Energy Efficiency Continuous Improvement Activity

based on Toyota Way and Toyota Production System,

and Contributions to a Sustainable Society

TOYOTA DO BRASIL

Nov 2018

I. Toyota do Brasil Outline

1. History – Vehicle production

	'50～70	'70～90	'90～00	'01～05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19
Overall	▼ 1958.1 Foundation						▼ TDB 50years (100 years Immigration)										▼ TDB 60 years	
SBC Plant	▼ 1962.11 Inauguration, Start Banderantes prod																	
			▼ 1997.2 Start Hilux Unit & Body Parts prod						▼ 11 Start Forged Parts						▼ Forging 3rd shift			
IDT Plant				▼ 1998.8 Inauguration, Start Corolla prod												▼ Corolla minor model change		
SOR Plant									Inauguration, Start Etios prod ▼ 9								▼ Start Yaris production	
PFZ Plant															▼ Engine Plant inauguration			

Bandeirantes

ETIOS

YARIS

HILUX

COROLLA

Our story began in 1958, 60 years ago.

I. Toyota do Brasil Outline

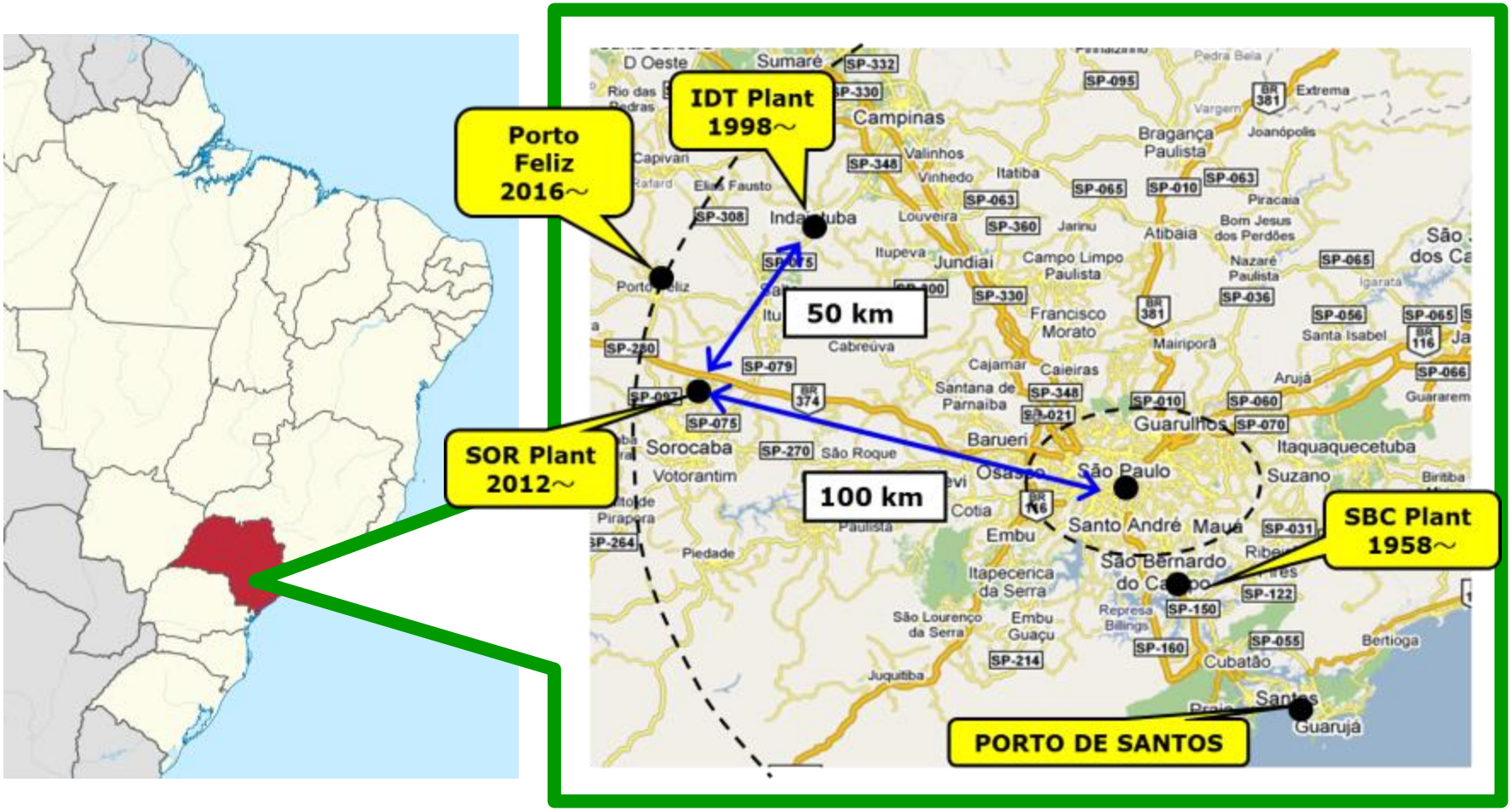
2. Sites

		SBC Plant	IDT Plant	SOR Plant	PFZ Plant
Establish		Nov 1962	Aug 1998	Sep 2012	Feb 2016
Operation		Parts production for Hilux & Corolla	Production of Corolla	Production of Etios and Yaris	Production of Engine
Prod capacity		Corolla 87K Forging 900K Hilux 131K	77K	112K	116K
Area	Site	193,362 ㎡	1,776,000 ㎡	3,700,000 ㎡	870,000 ㎡
	Building	68,400 ㎡	101,822 ㎡	98,500 ㎡	13,700 ㎡
Employees (2018 Jul)		1.437	2.115	2.434	623
Plant view					

We have 4 sites, all located in São Paulo State.

I. Toyota do Brasil Outline

2. Sites



All 4 plants located within 100 km of distance from São Paulo City.

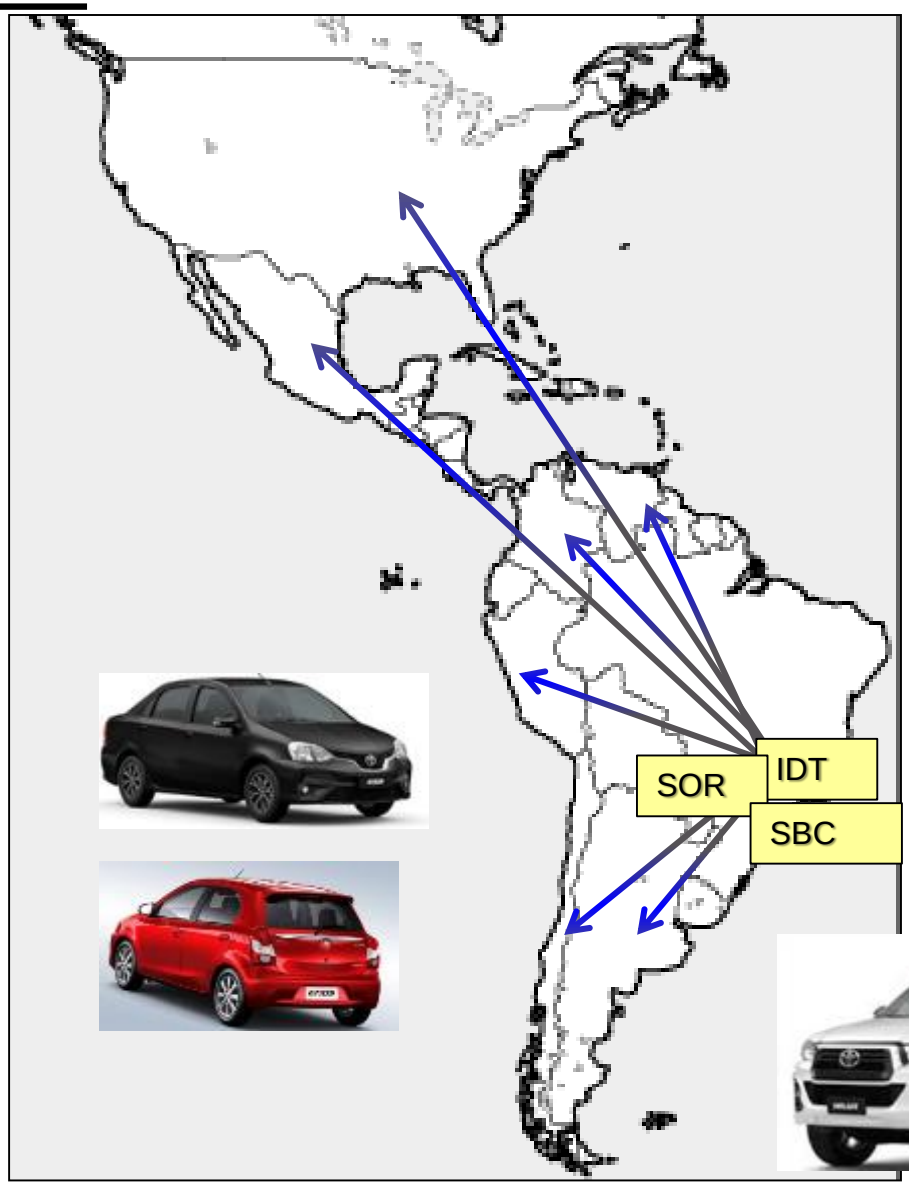
I. Toyota do Brasil Outline

3. Import & Export

Export Corolla and Etios to South America,

Engine components to North America.

Import Hilux from Argentina.



II. Toyota Environment Challenge 2050

Kindly access URL for more details.
https://www.toyota.co.jp/jpn/sustainability/environment/index.html

TMC announced the Environmental Challenge 2050 in October 2015. There are 6 Challenges. TDB is also conducting activities regionally.

