

# Water Efficiency at Toyota Motor Europe (TME)

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# TME's Stance to Environment:

Toyota → Resource Efficiency (“Zeronise & maximise”) Towards  
Zero waste, zero emissions

## Toyota's Earth Charter: 4 Pillars

1. **“Contribute toward a prosperous 21st century society”:**  
Challenging the achievement of zero emissions throughout all areas of business activities
2. **“Pursuit of environmental technologies“:**  
Enable environment and economy to coexist harmoniously
3. **“Voluntary actions”** On regional, national and global scale and promote continuous improvement
4. **“Working in co-operation with society”**

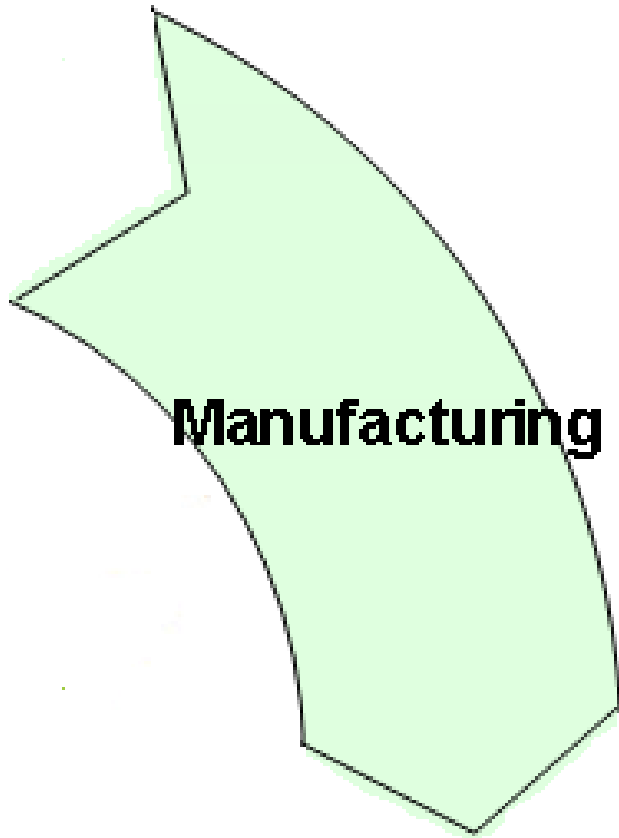


# In Practice: the 360° Approach EMS



- Toyota is made up of many core activities
- Resource use & environmental impact has a different meaning according to function
- During yearly Environmental Action Plan Review, each function must assess Environmental targets & resource management according to their functional use & relevance

