



Challenges faced and Achievements by Two-Wheeler manufacturers

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10th Nov. 2022



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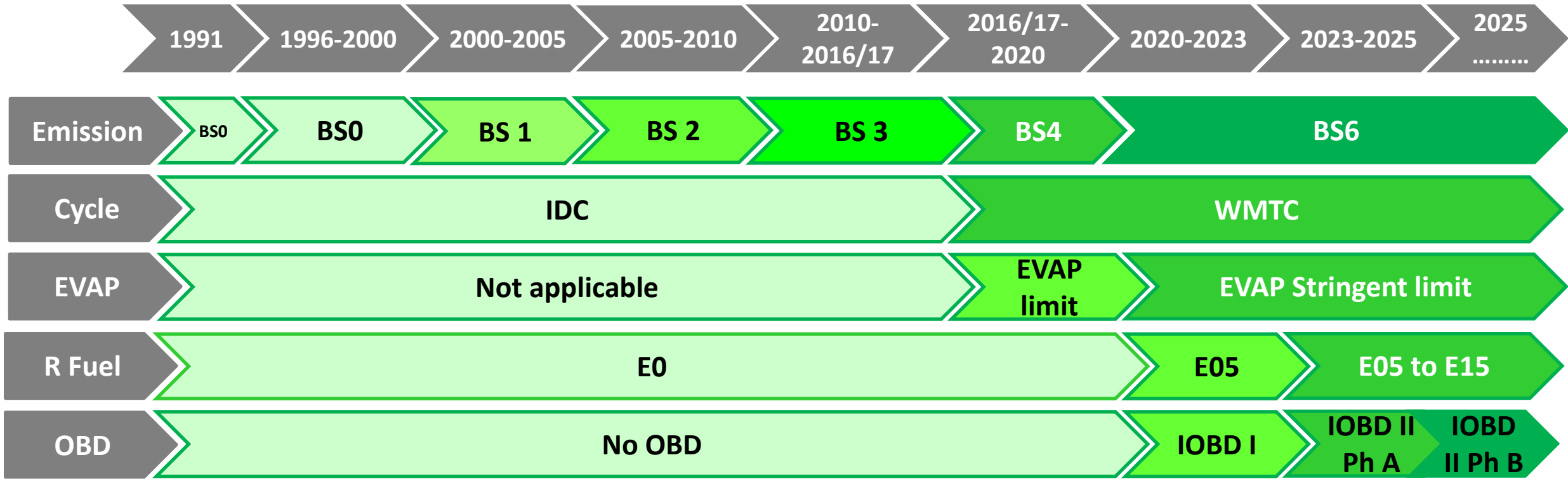
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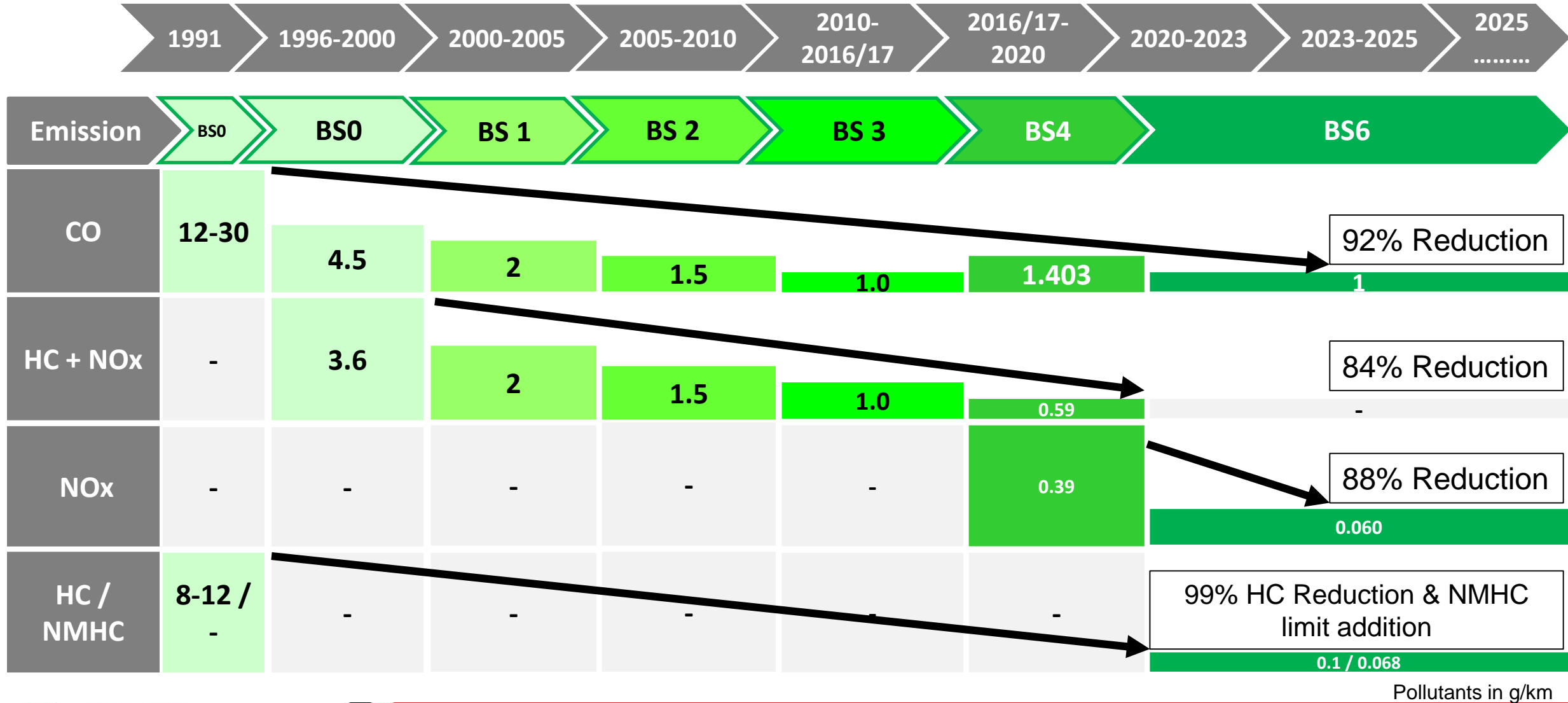
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Future challenges