II. Toyota Environment Challenge 2050

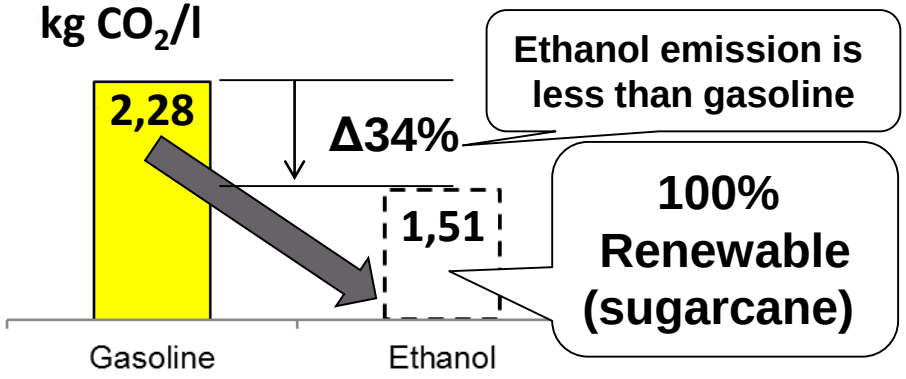
CHALLENGE 1
New Vehicle Zero CO_2 Emissions Challenge
CO_2 0

Challenge 1: New vehicle Zero CO_2 emission

Actions to reduce CO_2 emission of TOYOTA products.

Current:
Production of Flex Fuel Vehicle (FFV) – Gasoline / Bioethanol

Reference: CO2 emission per Fuel
kg CO_2/l



Ethanol emission is less than gasoline

100% Renewable (sugarcane)

Ref.: "Emission Report" of Brazilian Ministry of Environment

Ongoing:
High energy efficiency technology (Hybrid, Fuel Cell)

- Development of Hybrid FFV to improve fuel efficiency.

II. Toyota Environment Challenge 2050

CHALLENGE 2
Life Cycle Zero CO_2 Emissions Challenge

Challenge 2: Life cycle Zero CO_2 emission

Actions to reduce CO_2 emission in supplier, logistics and dealer activities.

Supplier

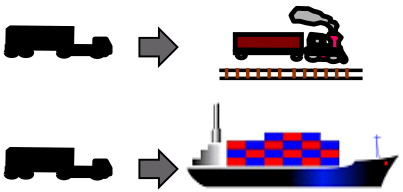
- Good KAIZEN sharing (through BRASA – Brazilian Toyota Suppliers Association)
- Green purchase guideline revision.
- ISO14001 certification promotion.

BRASA
Brazilian Automotive Suppliers Association

Logistics

- Fuel source change (Diesel → Gas → Renewable)
- Route optimization

- Modal changes



Dealer

- Environmental KPI collection promotion.
- ECODEALER award for best practices by ABRADIT (Toyota Dealers Association).
- Promotion of ISO 14001 certification.

ECO DEALER
ABRADIT • TOYOTA

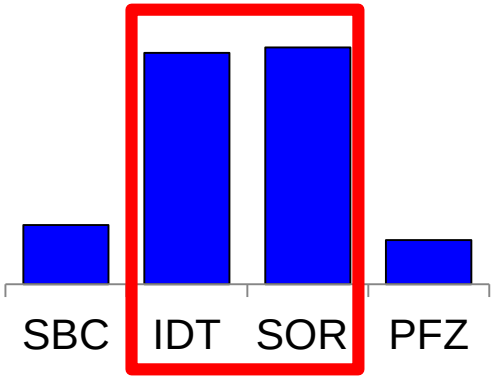
II. Toyota Environment Challenge 2050

CHALLENGE 4
水環境
インパクト最小化
チャレンジ

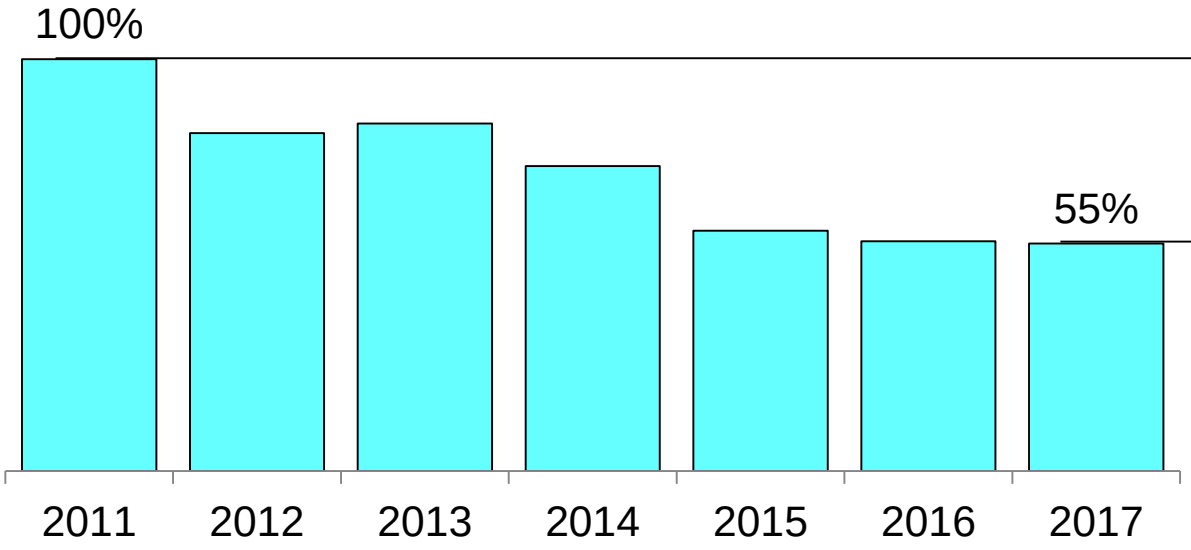
Challenge 4: Challenge of Minimizing and Optimizing Water Usage

Actions to reduce water usage in TDB production process.

In TDB, major consumption occur in Paint Shop at vehicle production plants.



Paint Shop (pre-treatment process).



▲45%

So far, TDB achieved 45% reduction in m^3/veh

II. Toyota Environment Challenge 2050

CHALLENGE 5
循環型社会・システム構築チャレンジ

Challenge 5: Establish a Recycling-based Society

Actions to reduce waste generation in TDB and partners.

Plants

- Waste generation reduction KAIZEN

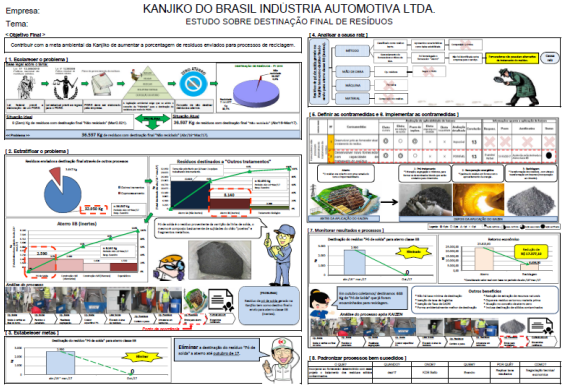
(ex. Paint sludge press)

Community

- Support NGO seamstress cooperative recycling used uniforms.

Supplier

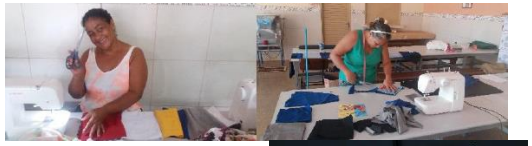
- Green purchase guideline
- Waste management KAIZEN sharing (through BRASA)

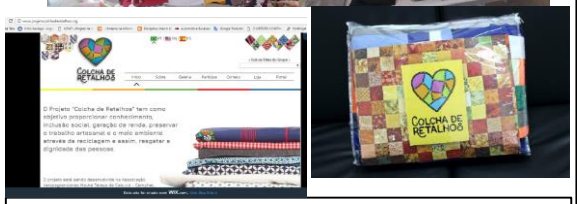


Winner BRASA 2017
KANJIKO

Dealer

- DERAP - Dealer environmental audit
- ISO14001
- ECODEALER Award





Winner Ecodealer 2017
Orion – Cuiabá

II. Toyota Environment Challenge 2050

CHALLENGE 6
人と自然が共生する未来づくりへのチャレンジ

Challenge 6: Future Society in Harmony w/ Nature

Promote Harmony with Nature in TDB, partners and community.

	1) Green Wave Project	2) Today for Tomorrow	3) Education for Sustainable Development
Plants	Planted 335.000 trees 	Inventory Flora: 53 species Fauna : 16 fishes, 10 reptiles, 186 birds, 38 mammals 	Environmental Month, Tree Day Water Day, Eco Mind Survey involving all 5700 employees 
Community	Supported 190.000 trees planting 	03 endangered species protection ongoing 	27 Cities influenced + 3 visitor centers established 

II. Toyota Environment Challenge 2050

CHALLENGE 6
人と自然が共生する未来づくりへのチャレンジ

Challenge 6: Future Society in Harmony w/ Nature

4. Dream Car Art Contest

2015
Age 12 to 15
Gabriele

2016
Age 12 to 15
Victoria

Application at
http://toyotadreamcar.com.br/

Edição 2016 Concurso de Arte CARRO DOS SONHOS

Spread Eco Mind in society through art contest.
Brazilian children won in 2015 and 2016!

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant CO_2 Zero Challenge

This Challenge is related to Energy Efficiency

Electricity

Natural Gas

Manufacturing

Consumption of energy = emission of CO_2.

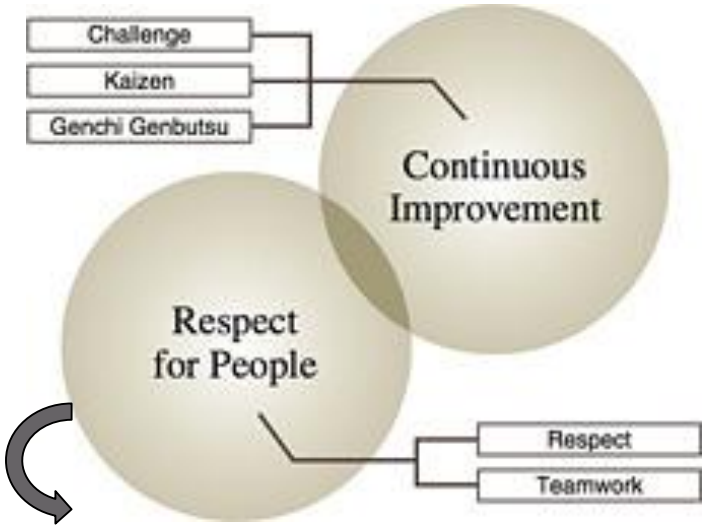
Energy Efficiency Up = Less CO_2 emission
Good for environment!