# Manufacturing



**The Production Process at the European Manufacturing Companies (EMCs) is an area where**

- 1. Large quantity of resources are used**
- 2. Directly under our control**

**Therefore resource use is highly regulated.**



# Strict Management of 4 Environmental Aspects

**ENERGY/CO<sub>2</sub>**



**WATER**



**AIR**



**WASTE**



# Case Study: Water Management in Toyota Motor Manufacturing France (TMMF)



# Process for Managing Water use

## Basic Principle:

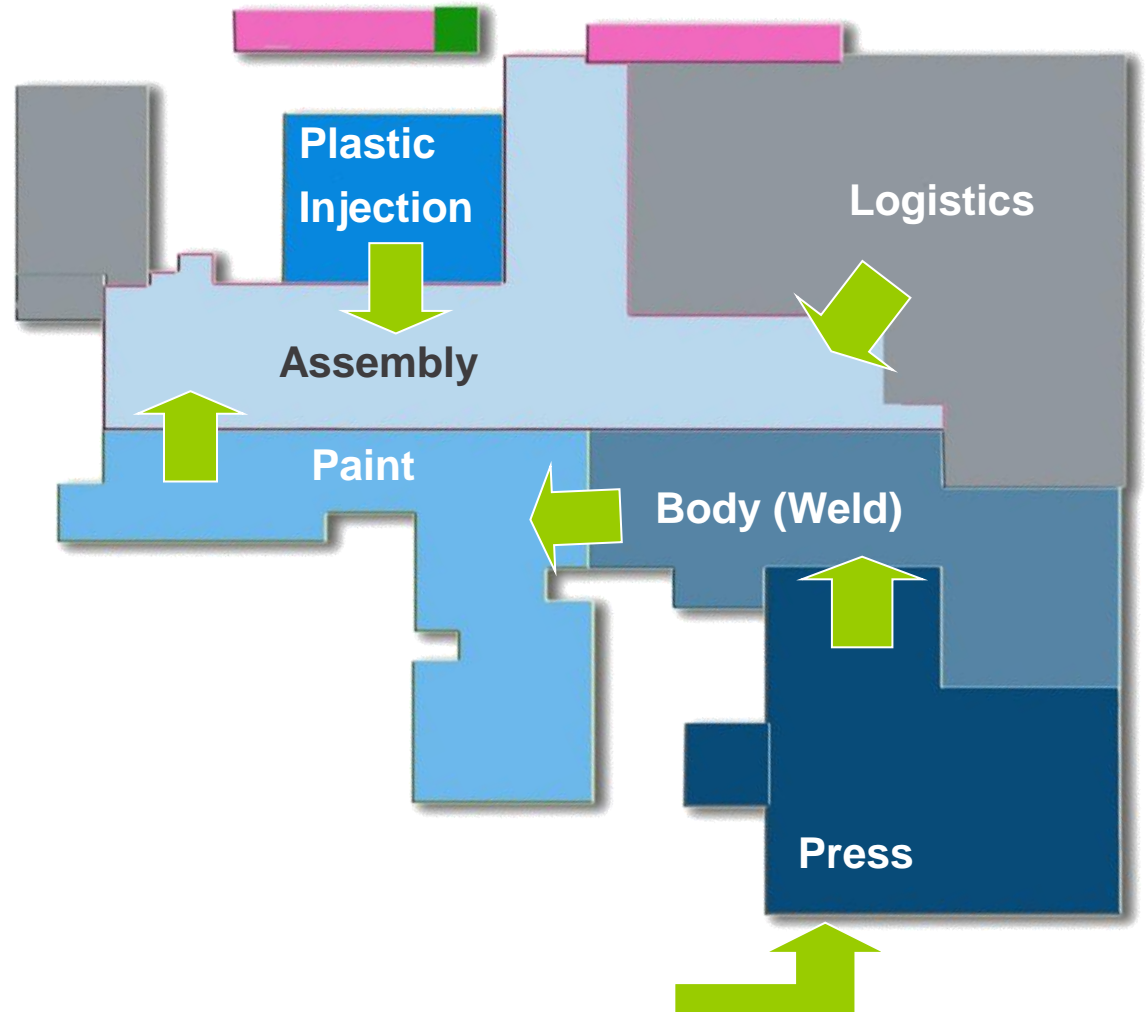
### Resource efficiency through Continuous Improvement (Kaizen)

1. Identify user
2. Identify How much/When/For what purpose
3. Work with process engineers to understand characteristics of water use & need
4. Assess possible countermeasures to reduce water use
5. Implement Countermeasures & monitor Results



# 1. Identify user: Priority to biggest impact

- Different purposes for water use according to shop
- Main water use in Paint shop (60-70%)
- Other major water use: cooling systems & steel rustproofing by electrochemical treatment