Overview of India's Emission Regulation for 2 wheeler



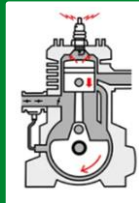
Overview of reduction in various pollutants



Technology Evolution 1991 - 2000



Introduction of CO & HC measurement



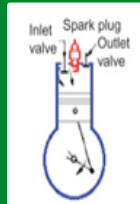
Mostly 2 Stroke engine were dominant



Majority were simple carburetor for fuel metering.



No use of after treatment device



4 strokes engine introduced due to stringent emission limit and for FE improvement

05 BS 1

1995 - 2000

1991 - 1995

2016 - 2020 BS 4

2020 - 2023 BS 6 OBD 1

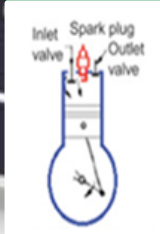
Technology Evolution 2000 - 2010

2005 - 2010
BS 2

2000 - 2005
BS 1

1995 - 2000

1991 - 1995



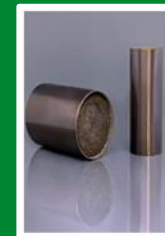
4 stroke engine started dominating 2 stroke.



Improved carburetor version with simple electronics (ignition switch)



Improved CDI with more than single ignition curve started getting introduced



Oxidation catalyst started getting introduced to address reduction in emission.

Technology Evolution 2010 - 2020

2005 - 2010 BS 2

2010 - 2016 BS 3

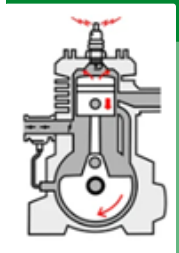
2000 - 2005 BS 1

1995 - 2000

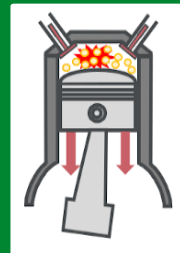
1991 - 1995

2016 - 2020 BS 4

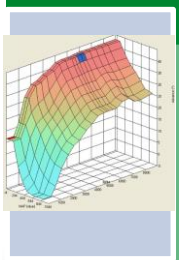
2020 - 2023 BS 6 OBD 1



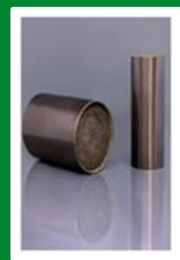
Two stroke engine negligible presence in market.



