a As per PNS for B100

^b Euro IV-PH (50 ppm sulfur) automotive diesel oil (ADO) to be introduced not later than January 1, 2016.

PNS/DOE QS 010:2015 – Euro IV-PH ADO (B5)

PROPERTY	EURO 4-PH ^b	Test Methods
Cetane number, min. or Derived cetane number, min.	50	PNS ASTM D 613 PNS ASTM D 6890 or PNS ASTM D 7170
Carbon residue on 10% Distillation residue, % mass, max. Conradson or Ramsbottoms or Micro	0.15	PNS ASTM D 189 or PNS ASTM D 524 or PNS ASTM D 4530
Color, ASTM	2.5 max.	PNS ASTM D 1500
Copper strip corrosion, 3h at 50 °C, max.	No. 1	PNS ASTM D 130 or PNS ISO 2160
Density at 15 °C, kg/L	0.820-0.860	PNS ASTM D 1298 or PNS ASTM D 4052
Distillation, 90% recovered, °C, max	370	PNS ASTM D 86
FAME ^a , content, % volume.	4.7-5.2	EN 14078 or PNS/DOE TM 01 or PNS/DOE TM 02
Flash point, Pensky-Martens, °C, min.	55	PNS ASTM D 93
Kinematic viscosity, mm ² /s at 40°C	2.0-4.5	PNS ASTM D 445 PNS ASTM D 7042
Lubricity, (HRFF), wear scar dia. @ 60 °C, micron, max.	460	PNS ASTM D 6079
Methyl Laurate (C12 ME), % mass, min	2.0	PNS/DOE TM 01
Sulfur, % mass, max.	0.005	PNS ASTM D 4294 or PNS ASTM D 2622 or PNS ASTM D5453 or PNS ASTM D7039
Water, % volume, max. ^b	0.05	PNS ASTM D 6304 or PNS ISO 12937 or PNS ASTM E 203
Water and sediment, % volume, max.	0.10	PNS ASTM D 2709

^a As per PNS for B100

PNS/DOE QS 002:2015 – Coconut Methyl Ester (B100)

PROPERTY	EURO 4-PH ^b	Test Methods
Appearance	Clear and bright, visibly free of suspended or precipitated contaminants	Visual
Acid number, mg KOH/g, max.	0.50	PNS ASTM D 664 or PNS ASTM D 974 or EN 14104
Carbon residue on 10% Distillation residue, % mass, max.	0.3	PNS ASTM D 4530 or PNS ISO 10370
Cetane number ^a , min	55	PNS ASTM D 613 or PNS ASTM D 6890 or PNS ISO 5165 or IP 498/03
Cloud point, °C, max	5	PNS ASSTM D2500
Copper strip corrosion, 3h at 50 °C, max.	No. 1	PNS ASTM D 130 or PNS ISO 2160
Density at 15 °C, kg/L	0.860 – 0.90	PNS ASTM D 1298 or PNS ASTM D 4052 or PNS ISO 3675
Distillation, AET 90% recovered, °C, max	360	PNS ASTM D 86 or PNS ASTM D 160
FAME ^a , content, % mass, min	96.5	PNS/DOE TM 01
Flash point, Pensky-Martens, °C, min.	100	PNS ASTM D 93
Glycerin, % mass max. Free glycerin	0.02	AOCS Ea 6-94 (1997) PNS ASTM D 6584 or EN 14105
Total glycerin	0.24	AOCS Ca 14-56 (1997) or PNS ASTM D 6584 or EN 14105

PNS/DOE QS 002:2015 – Coconut Methyl Ester (B100)