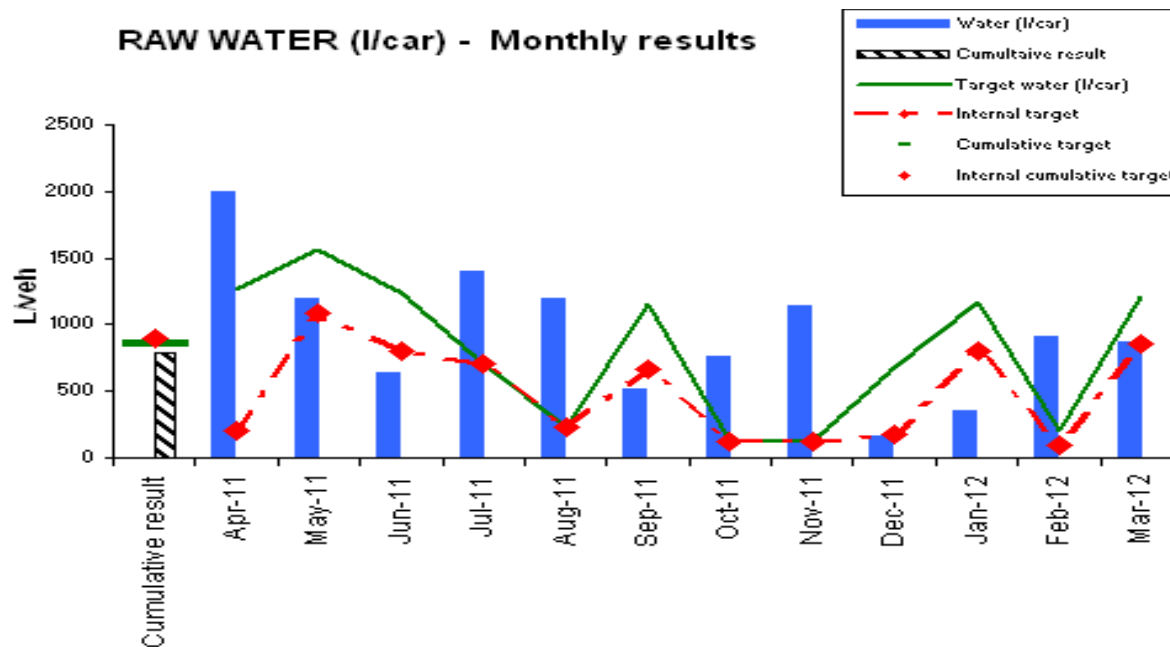




## 2. Identify where, how much, when & for what purpose:

### Water consumption is monitored rigorously

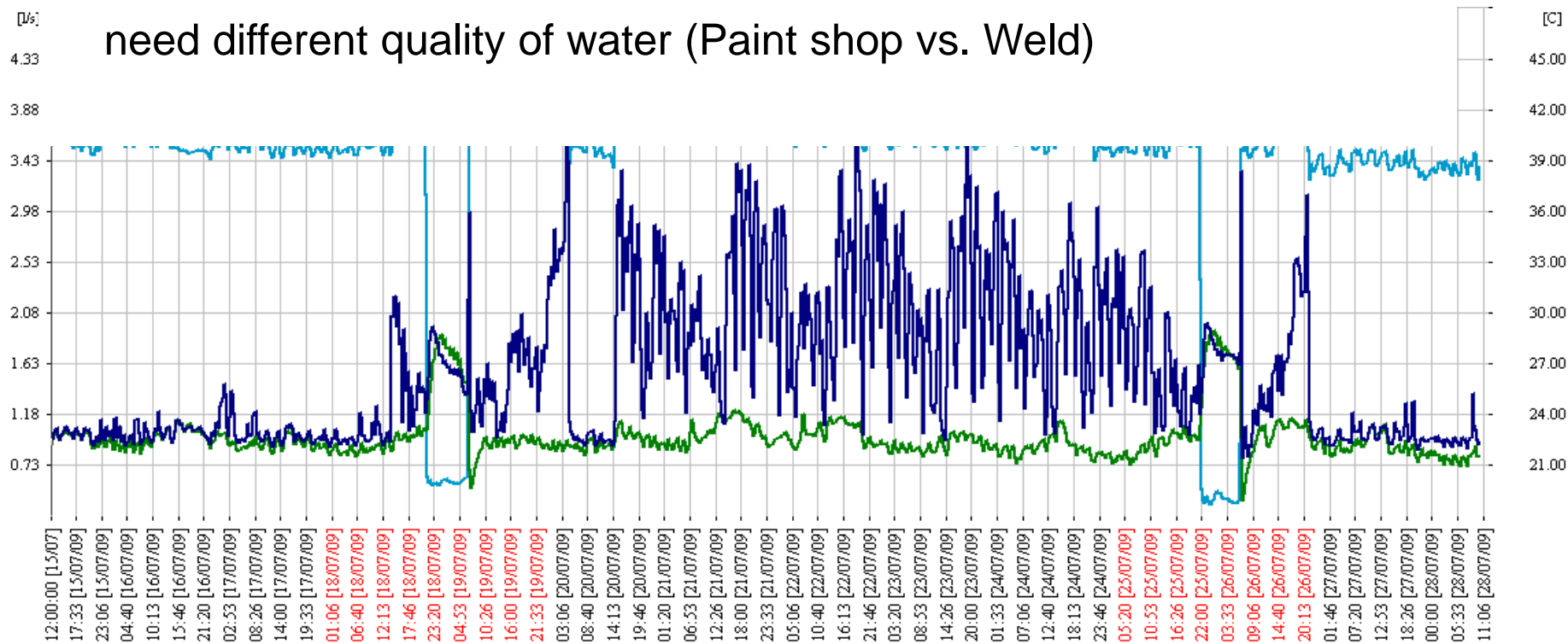
- Figures are presented to Top Management during monthly meeting
- Each shop and each manager is responsible to reach his own targets