II. Toyota Environment Challenge 2050

Challenge 3: Plant CO_2 Zero Challenge

1. Energy Efficiency Management – Thinking Way

   1) Toyota Way.



Continuous Improvement
"Challenge members to tackle a problem and implement KAIZEN, after deep investigation through GENCHI GENBUTSU"

Respect for People
Encourage members to work together in team, each one contribuiting with solution.

HR DEVELOPMENT TEAMWORK

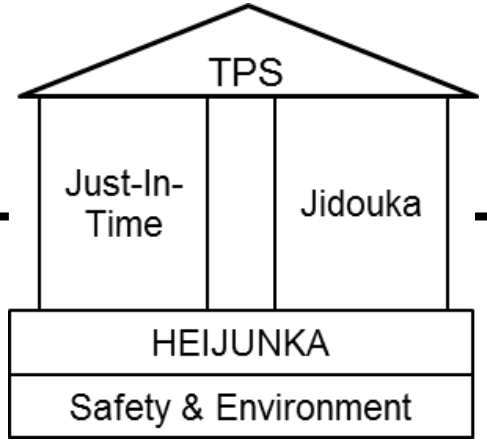
First Principle is Toyota Way

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

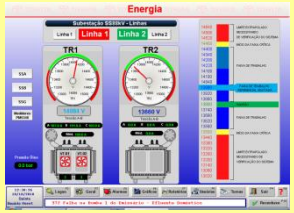
1. Energy Efficiency Management – Thinking Way
   2) TPS (Toyota Production System)



Just-In-Time
"Produce only what is needed, in the amount needed, when is needed, with **minimum resources."**

JIDOUKA
"Stop automatically when defect is detected".

Measurement & Control (MIERUKA)



"Use necessary resources
Only when needed
Only amount needed"

Identify and Eliminate WASTE (in japanese, MUDA)

Second Principle is Toyota Production System

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant CO_2 Zero Challenge

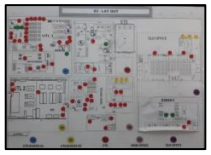
1. Energy Efficiency Management – Thinking Way

3) Management & GENBA

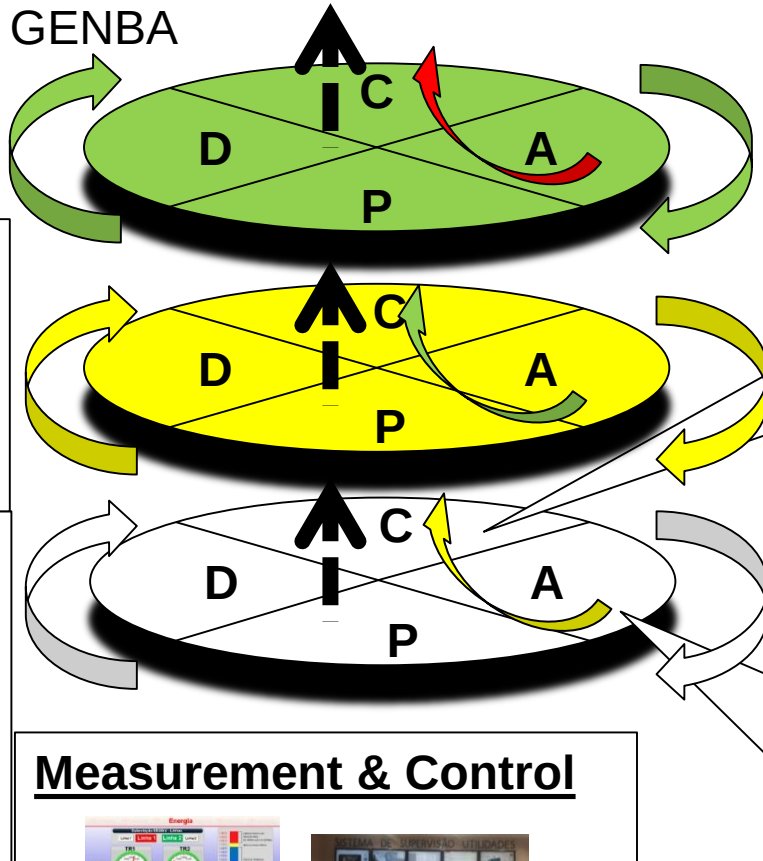
Management

GENBA

MIERUKA



TEAMWORK



Management

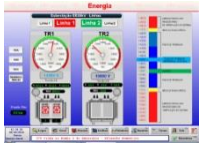
GENCHI GENBUTSU

Management

Strategy

ENERGY EFFICIENCY 3 STEPS ACTIVITY			
STEP	1ST	2ND	3RD
FOCUS POINT	Turn Off if not in use	Eliminate Waste. Use only necessary amount.	Upgrade equipment technolgy for better efficiency.
EXAMPLES	Lights down activity 	ABCD Concept 	LED lamp adoption 

Measurement & Control



Managerment give direction of KAIZEN implementation.

II. Toyota Environment Challenge 2050

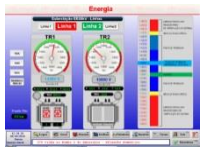
CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant CO_2 Zero Challenge

4. Energy Management System – “Supervisory”

Management

Measurement & Control



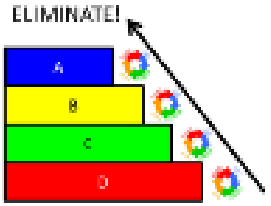
MIERUKA

GENCHI GENBUTSU

GENBA

ENERGY EFFICIENCY 3 STEPS ACTIVITY

STEP	1ST	2ND	3RD
FOCUS POINT	Turn Off if not in use	Eliminate Waste. Use only necessary amount	Upgrade equipment technlolgy for better efficiency.
EXAMPLES	Lights down activity	ABCD Concept	LED lamp adoption



Now we will explain our Energy Management System.

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant CO_2 Zero Challenge

4. Utility Management System – “Supervisory”

1) On-line monitor and management report.

In each plant, we have Utility Management Room.

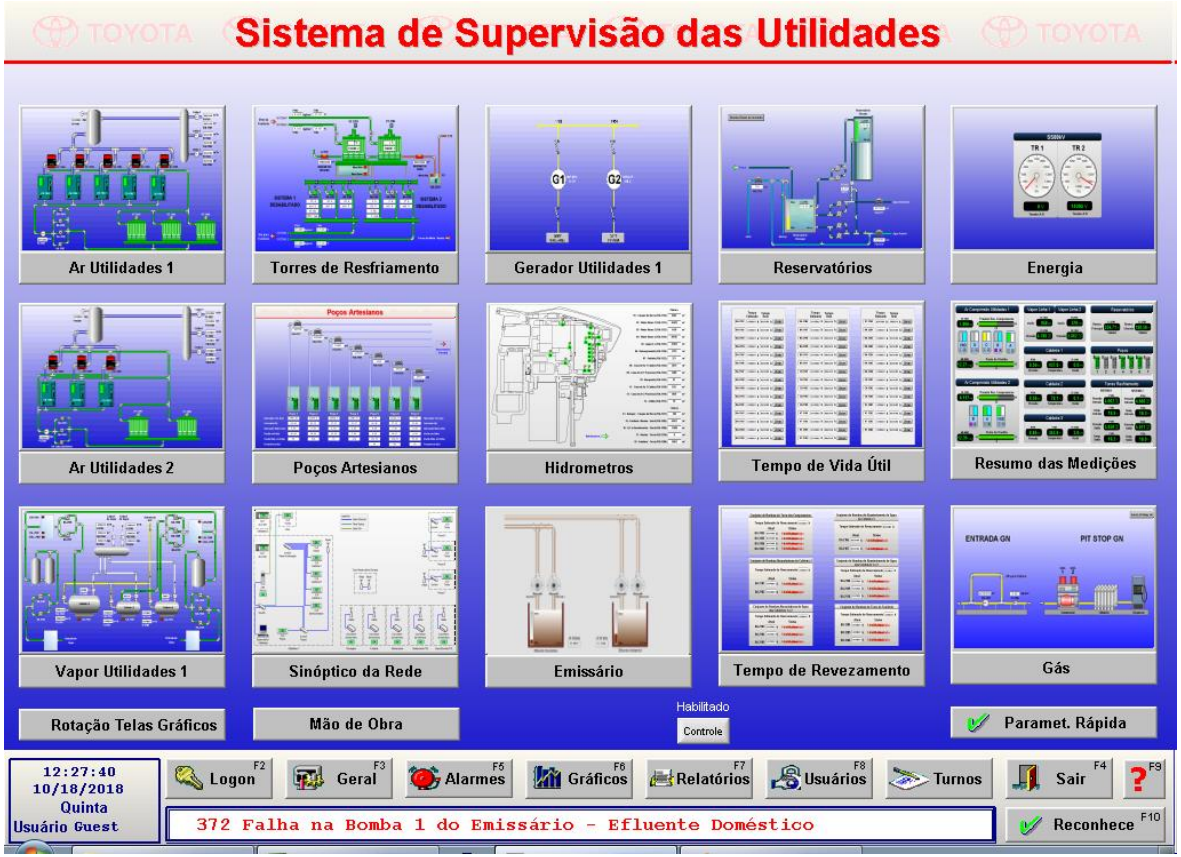
II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

4. Utility Management System – “Supervisory”

2) Cover all utility items (boiler, steam, etc).



System allow to control all utility items.