4 stroke engine Port fuel injection

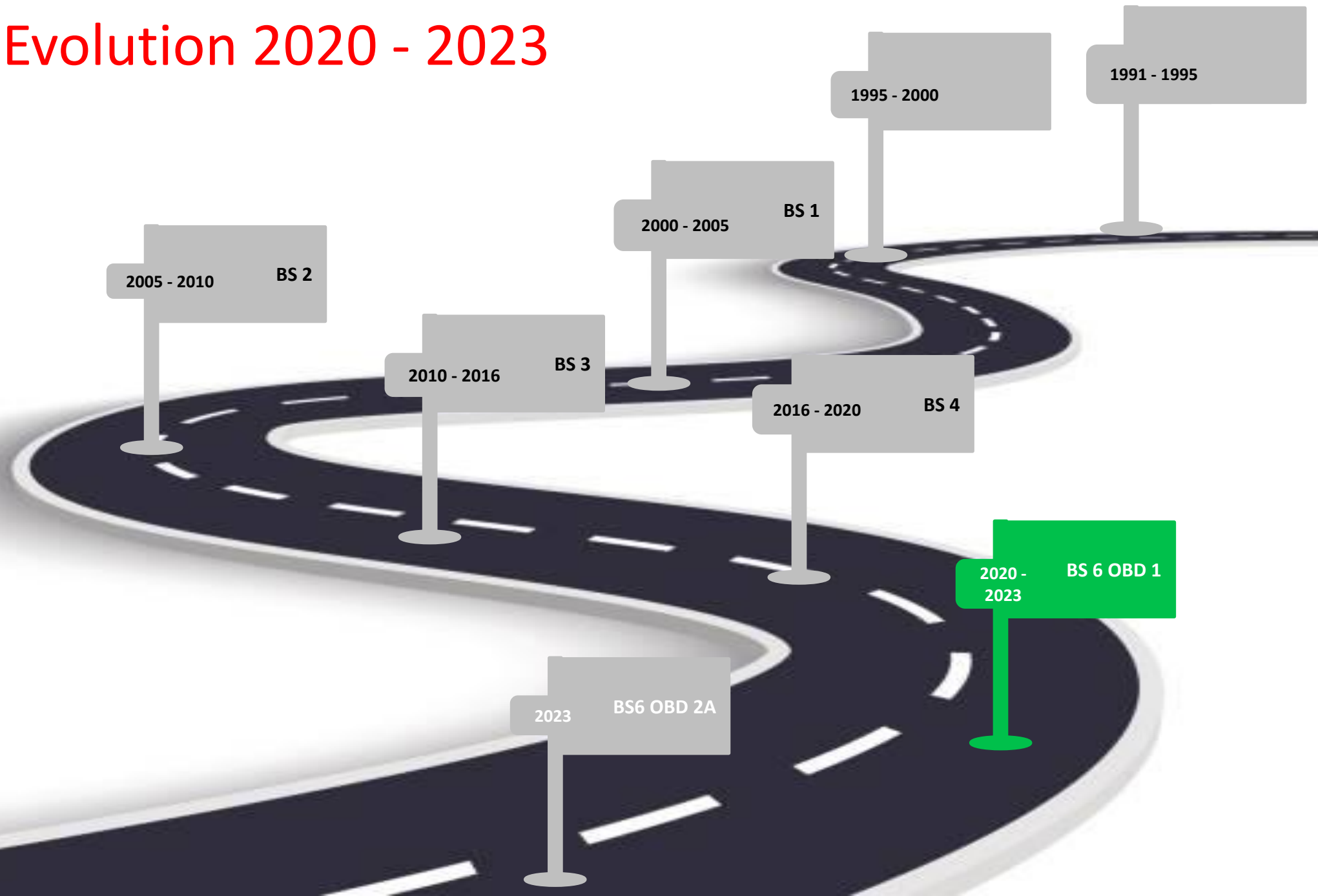


Multipoint ignition points

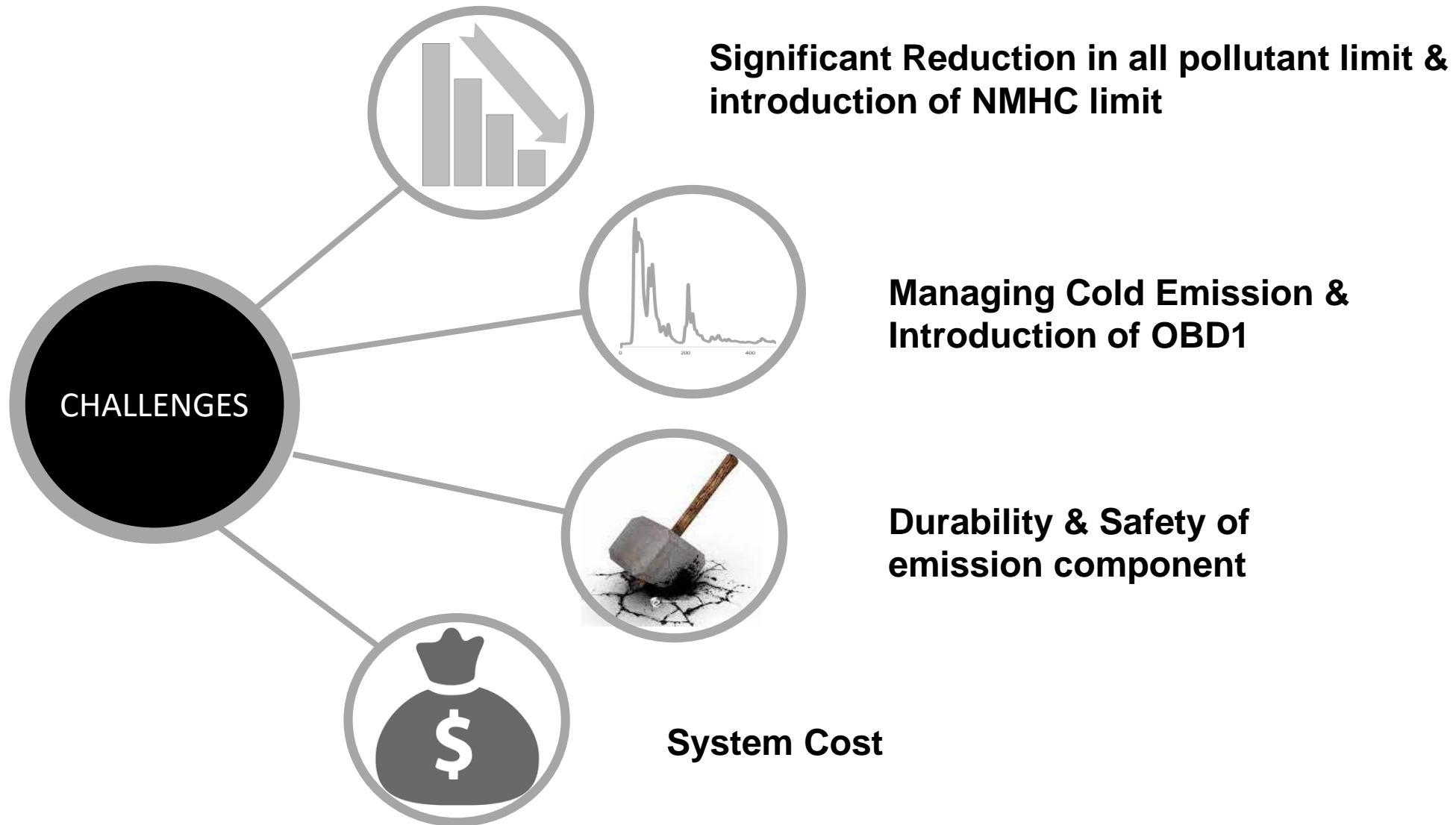


Improved Oxidation catalyst

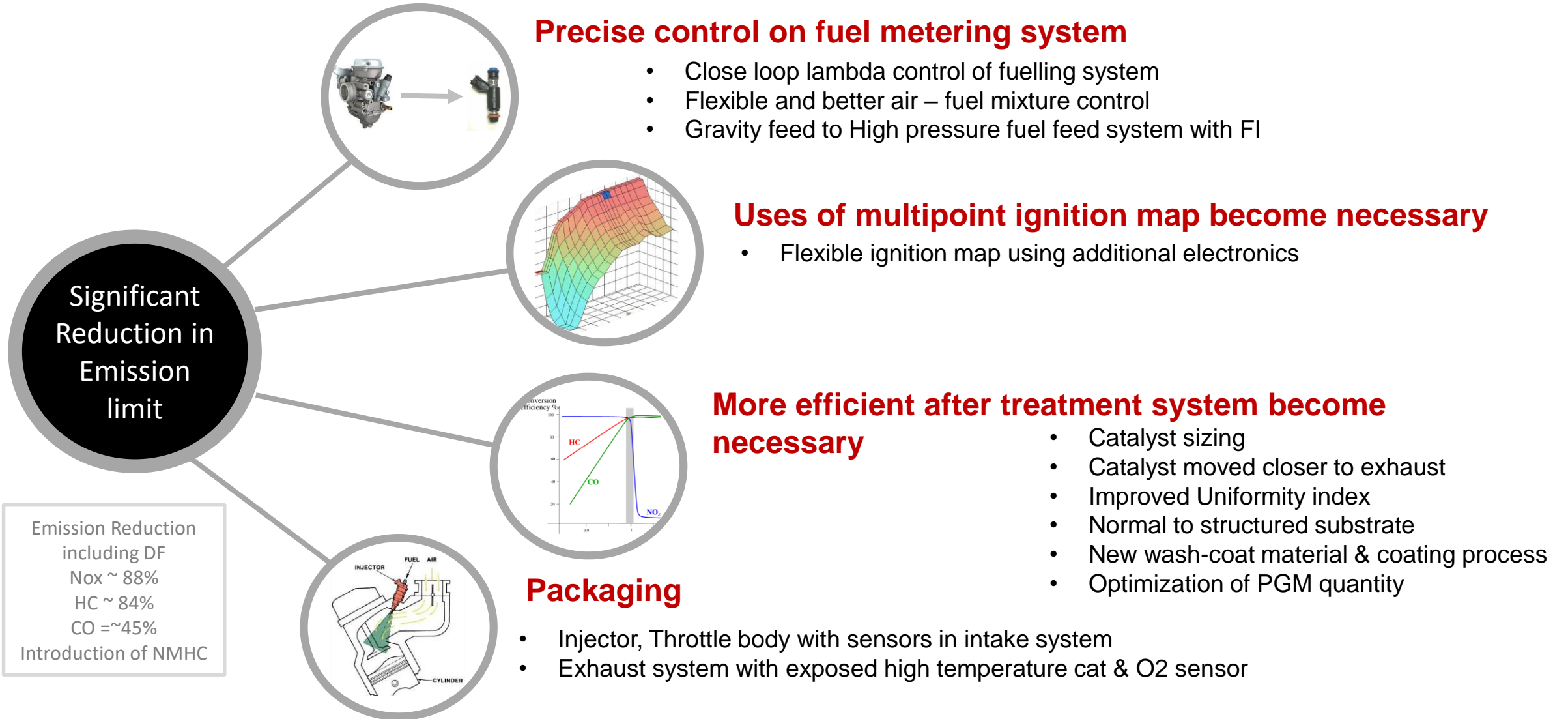
Technology Evolution 2020 - 2023



Major challenges – BSIV to BSVI



Major challenges – BSIV to BSVI



Emission Reduction including DF
Nox ~ 88%
HC ~ 84%
CO ~ 45%
Introduction of NMHC

Precise control on fuel metering system

- Close loop lambda control of fuelling system
- Flexible and better air – fuel mixture control
- Gravity feed to High pressure fuel feed system with FI