# 3. Work with process engineers to understand characteristics of water use:

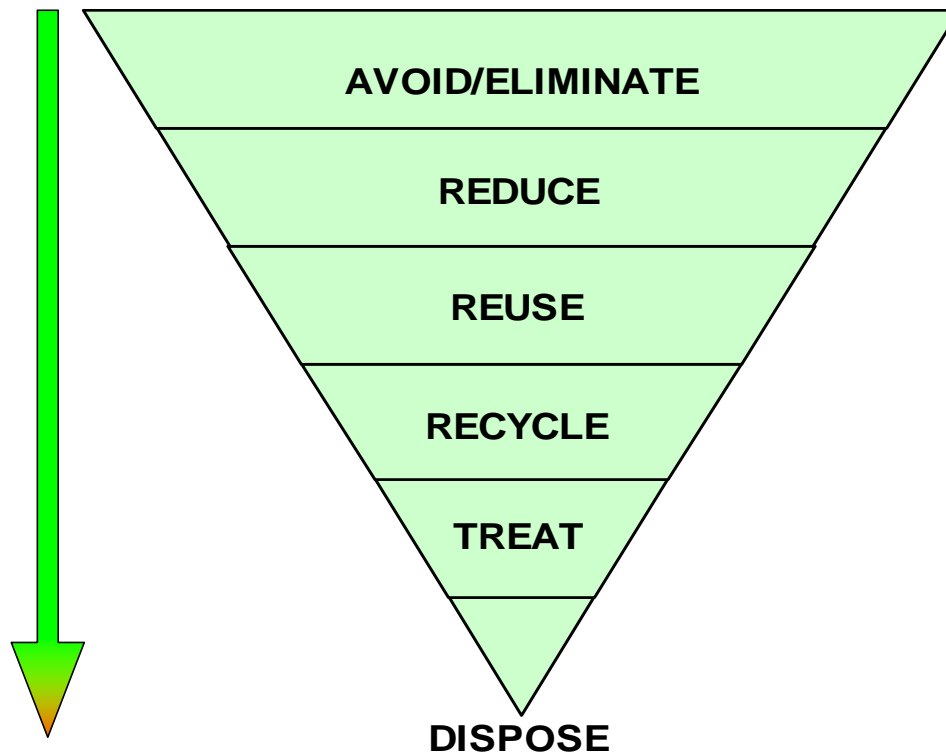
**Includes Pressure, Flow, Quality of Water, Temperature**

- According to purpose (previously identified) some processes may need different quality of water (Paint shop vs. Weld)



## 4. Assess possible countermeasures to reduce water use:

### Waste Hierarchy Pyramid:



## 4.1 Assess Countermeasures:

I.