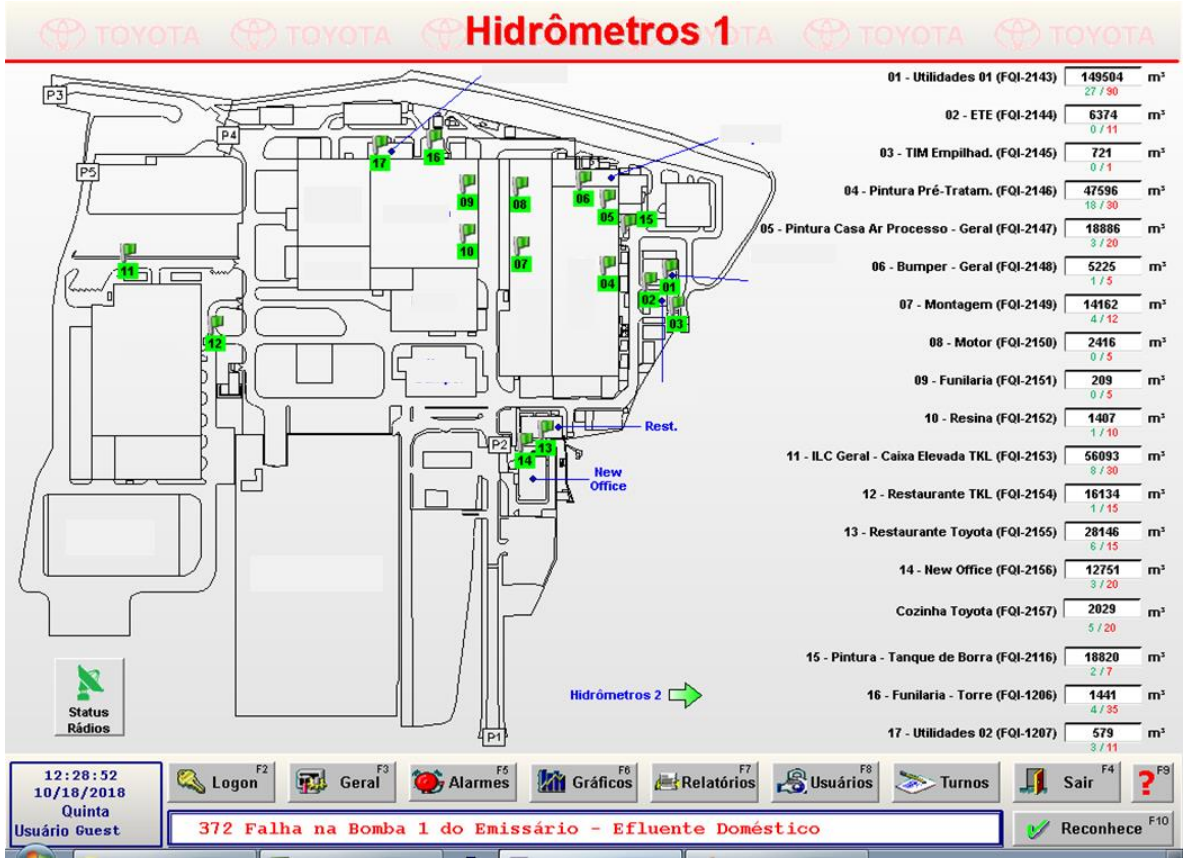
II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

4. Utility Management System – “Supervisory”

4) Installation of meters (ex. water consumption points)



Meters are installed in key points for KAIZEN.

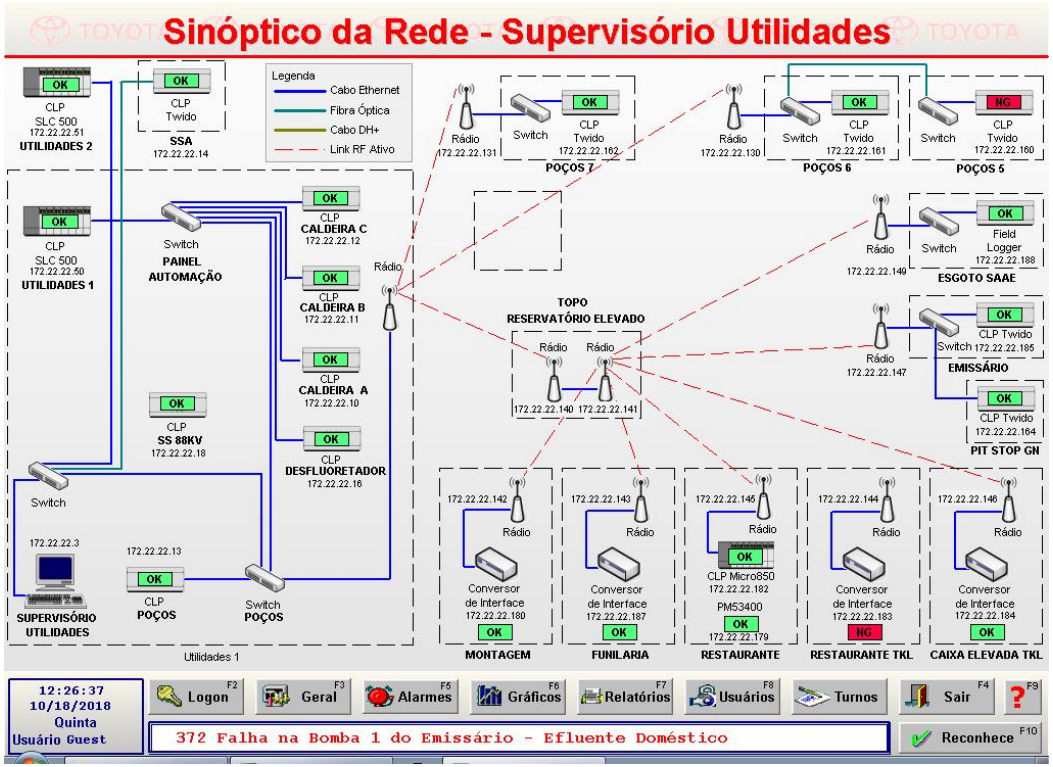
II. Toyota Environment Challenge 2050

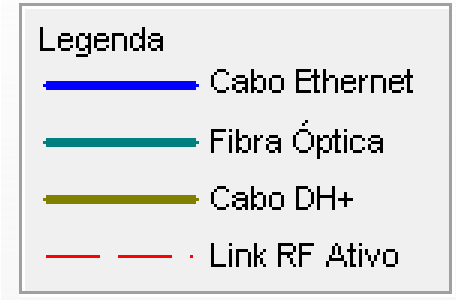
CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

4. Utility Management System – “Supervisory”

3) Data collection (via ethernet, optical cable, DH+ cable and RF – radio frequency net)





Data collection is done by meters and transmitted By 4 different ways.

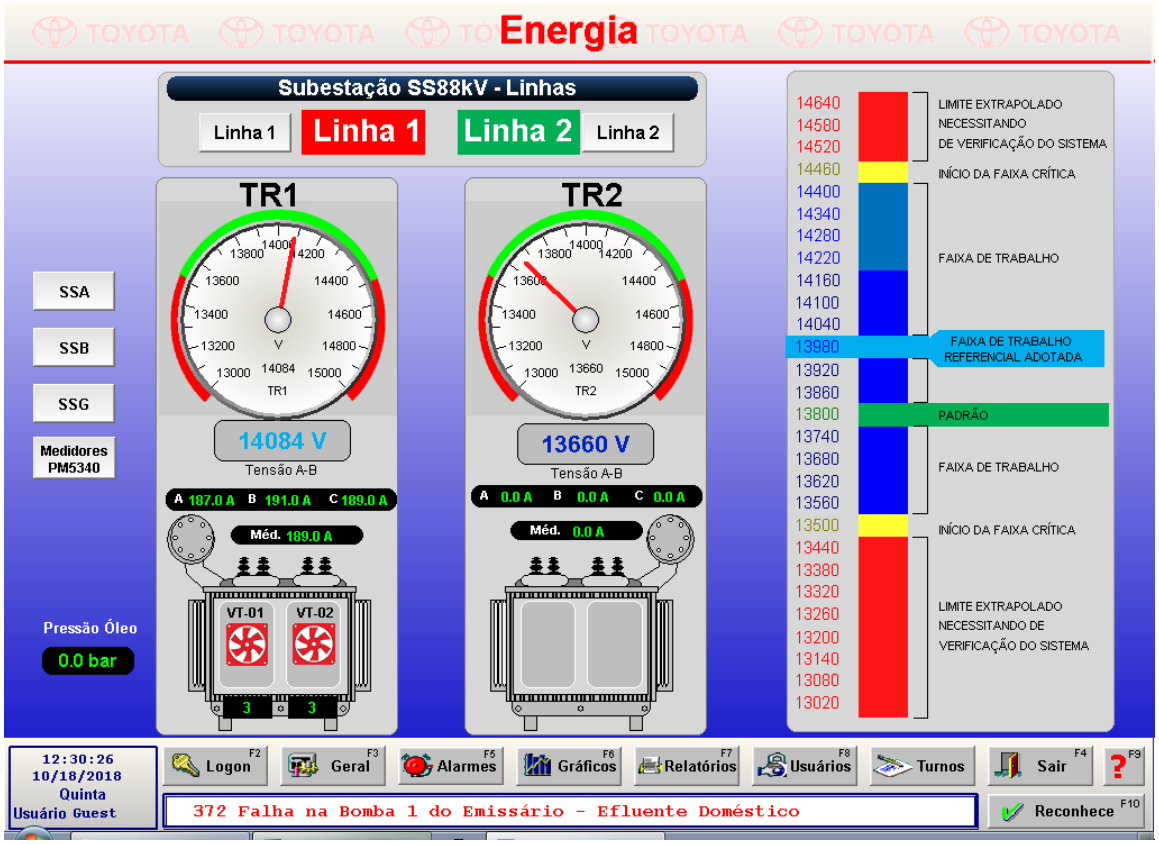
II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

4. Utility Management System – “Supervisory”

5) On-line monitor and management report (cont.)



In case of abnormality, warning by alarm happens.

II. Toyota Environment Challenge 2050

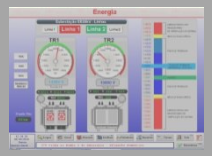
CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant CO_2 Zero Challenge

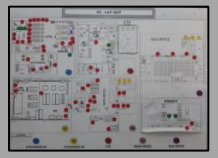
5. ABCD Concept

Management

Measurement & Control

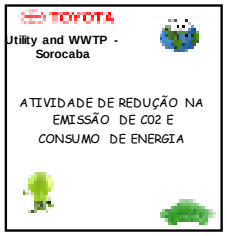
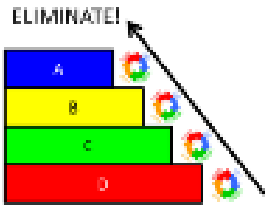



MIERUKA




GENCHI GENBUTSU

GENBA

ENERGY EFFICIENCY 3 STEPS ACTIVITY			
STEP	1ST	2ND	3RD
FOCUS POINT	Turn Off if not in use	Eliminate Waste. Use only necessary amount	Upgrade equipment technlolgy for better efficiency.
EXAMPLES	Lights down activity 	ABCD Concept 	LED lamp adoption 

Now we will explain how GENBA conduct ABCD concept.