Uses of multipoint ignition map become necessary

- Flexible ignition map using additional electronics

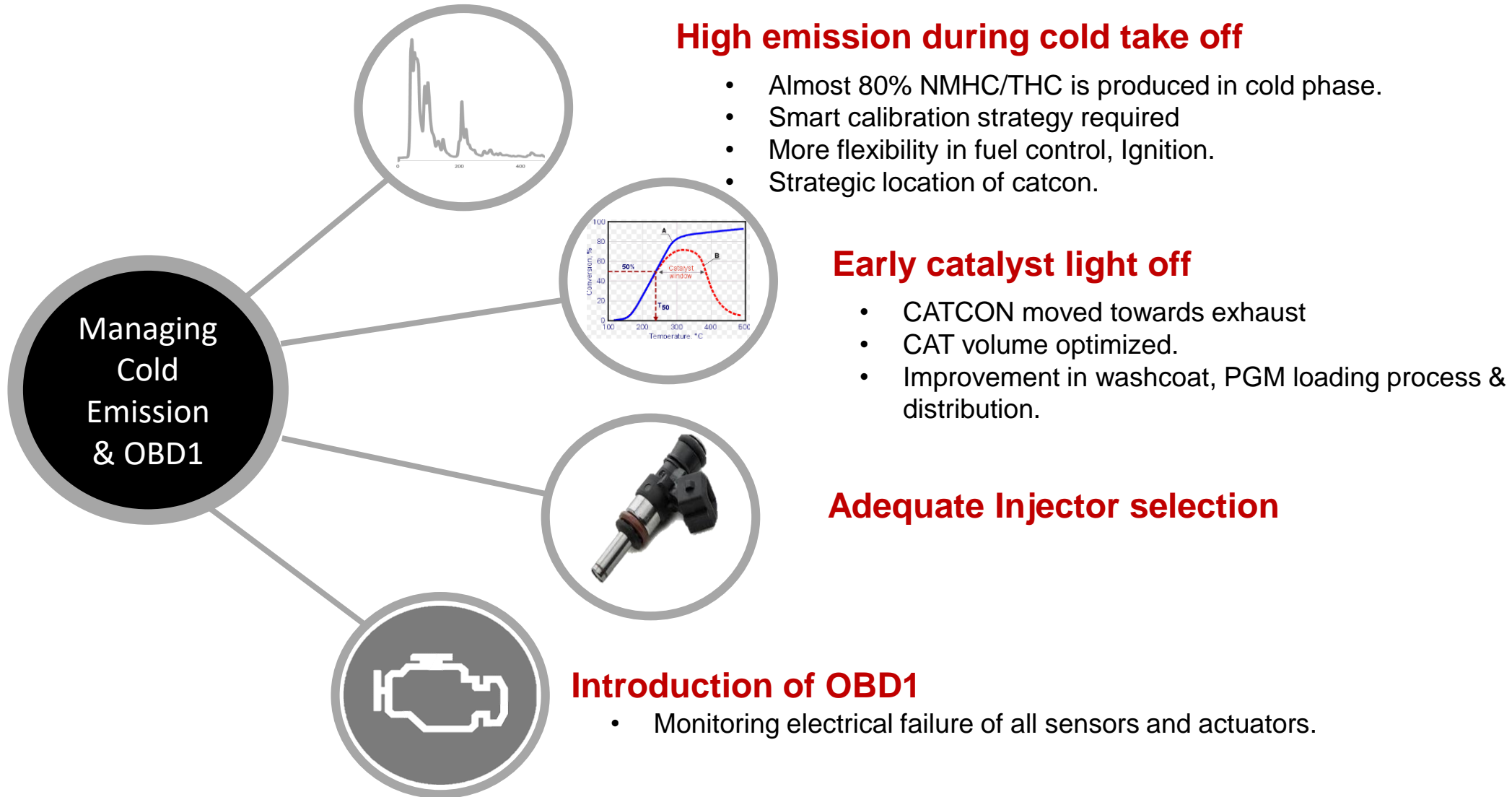
More efficient after treatment system become necessary

- Catalyst sizing
- Catalyst moved closer to exhaust
- Improved Uniformity index
- Normal to structured substrate
- New wash-coat material & coating process
- Optimization of PGM quantity