Continuation

PROPERTY	EURO 4-PH ^b	Test Methods
Glyceride content, % mass, max. Monoglyceride di-glyceride tri-glyceride	0.80 0.20 0.20	EN 14105 or PNS ASTM D6584
Group Metals, mg/kg, max. Group I metals (Na+K)	5	EN 14108 EN 14109
Group II metals (Ca+Mg)	5	EN 14538
Iodine Number, gl2/100g, max	10	EN 14111
Methanol content, % m/m, max.	0.20	EN 14110
Methyl Laurate, % mass, min.	45	PNS/DOE TM 01
Oxidation stability, 110 oC, hours, min	10	EN 14112
Phosphorus, % mass, max	0.001	PNS ASTM D 4951
Sulfated ash, % mass, max.	0.020	PNS ASTM D 874
Sulfur, % mass, max.	0.001	PNS ASTM D 1266 or PNS ASTM D 2622 or PNS ASTM D5453 or PNS ASTM D7039
Viscosity, Kinematic at 40°C , mm ² /s	2.0-4.5	PNS ASTM D 445
Water, % volume, max. ^b	0.05	PNS ASTM D 6304 or PNS ISO 12937 or PNS ASTM E 203
Water and sediment, % volume, max.	0.05	PNS ASTM D 2709

a To be reported quarterly

Note: Cold Soak Filterability Test (CSFT) using ASTM D7501. Results to be reported monthly by the biodiesel supplier.