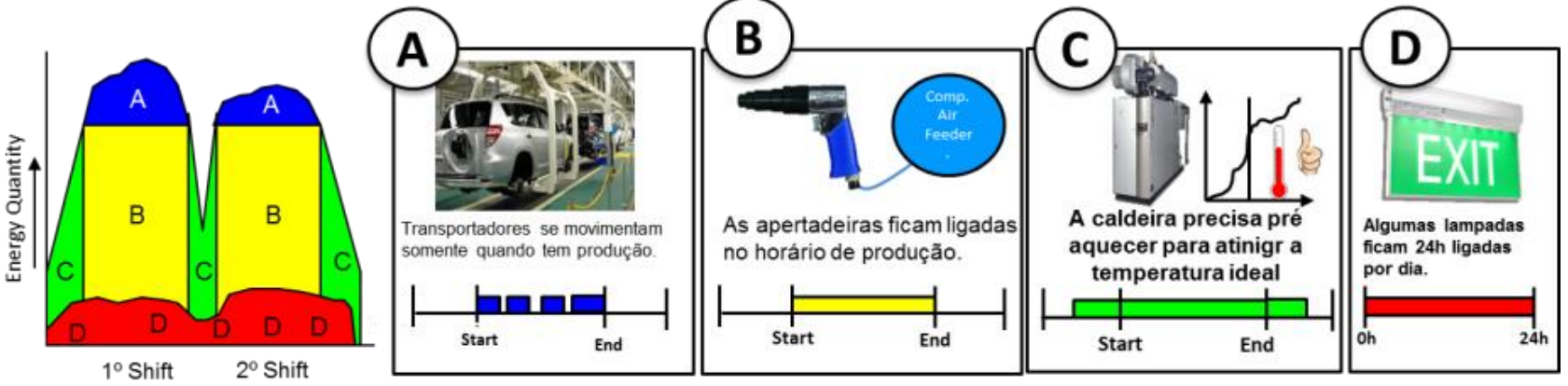
II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

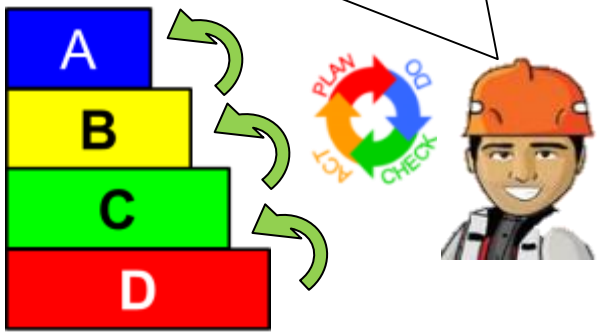
5. ABCD Concept

1) Classify energy usage amount by type.



2) Study and implement KAIZEN

2-1) Run PDCA to level up



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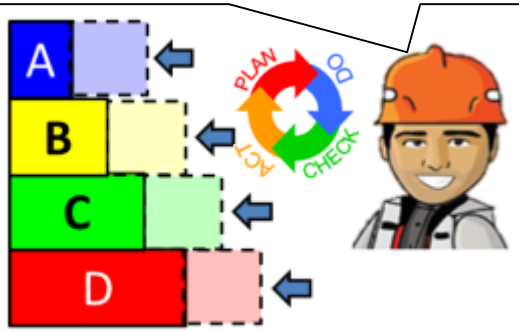
2-2) Run PDCA to reduce volume



Identify type of consumption, upgrade and reduce.

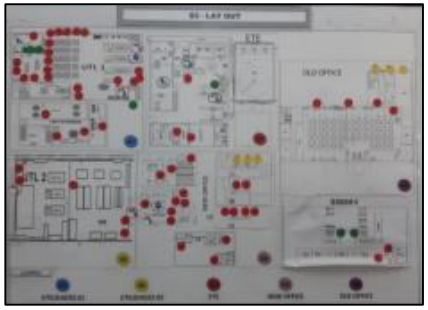
II. Toyota Environment Challenge 2050

Challenge 3: Plant CO_2 Zero Challenge

5. ABCD Concept

3) Deploy to all shops, all plants.

4) Each shop map and control



5) Top management involvement
EVP, VP and Director conduct GENCHI GENBUTSU to motivate members.

6) Recognition from Toyota top management

Global Best (Toyota Motor Co.)

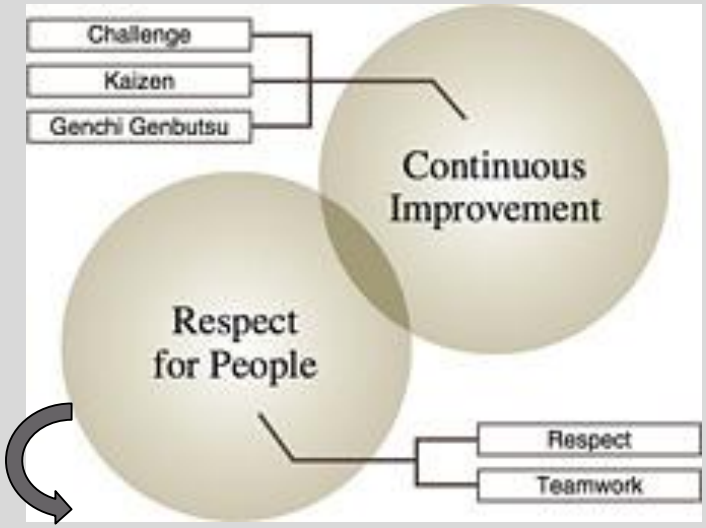
Important: strong support from top management.
Recognition from TMC top management.

II. Toyota Environment Challenge 2050

Challenge 3: Plant CO_2 Zero Challenge

1. Energy Efficiency Management – Thinking Way

   1) Toyota Way.



Continuous Improvement
"Challenge members to tackle a problem and implement KAIZEN, after deep investigation through GENCHI GENBUTSU"

Respect for People
Encourage members to work together in team, each one contribuiting with solution.

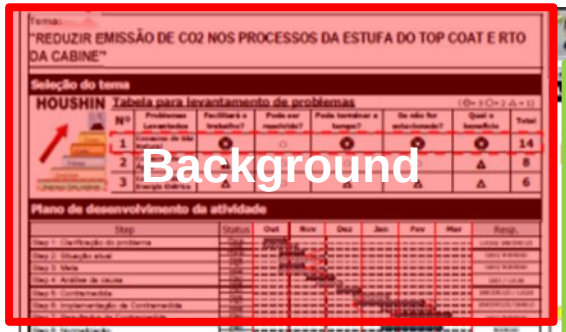
HR DEVELOPMENT
TEAMWORK

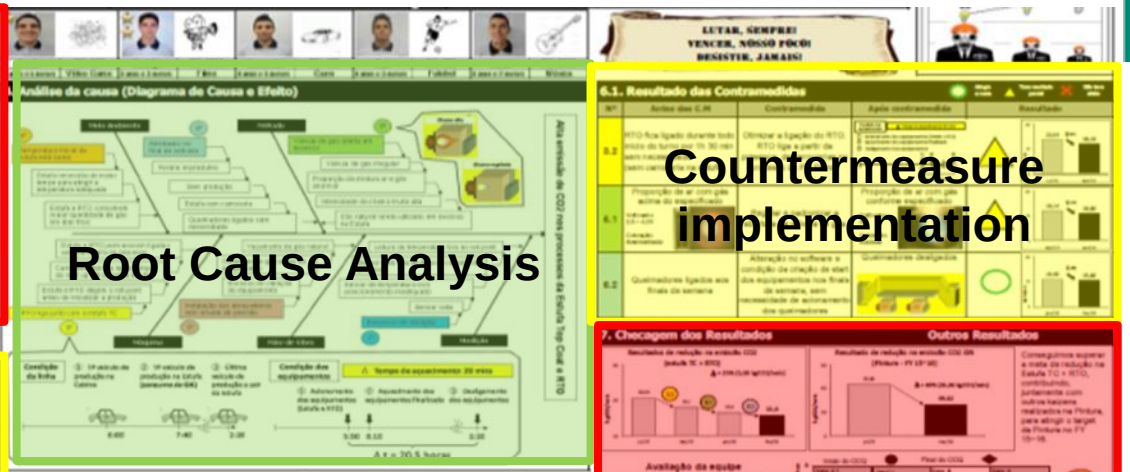
II. Toyota Environment Challenge 2050

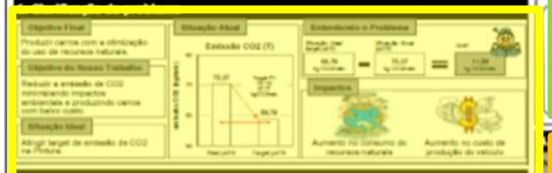
CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