AVOID/ELIMINATE

**Avoid use of clean drinking water in processes where high quality water is not necessary.**

**A) Directly from Suppliers:** TMMF Differentiates sources of water according to quality. 2 Water suppliers:

**1) Potable water** (for drinking, higher standards usually treated with fluorine)

**2) Industrial water:** non-potable water from the city network (polluted by NO<sub>3</sub>) not suitable for drinking but good for manufacturing).

**B) Substituting tap water with rain water:** In TMMF, a rainwater collection basin was installed in 2008 allowing rain water to be used in the manufacturing process.



**TMMF saves 36%** of the plant's normal use of purchased water by collecting and recovering rainwater from the yard.

Cost of installation : 200 000 €

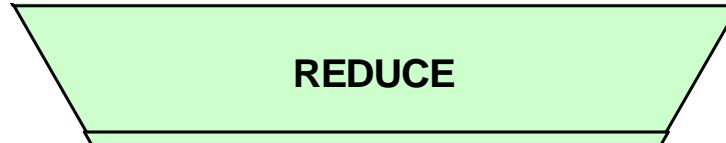
Took 1 yr for it to become operational SOP : January 2009

Cost recovery : actual 4 years, below our calculation of 2 years essentially due to decrease of production and low rainfall since 2009.



## 4.2 Assess Countermeasures:

II.



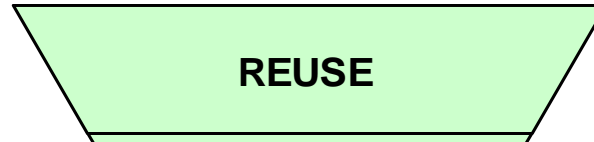
**Reduce quantity of necessary water in processes by installing new equipment that is precise in its use & regularly updating outdated equipment**

Ex: Cooling water plants are required to operate while injection machines are running to supply water to chillers & hydraulics.

The old equipment was on all the time, however plant timers were installed that enable cooling water to automatically switch on & off at start/end of each shift.

## 4.3 Assess Countermeasures:

III.

