

# BAT emission legislation worldwide

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## ○ Agenda

- How we understand BAT
- Motivation for BAT
- Air pollution | Economical Consequences
- Extract out of ww legislation and trends

## ○ How we understand BAT

- **B**est **A**vailable **T**echnologies in emission reduction
- Continuous research and development for solutions to reduce harmful substances to lowest possible level
- Continuous improvement of measurement devices to detect lower emission levels
- Continuous improvement on certification procedures to enforce and qualify innovative solutions
- The request for **B**est **A**vailable **T**echnologies enforces innovation and markets to the benefit of the society

## ○ Motivation for BAT

### Goals and intension for Industrialization | Mobilization

- Economical growth
- Technological development
- Value creation
- Prosperity of the society
- Higher living standards
- Higher mobilization





## ○ Motivation for BAT

### Side effects of Industrialization | Mobilization

- Pollutants released to the environment
- An increase in automobiles
- Congested cities
- Increasing per capita energy consumption
- Increased health effects
- Poisoning of water
- Increasing GHG and Global Warming



# Engineering Challenge to bridge Targets and Challenges

## Goals / Targets



## Challenges



The challenge to bridge industrialization and mobilization in emerging markets with health effects and sustainability

## ○ Air pollution | Economical Consequences

### OECD statements on economical consequences

- Health care cost due to air pollution in 2015 estimated with 21 billion USD
- Health care cost due to air pollution in 2060 estimated with 176 billion USD
- Equivalent to apr. **1% GDP by 2060**

### Health effect in New Delhi 2010<sup>1)</sup>

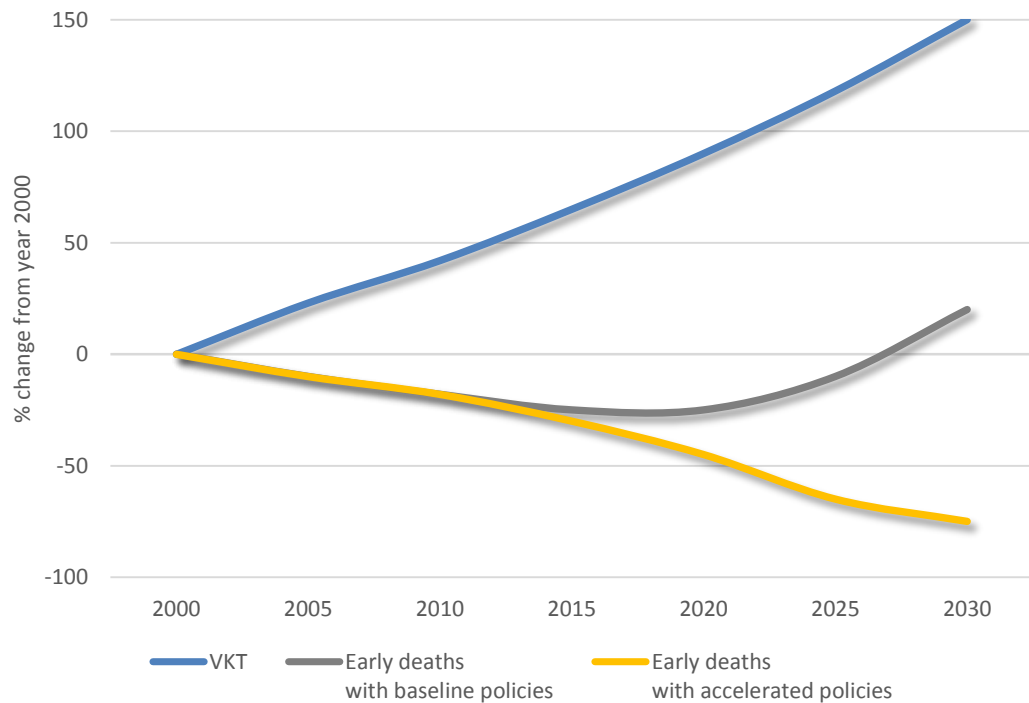
- 7,000 – 16,000 premature deaths
- 31,000 hospitalizations (respiratory and cardiac illness)
- 480,000 emergency room visits
- 51,2 million restricted activity days

1) Source: Guttikunda and Goel, 2013; Health impacts of particulate pollution in a megacity