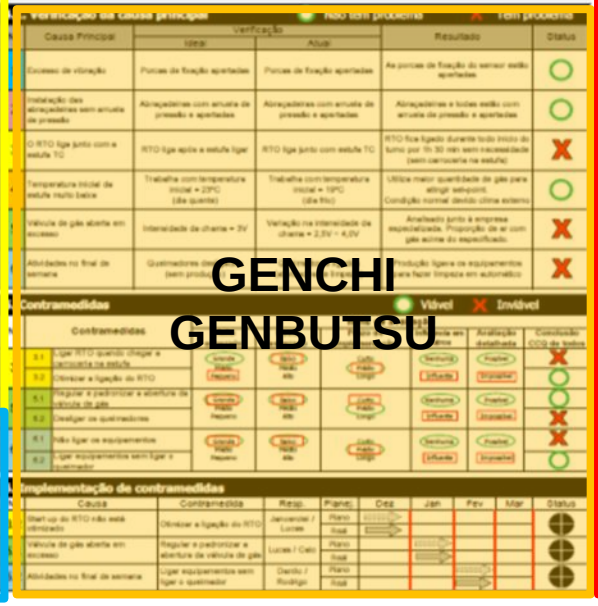
Challenge 3: Plant Co2 Zero Challenge

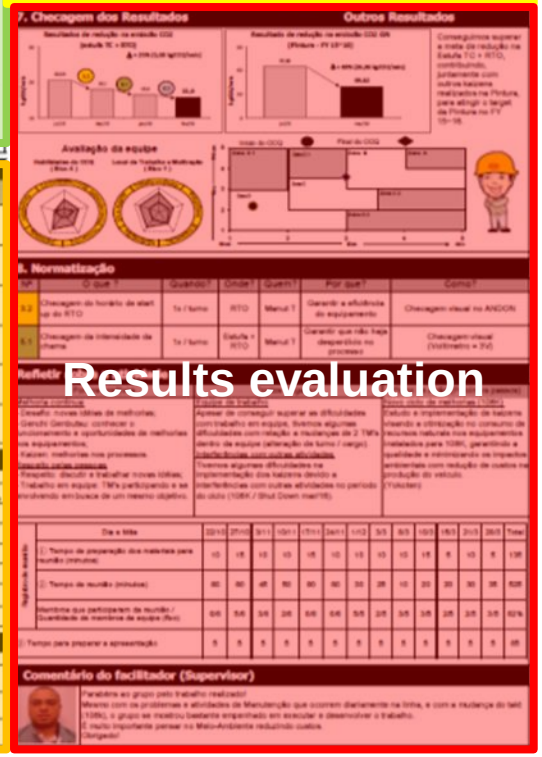
Quality Control Cyrcle A0

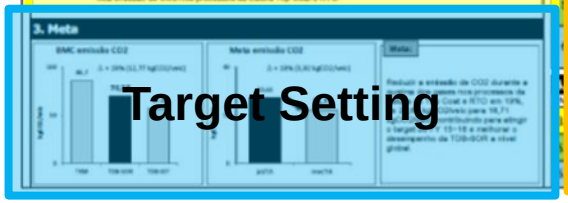












II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant Co2 Zero Challenge

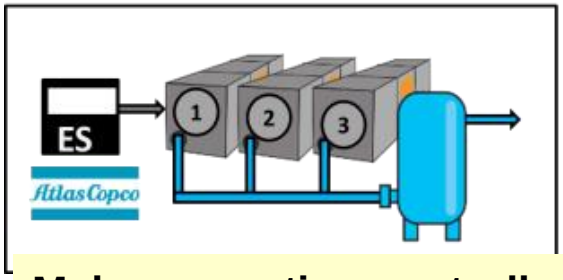
7) KAIZEN examples

HR DEVELOPMENT & CHALLENGE

Ex.1

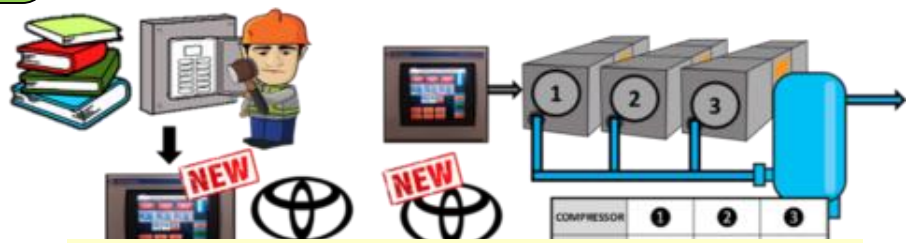
Before

COMPRESSOR SYSTEM



Maker operation controller.
Expensive upgrade

After



Member studies equipment manual.
Developed low budget controller.
Optimized compressor usage.

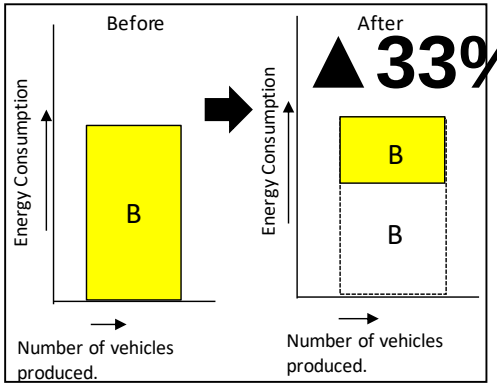
Attention point

1 – Monitor equipment operation and grasp idleness.

2 – Challenge member. Motivation up.

Results

Reduction:
0,11 kg CO2/Veh



II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

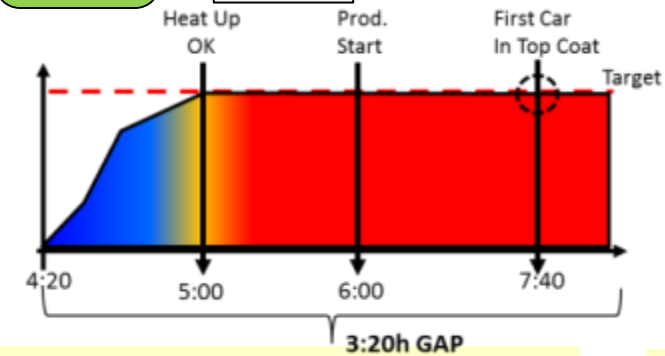
Challenge 3: Plant Co2 Zero Challenge

7) KAIZEN examples

Teamwork & GENCHI GENBUTSU

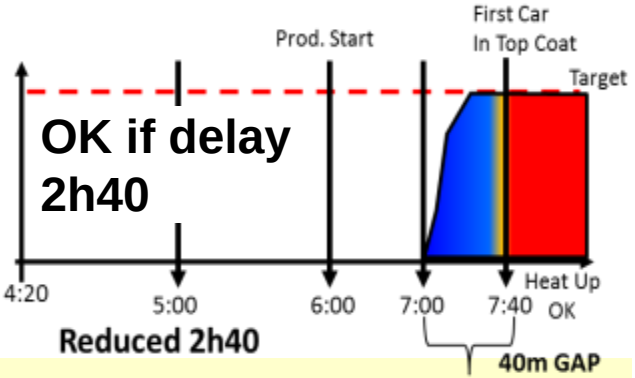
Ex. 2

Before **RTO**



Paint Shop Oven and RTO Operation started 4:20 AM.

After

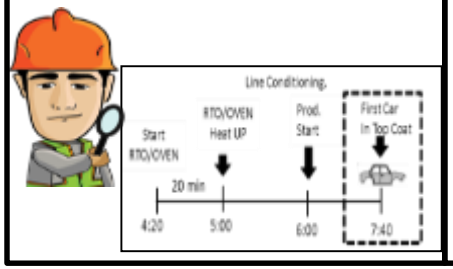


After studying paint drying parameters and repeated try-outs, reduced start time.

Attention point

Teamwork Utility & Paint Shop

1 – Studying process minute by minute.

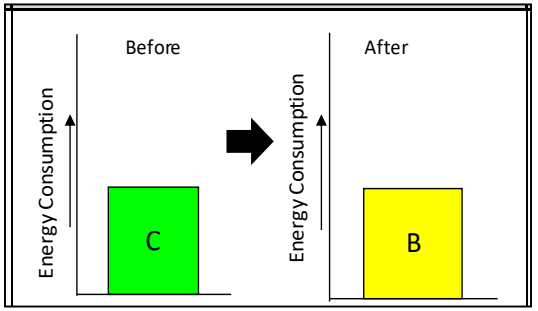


2 – Repeated try-out to define new equipment start time.

4:20 – Too Early ✖
5:00 – Too Early ✖
6:00 – Too Early ✖
7:00 – Ok ✔
7:30 – Too Late ✖

Results

Reduction:
1,65kg CO_2/Veh



Level up

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

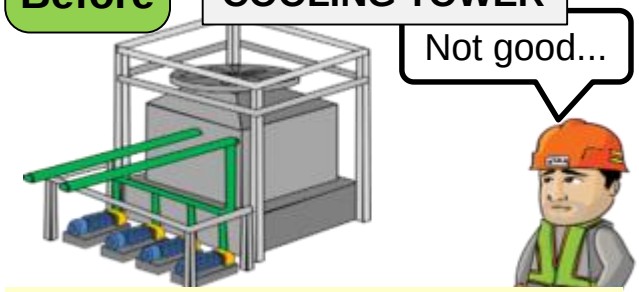
Challenge 3: Plant Co2 Zero Challenge

7) KAIZEN examples (cont.)

Teamwork & Challenge

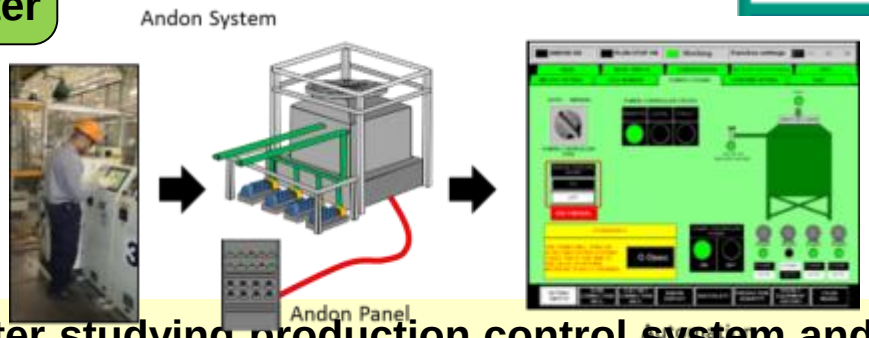
Ex. 3

Before



Welding Shop cooling tower on/ off done manually. Sometimes member forget.

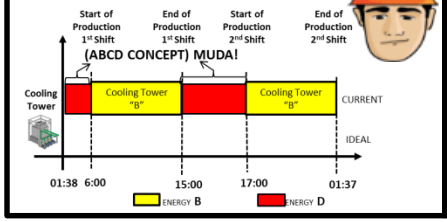
After



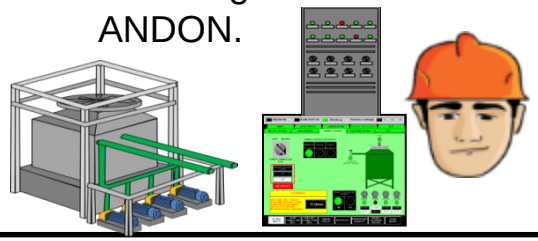
After studying production control system and Implementing control switch in cooling tower, on / off is done automatically with production.