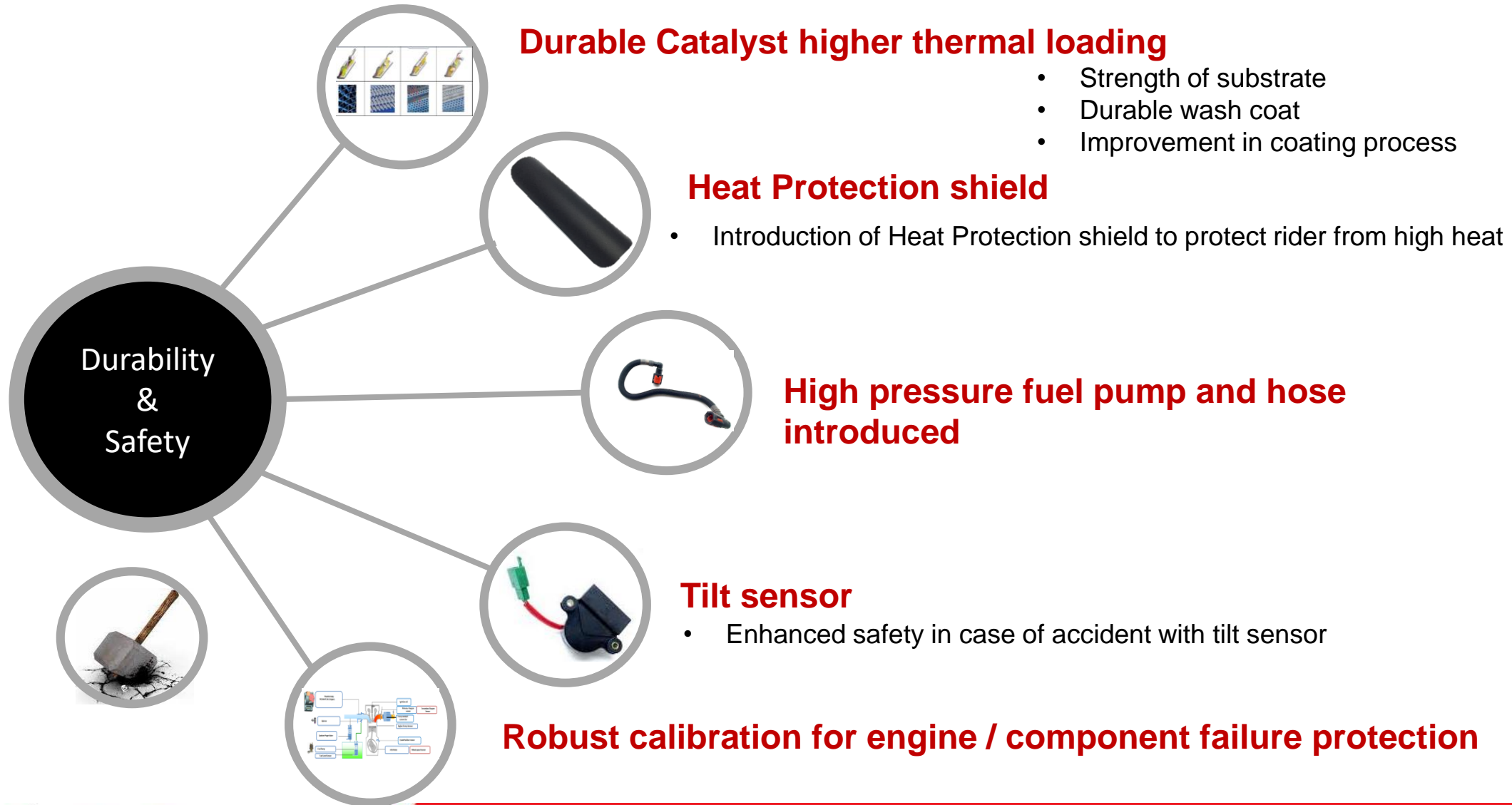
Packaging

- Injector, Throttle body with sensors in intake system
- Exhaust system with exposed high temperature cat & O2 sensor