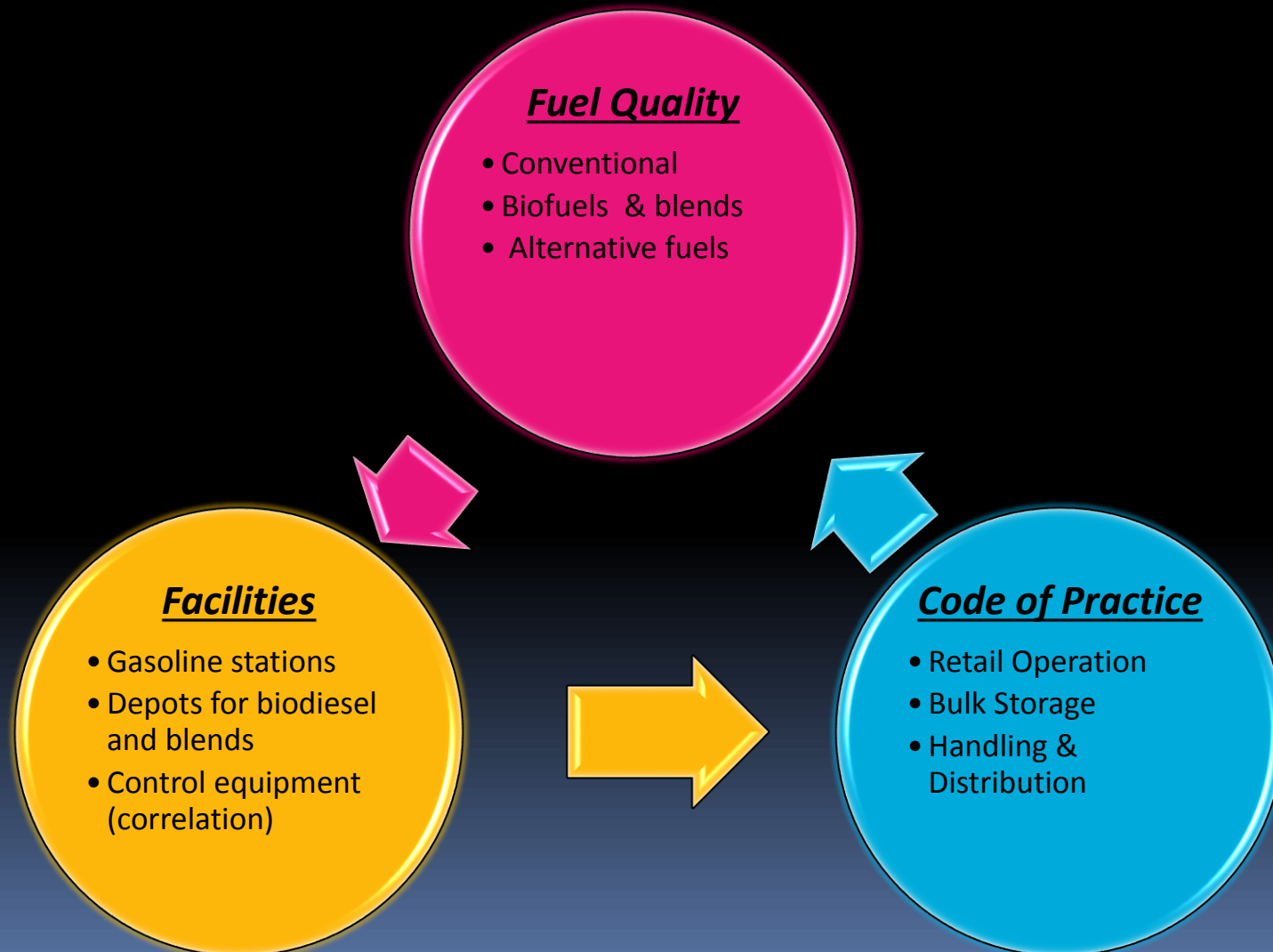
Issued the Standard for B5

But there is an issue on flakes . . .

Status	Remarks
The formation of flakes and the susceptibility to form flakes were determined to be:	Solutions: 1. Greater preference to use RBD vs. CNO
1. Feedstock used; CNO is more prone to flake formation	2. Producers to establish increased washing processes depending on on-line soap testing
2. Inadequate washing can also lead to flake formation	3. Adopt the CSFT as the final arbiter to determine if the product will form flakes down the distribution chain
3. Insufficient cooling & settling period caused quality assurance issues at the buyer level	4. Oil companies (buyer) and biodiesel producers (seller) to agree on the QC/QA testing protocols

Standards Harmonization in Downstream Petroleum Industry

Cleaner Fuels and Safer Technologies



Facilities Standards Developed

- **Storing and Handling of CME and CME-Blends Petroleum in LPP Depot**
- **Storing and Handling of B5 in Retail Outlet**

ENFORCEMENT OF STANDARDS

Product sampling and facility check

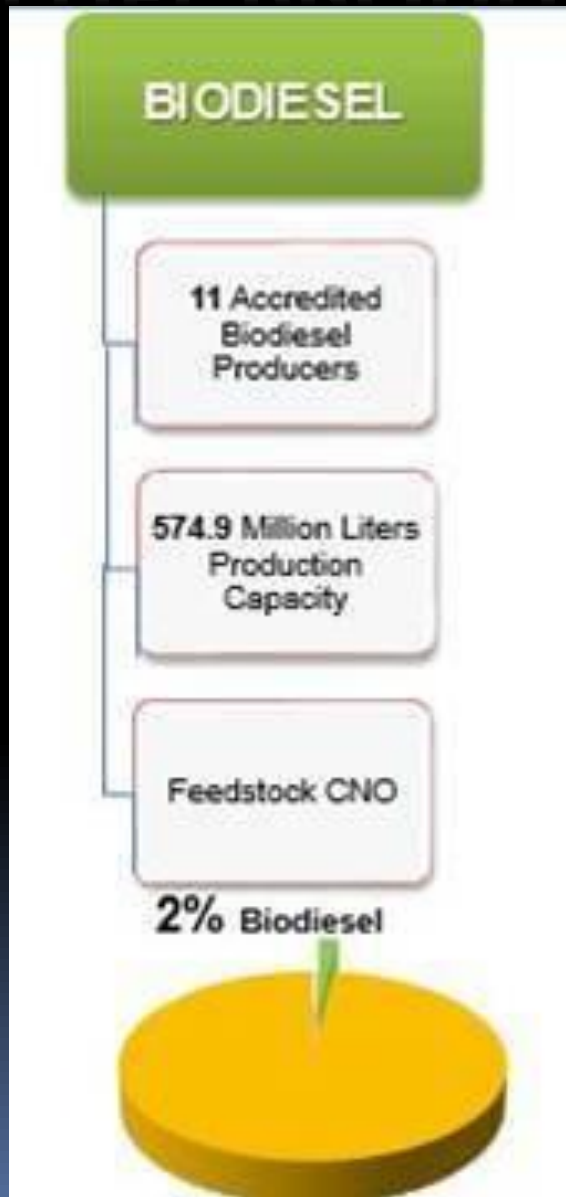


Sampling frequency:
At least once a year
inspected for major
facilities nationwide