Attention point

1 – Involve all related areas to solve problem.



2 – Study, architect and implement interlock operation of cooling tower with ANDON.

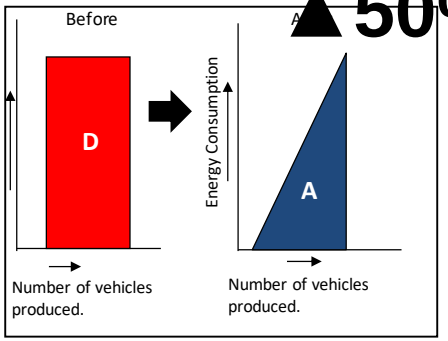


Results

Reduction:

0,04kg CO_2/Veh

▲50%



II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant Co2 Zero Challenge

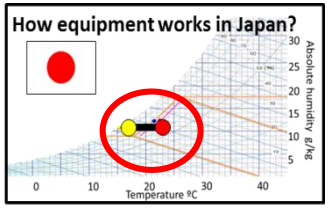
7) KAIZEN examples (cont.)

Teamwork & Challenge

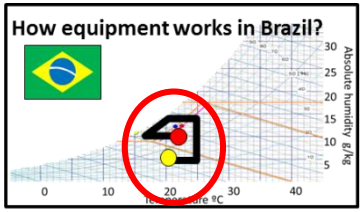
Ex. 4

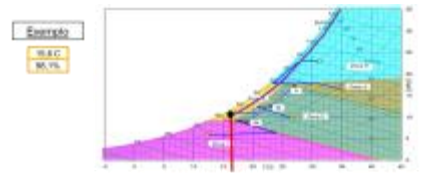
Before **AIR SUPPLY HOUSE** **After**

Plan



Actual





Zona do Ar externo	O que liga?
Zona 1(Temperatura baixa)	Pre-Heater+Chuveiro+Re-Heater
Zona 2 (Temperatura media, Baixa umidade)	Chuveiro(+Re-Heater)
Zona 3 (Temperatura media, Alta umidade)	Somente o Re-Heater
Zona 4 (Temperatura Alta, Umidade media)	Chuveiro+Cooler
Zona 5 (Temperatura Alta, Alta umidade)	Cooler + Re-Heater

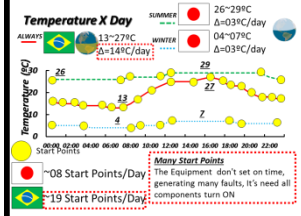
Paint Shop Air Supply House (ASH) operate with fixed parameters (JPN)

Implemented parameters to save energy to achieve good condition according to temperature and humidity (Enthalpy)

Attention point HR development, motivation up

1 – Study equipment advanced features.

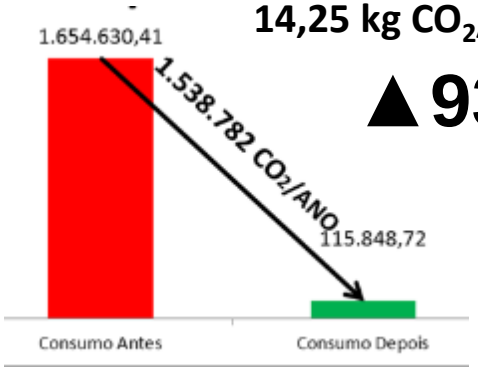
2 – Study Thermodynamics and investigation of gap in Plan x Actual



Results

Reduction:
14,25 kg CO_2/Veh

▲93%



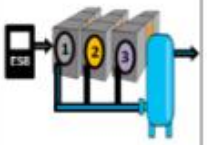
II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ
CO2 0

Challenge 3: Plant Co2 Zero Challenge

The Power of Team Work

	KAIZEN	PHOTO
1) Painting	① Water Consumption Reduction in PT/ED	
	② Reduce excess of overflow at Surface Conditioner tank	
2) Utility	① Sensor position change in cooling tower	
	② Reduce salt concentration by softener installation in cooling tower	
3) Adm	① Reduce water consumption for cleaning food	
	② Stroke limiter in toilets taps	

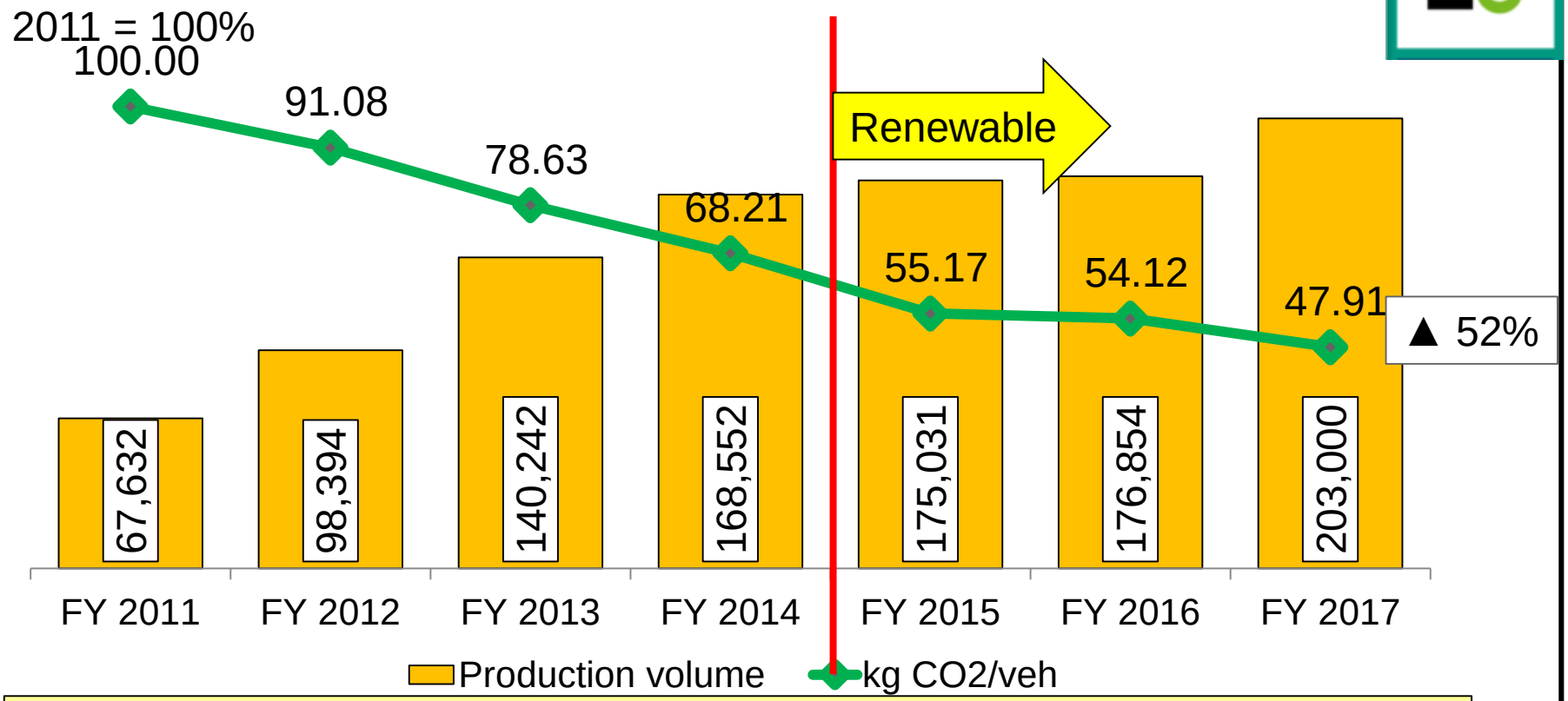
KAIZEN	TEAM WORK
RTO - Paint Shop 	
Paint Compressors - Utility 	 
Cooling Tower - Welding 	

Members of different area and skills contribute for results.