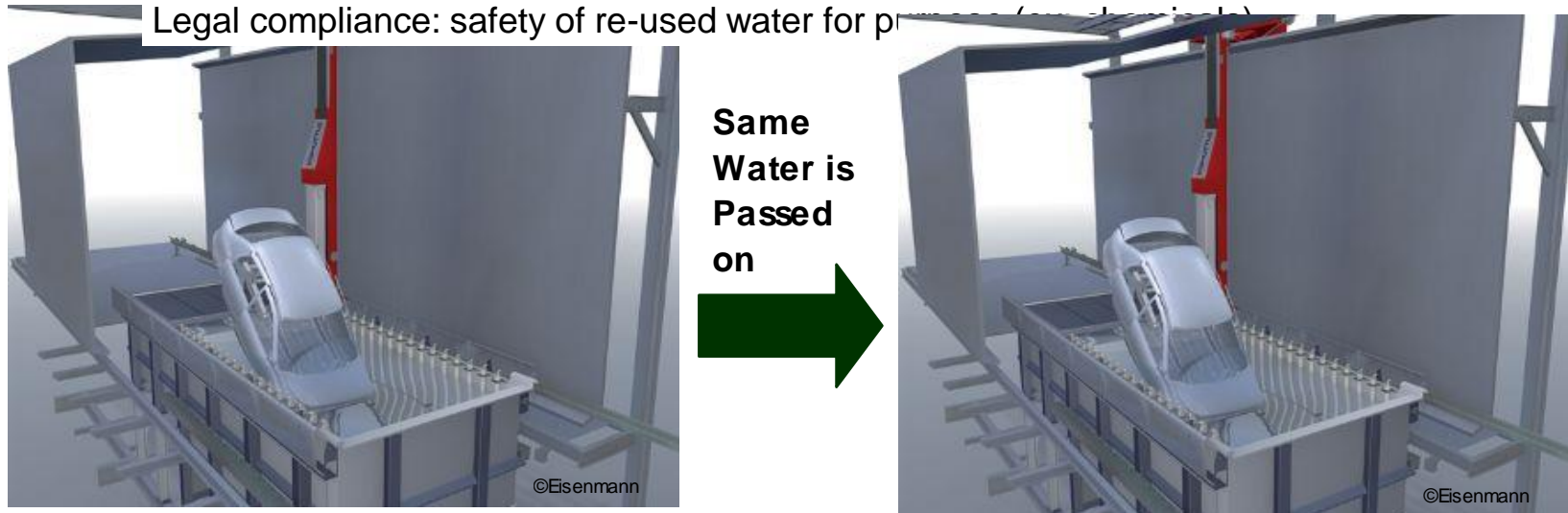


**Cascaded water use:** Gray water discharged by shops can sometimes be re-used by other shops without any treatment.

**Constraint :**

Make sure re-used water doesn't impact quality

Legal compliance: safety of re-used water for p





## 4.4 Assess Countermeasures:



**By chemically/biologically treating water inhouse, water can then be reused within the process, thus creating closed loop systems.**



### 1. Example: Paint Shop

Water is sprayed in order to capture over-spray paint.

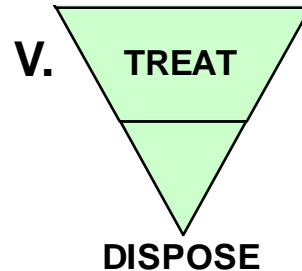
This water is recycled continuously within the process, after it passes through filters and chemical treatment to keep the water fresh

## **Overall TMMF treats all discharge water through inhouse Waste Water Treatment process**



**Today 40% of treated discharge water is recycled back into the production process**

## 4.5 Assess Countermeasures:



**All Water at TMMF plant is treated in-house**

→ **benefit we take control of whole process**

- 1. Chemical Treatment processes:** a) Dissolved air floatation b) Gravity settlement c) PH control
- 2. Biological Treatment processes:** micro-organisms that remove soluble polluting matter

After In-House treatment, the water discharged into rivers is cleaner than the river quality, with removed Nitrates



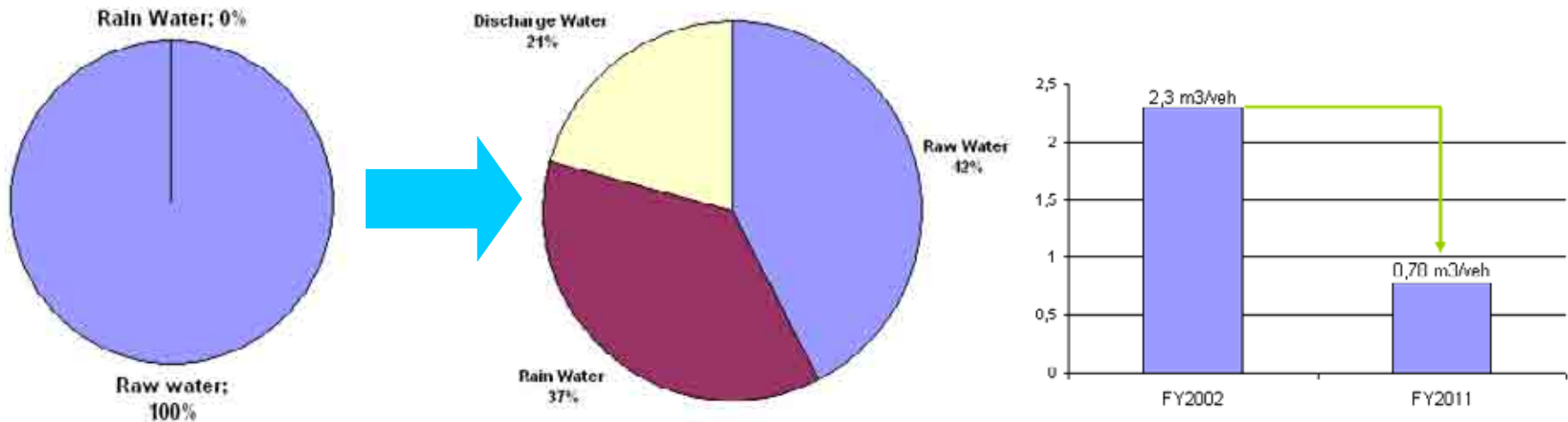
## Cost of water treatment :