ENFORCEMENT OF STANDARDS



BIOFUEL PRODUCERS



Past and Current R&D Initiatives on Biodiesel

“Five Percent and Twenty Percent Biodiesel Blends for In-Use Vehicles: A Validation Road Test”

-Technological University of the Philippines

“Pilot Study on the Performance of Engines of Light Vehicles using 4% Esterified Used Vegetable Oil”

-USAID-Clean Energy Project

“Actual On-Road Run Testing Using B5”

-DOE-REMB



Engine Components Inspection

1. Formulation of test protocol with DOST-PCIEERD, PCA, TUP, UP-NCTS.
2. Actual test has covered 5,326 kms of flat and elevated/high altitude terrains



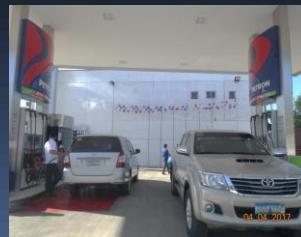
Toyota Innova



Toyota Hilux



Blending (B5)



Refueling (B2)



Refueling (B5)



Emission Testing

Proposed Increase in Biodiesel Blend (B2 to B5)

Issue	Status	Remarks
1. Vehicle/fuel compatibility (international)	No modification necessary	Up to B5 provided the B100 complies with ASTM specs
2. Vehicle/fuel compatibility (Philippine-made vehicles)	Hi-way driving Hi-elevation operation Endurance testing	Endurance testing at Philippine conditions
3. Vehicle/fuel compatibility (PUJ use)	Completed	Conducted by UP-NCTS on actual PUJ routes
4. Economic study	Completed	Conducted by UPLB
5. Economic study	Completed	Conducted by EPDP/UP-Econ
6. Supply issue – feedstock	Re-assessment of priorities & improving land/crop productivity	Awaiting their 2018 assessment
7. Supply issue – production capacity	Currently under utilized, can go to B5	Supporting higher blends

Biodiesel Project Proposals

“Environmental and Energetic Studies of Biodiesel Production from Coconut Oil in the Philippines”

-University of the Philippines Los Baños / Philippine Coconut Authority

“Characterization and Performance Testing of the Biodiesel/Diesel Blends from Combined Feedstock of Various Vegetable and Used Cooking Oils”

-Department of Science and Technology ITDI

“Performance Evaluation of Straight Vegetable Oils for Power Generation”

-Technological University of the Philippines

Higher Biodiesel Blends

Issues/Constraints

1. SUPPLY AVAILABILITY

- Insufficient capacity of local biodiesel plants to meet product specs
- Role of the agricultural sector for food supply security

2. PRICE

- Higher blend quality means higher price

3. INVESTMENT REQUIREMENT AND CLIMATE

- Local refineries need upgrading/capacity expansion

4. TECHNICAL

- Flakes formation tendency of CME
- Compatibility of biodiesel blend with vehicle

5. ECONOMIC ADVANTAGE

FUEL QUALITY ROADMAP

Overall
Objective
By 2030

Short-Term
(2016-2017)

Medium-Term
(2018-2020)

Long-Term
(2021-2030)