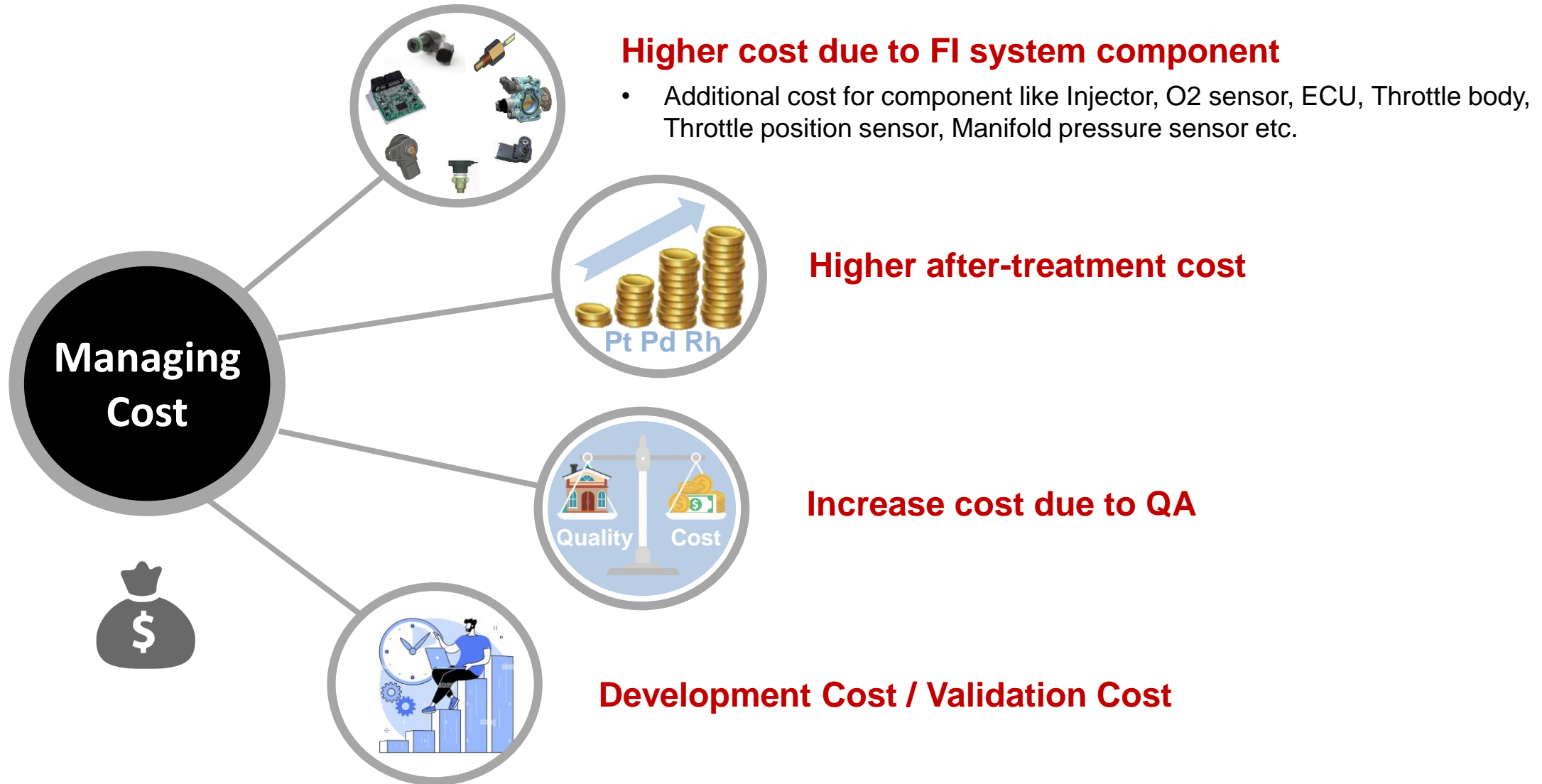
Major challenges – BSIV to BSVI



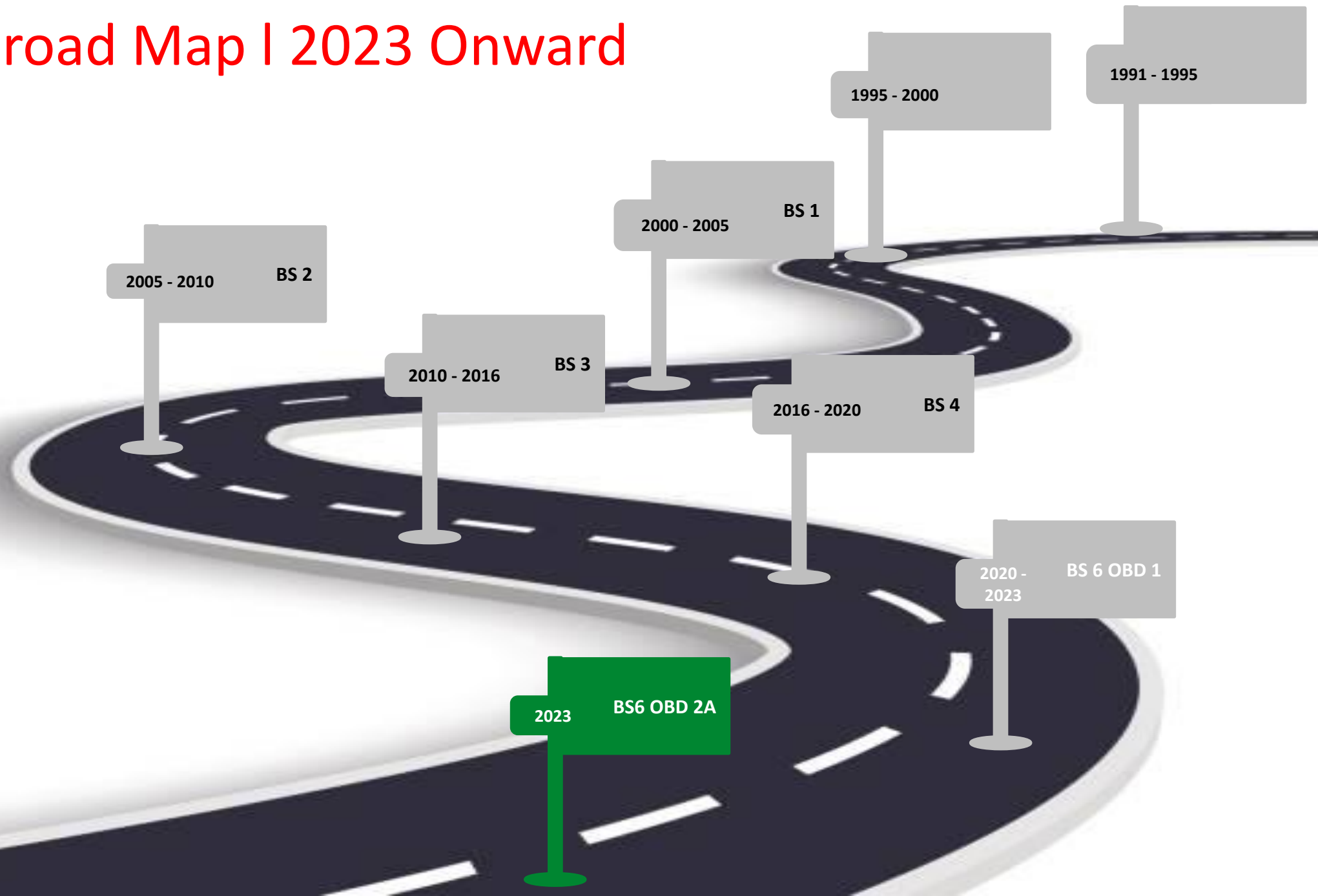
Major challenges – BSIV to BSVI



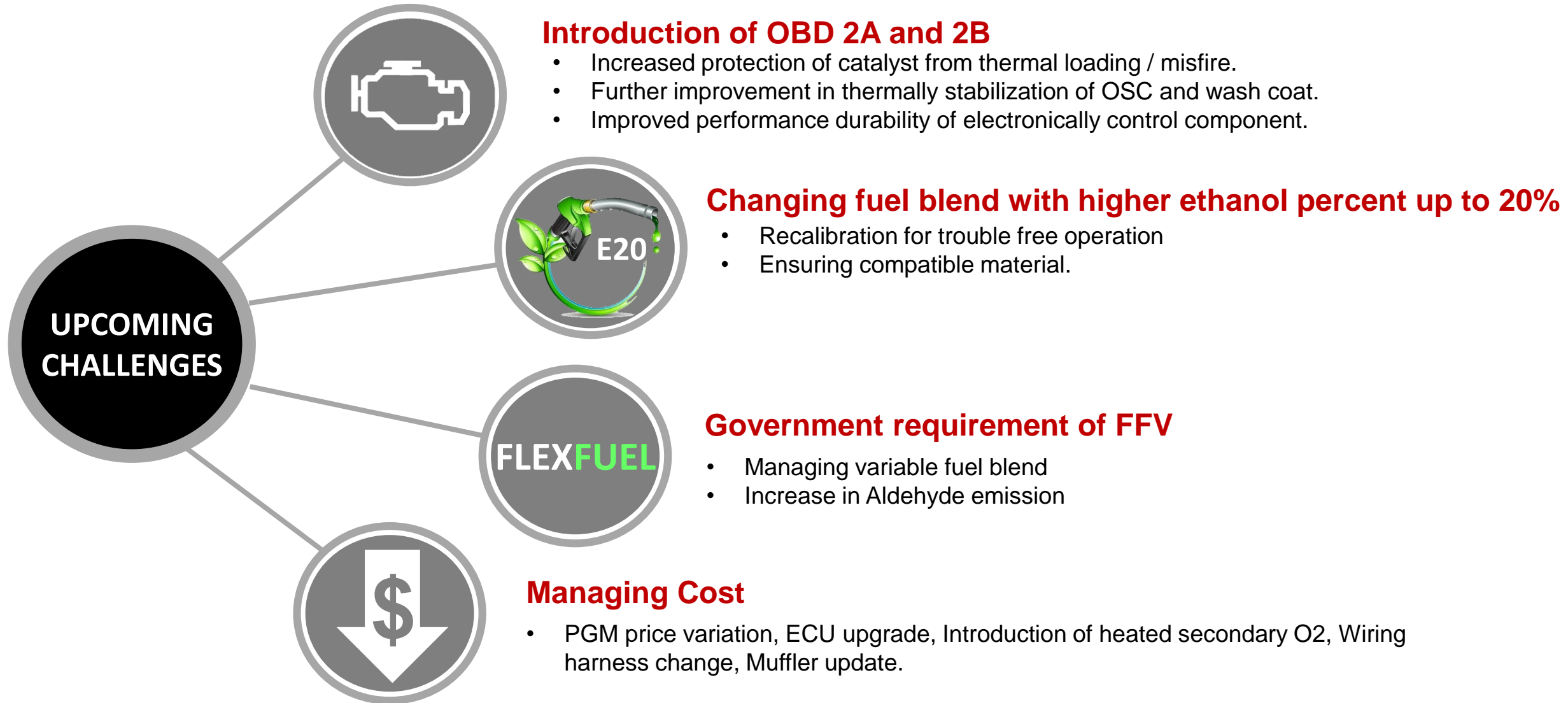
Major challenges – BSIV to BSVI