- a) **Recycled water** ( coming from rain water + waste water treatment discharge water)  $\pm 0.25$  €/m<sup>3</sup> including Manpower, Energy, chemicals, consummables (filters)
  
- b) **Industrial water** ( coming from city network)  $\pm 0.75$  €/m<sup>3</sup> including Manpower, Energy, chemicals, consummables (filters)



# 5. Implement Countermeasures & Monitor results:

## Water Consumption Repartition

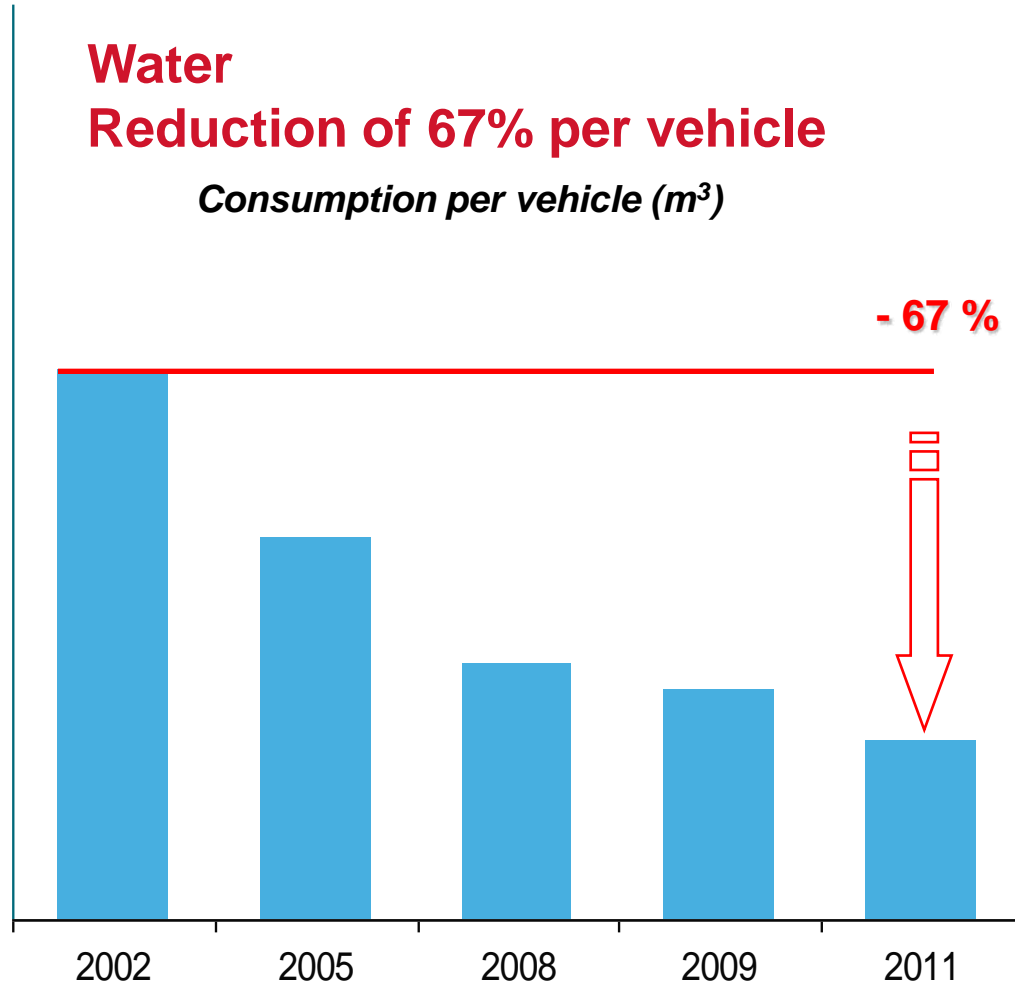


**In 2011, TMMF performance achieved zero purchased water consumption during 14 weeks**

Next challenge : extend our rainwater storage capacity to obtain zero water consumption all year long