STANDARD
DEVELOPMENT



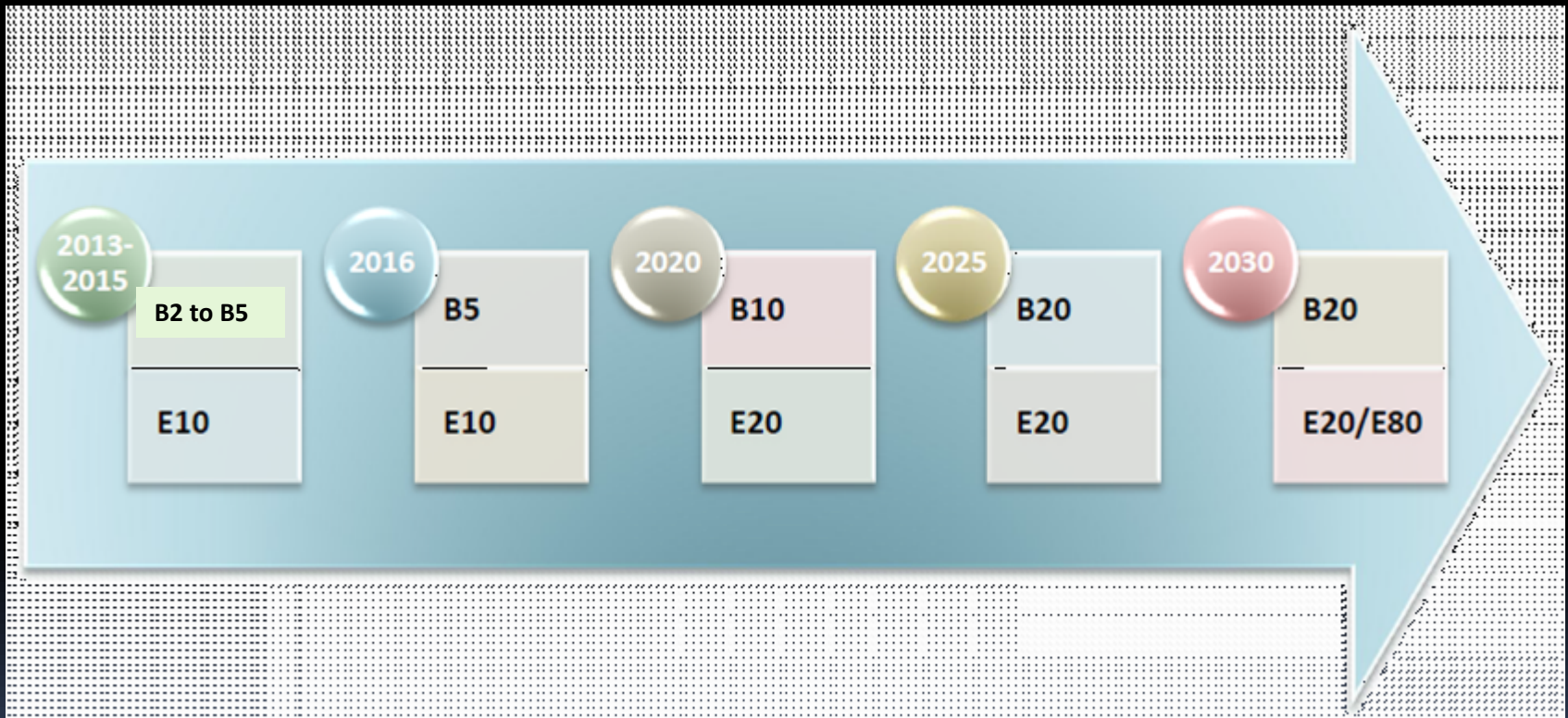
- Sulfur reduction from 500ppm to 50ppm
- Application of modern emulsion
- **Introduction of higher biodiesel level (B5)**

- Olefin & aromatic content limits
- Additional composition controls
- Prohibition of more metallic additives
- **Introduction of non-coconut biodiesel feedstocks**

- Further Benzene reduction
- **Introduction of hydrolyzed fuel**
- Higher bioethanol level (E20)
- Introduction of ultra-low sulfur
- Low carbon fuel standard

Improved policy governing the oil downstream sector to ensure a vibrant industry ; Control emissions of traditional air pollutants; and Energy security & CO₂ reduction

Targeted Biofuels Blend, 2011-2030



Thank you



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