II. Toyota Environment Challenge2050

Challenge 3: Plant Co2 Zero Challenge

7. Overall Energy Efficiency KAIZEN activity results

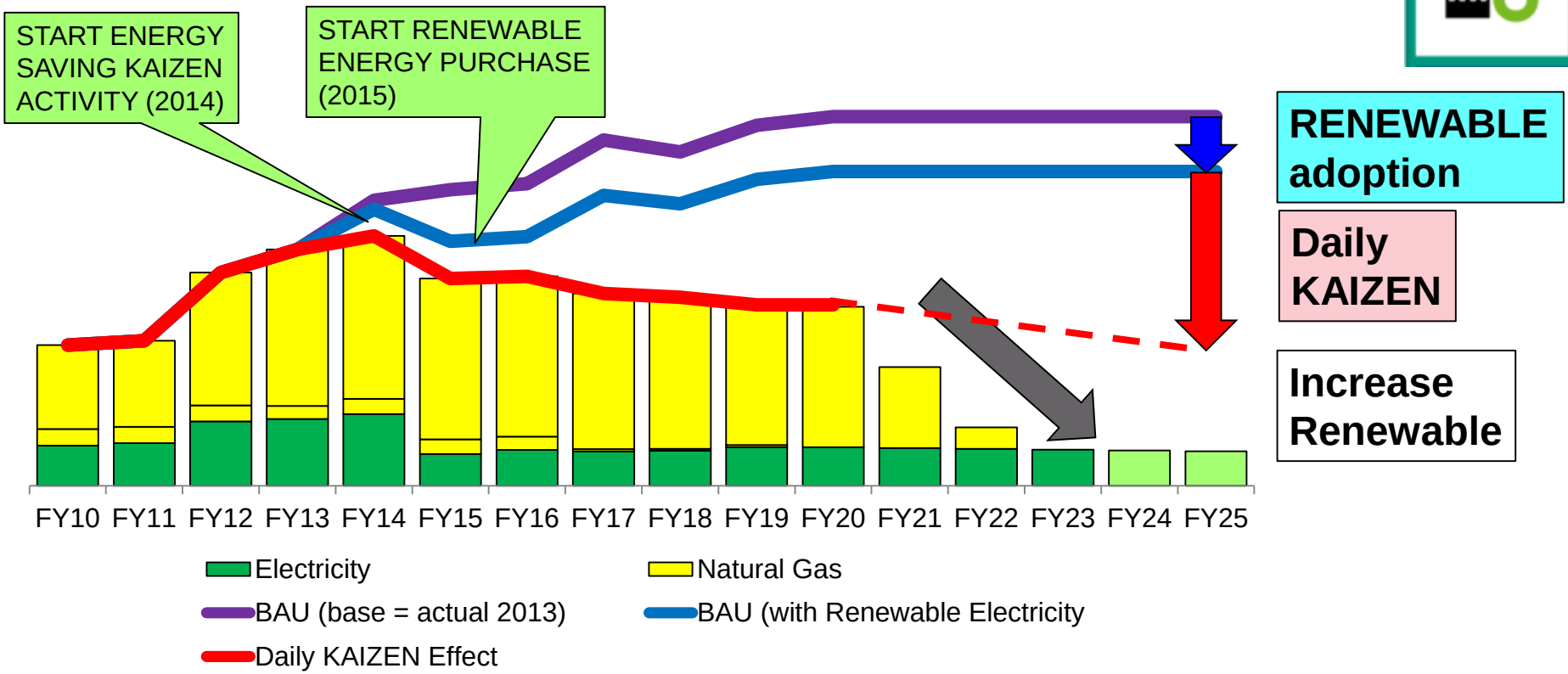


Despite production increase, <u>emission per unit</u> <u>decreased 52%</u> thanks to daily KAIZEN and renewable.

II. Toyota Environment Challenge 2050

Challenge 3: Plant CO_2 Zero Challenge

2. Roadmap towards Zero Emission



1) Conduct Energy Saving Daily KAIZEN Activity and
2) Increase renewable energy usage
to achieve CO_2 Zero emission in 2025 (before TMC).

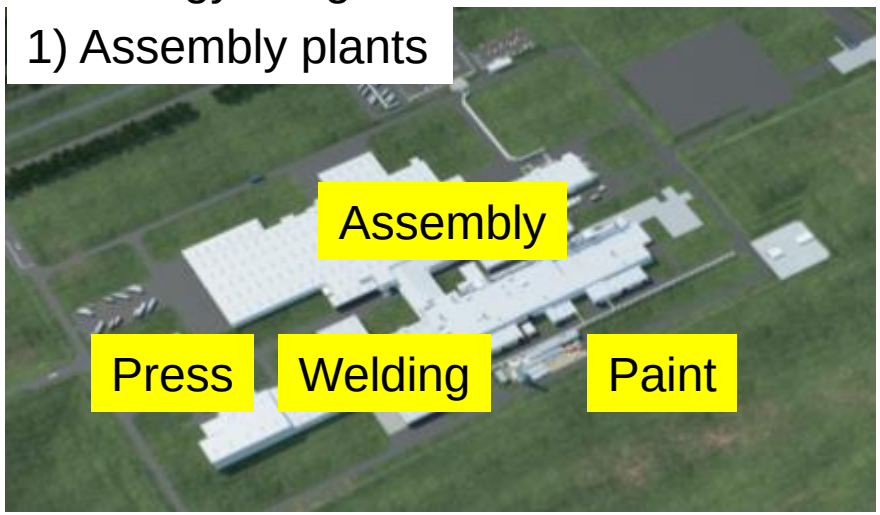
THANK YOU VERY MUCH!

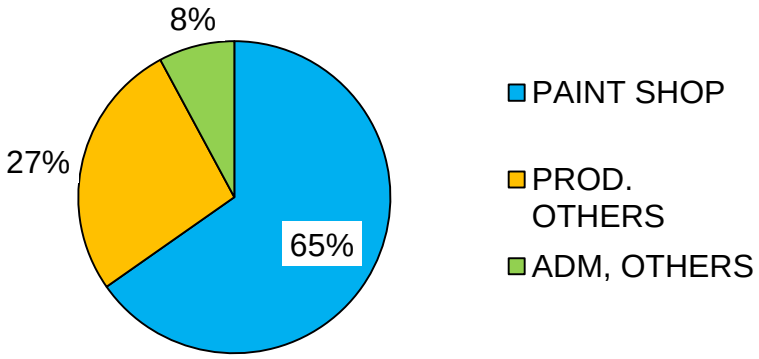
II. Toyota Environment Challenge 2050

Challenge 3: Plant CO_2 Zero Challenge

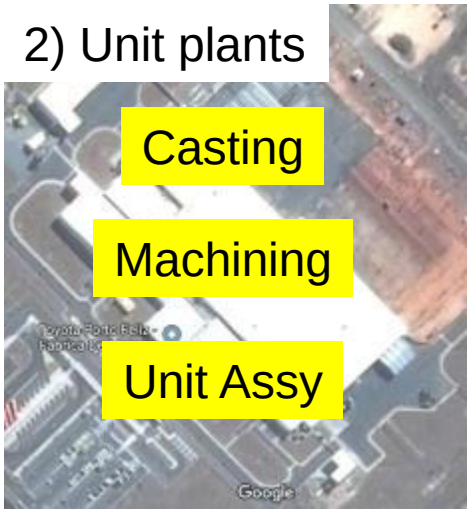
2. Energy usage

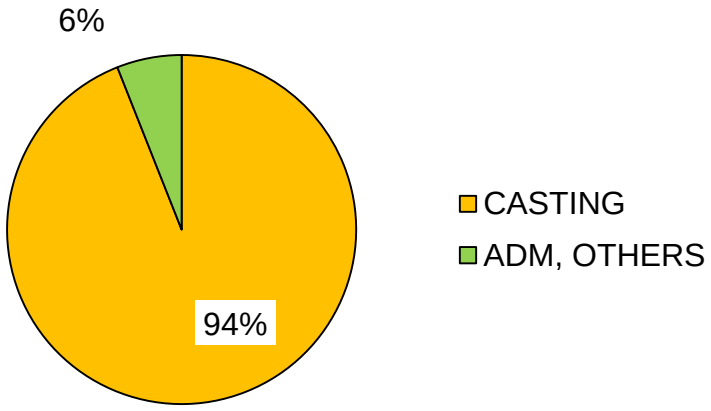
1) Assembly plants





2) Unit plants





Energy usage depends on plant characteristics.

II. Toyota Environment Challenge 2050

CHALLENGE 3
工場CO2ゼロチャレンジ

Challenge 3: Plant CO_2 Zero Challenge

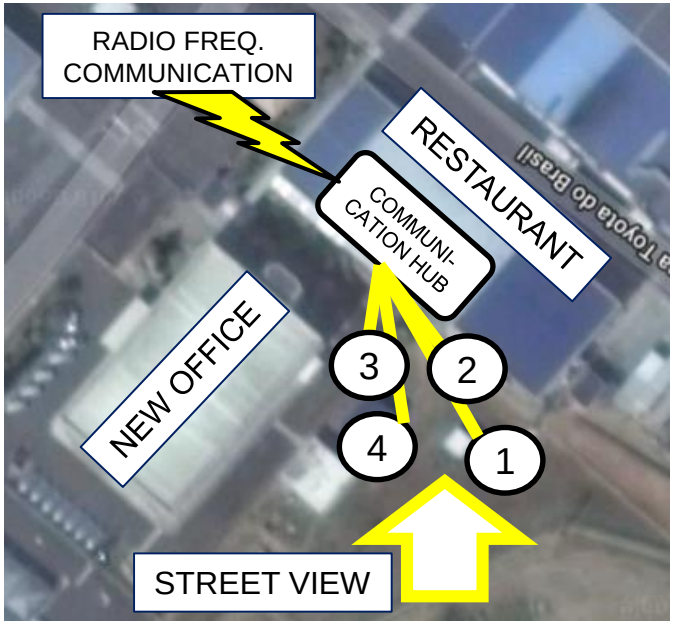
4. Energy Management System – “Supervisory”

6) Example of remote measurement

NEW OFFICE AND BANK ENERGY METER

RESTAURANT ENERGY

RESTAURANT ENERGY METER



RESTAURANT WATER

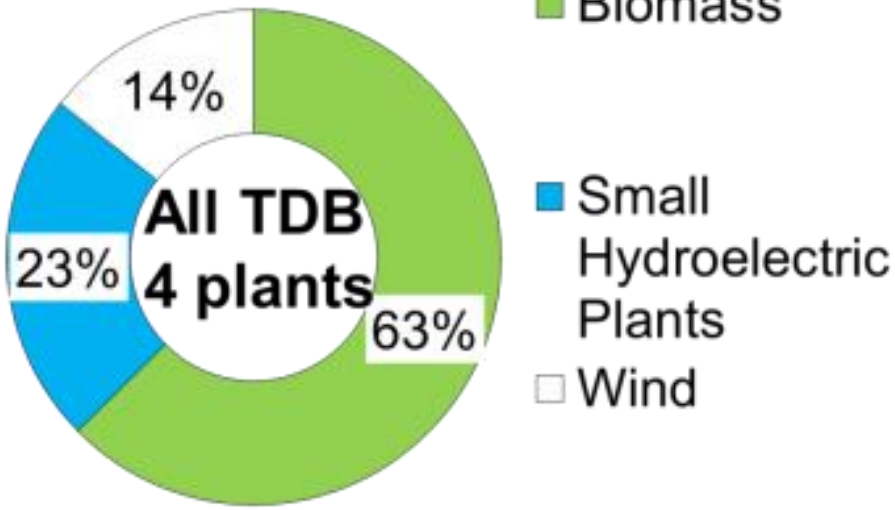
Information is concentrated in hub, then transmitted by radio frequency.

II. Toyota Environment Challenge2050

CHALLENGE 3
工場CO2ゼロ チャレンジ
CO2 0

Challenge 3: Plant Co2 Zero Challenge

6. Renewable Energy Adoption



Since January 2015, TDB is purchasing **100%** energy from **renewable sources.**

Kg CO_2 reduction per kWh = ▲47%