# Results from Water Management Improvement Activities

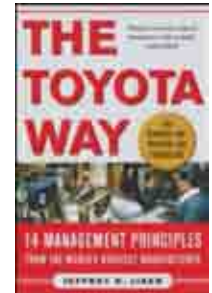
**Water  
Reduction of 67% per vehicle**  
*Consumption per vehicle (m<sup>3</sup>)*



# Main Motivations

## 1) Toyota Way Values: Continuous improvement through

- **Challenge**: includes view of Long-range perspective
- **Kaizen**: Innovative thinking, building lean systems & structure
- **Genchi Genbutsu**: Solving the problem by going to the source & finding the facts



## 2) Toyota Production System (TPS): Lean Manufacturing based on process standardization and « Kaizen » activities

- Objective to remove overburden (muri) inconsistency (mura), and to **eliminate 7 forms of waste (muda)**



# Comments & Considerations:

- 1) Manufacturing plants are very technology based:** Open to innovation –no “traditional way” of doing things. Equipment & machines facilitate more efficient use of resources
- 2) Engineering & Maintenance Personnel:** TME & EMCs benefit from much technical in-house knowledge for improving efficiency, & continuous improvement.



# Comments & Considerations:

- 3) Benefit of having invested early:** No big peaks of costs, simply continuous improvement. (TMMF was created with resource efficiency in mind (a compact plant with 30 % less surface than usual (170.000 m<sup>2</sup>))

**For ex: the network to differentiate potable water vs. industrial water has always existed therefore no extra cost**

- Could explain why water use is more price inelastic than other industries as resource efficiency fairly advanced
- recognize that making changes might require greater cost for other industries who haven't started

# Comments & Considerations:

- 4) **Using the appropriate technology is important:** deciding whether or not to install a system, must consider the costs of buying, installing and maintaining the system:

Verify alternative solutions according to need purpose:

## Ex: Selection of Water Treatment System

(from BREEAM)

	Cesspool	Septic tank	Micro-treatment plant	Constructed wetland	Connection to sewer
Capital cost	Low	Medium	High	Medium	Varies with sewer/site position
Maintenance	Low	High	High	High	Low
Frequency of waste removal	High	Medium	Low	Low	Never, unless pump failure occurs
Area required	Low	High	Low	High	Low
Ground type	any	Well draining	Watercourse nearby or well draining	Well draining	any
Electricity use	no	no	yes	yes	Yes if pumping required

# Comments & Considerations:

- 5) **Opt for the quick wins:** Some financial investments (like fixing leaks) can be quite small, but with significant impact
- 6) **EMCs benefit from constant environment** (not usually impacted by external factors such as weather)
- 7) **Production is dependent on demand** (pull rather than push incentive)
  - & Using more water will not grow more cars,
- 8) **We are a measured industry:** Tradition of monitoring through lean manufacturing.

## Quick Facts:

- Since 2002, consolidated Toyota manufacturing plants across Europe have reduced purchased water usage (m<sup>3</sup>/vehicle) by 54%.
- By developing reverse osmosis technology, TMUK recycled over 150,000m<sup>3</sup> of waste water since 2003, a reduction of ±1m<sup>3</sup> /vehicle
- In 2011, the average total water consumption needed to manufacture a Toyota car in Europe was 2.1m<sup>3</sup>/vehicle.
- TMMF achieved best performance in FY11, with 0.78m<sup>3</sup>/vehicle.

**Thank you**