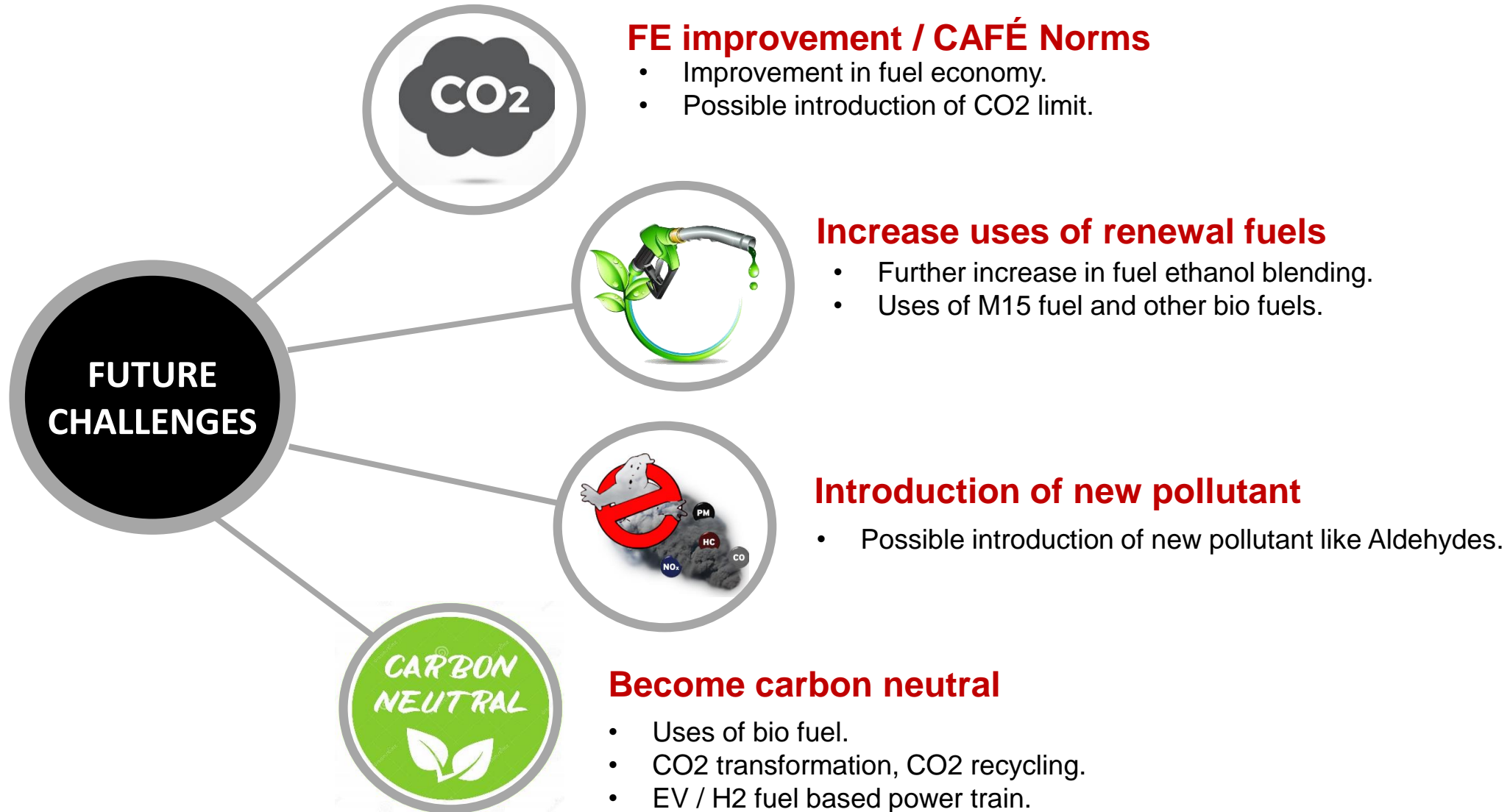
Technology road Map | 2023 Onward



Upcoming further challenges post BS6



Future challenges



*Challenges are what make life interesting
and
overcoming them is what makes life meaningful*

Joshua J. Marine