## Air pollution | Effects from road traffic

### Global trends in vehicle-kilometers travelled (VKT) and early deaths from vehicle-related fine particle exposure



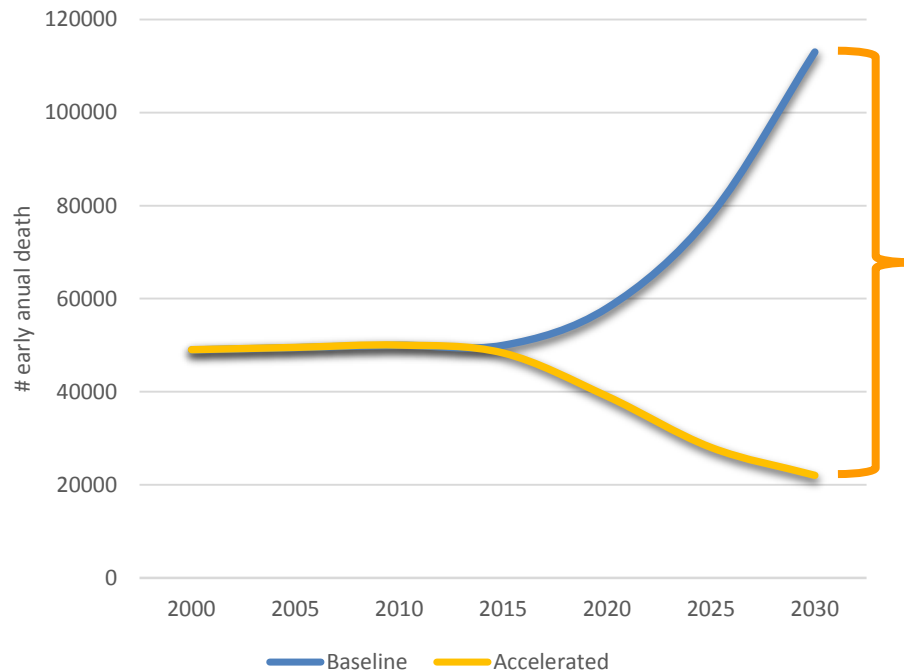
- VKT growth overcomes benefits of current policies by 2020
- Much lower limits on vehicle emissions would save more than 200,000 premature deaths in 2030 (equivalent to a 75 percent reduction)
- Action is most urgently needed
- First fit and retrofit



## Air pollution | Effects from road traffic

### Annual early deaths under current and possible enhanced policies

Countries: China & India



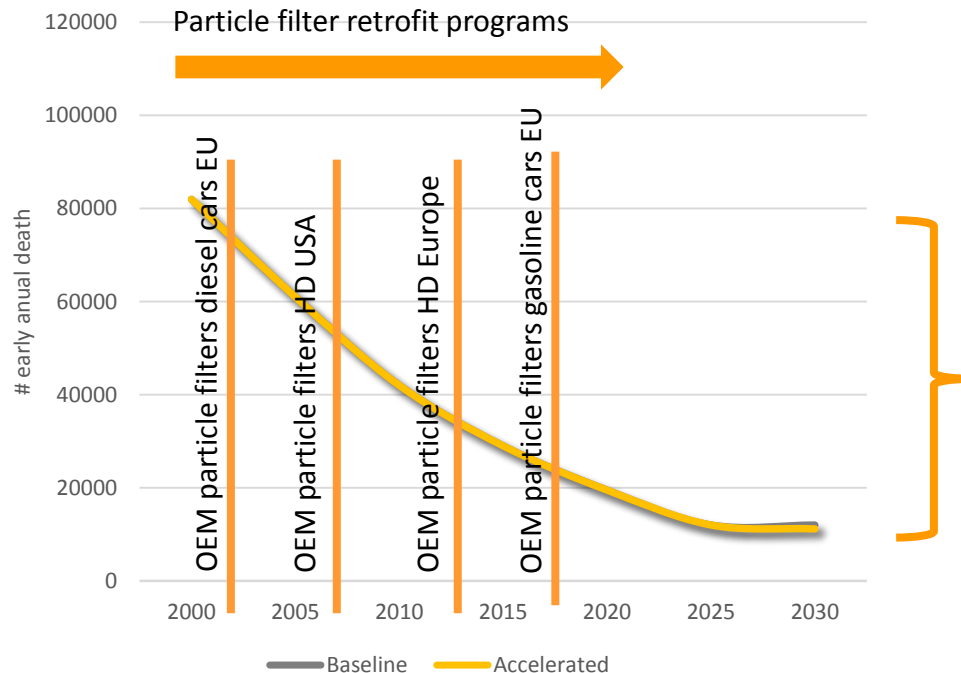
#### Effects and options

- India and China are the two most populous countries
- Without enhancing low emission technology plus filters for UFP China and India could see 110,000 early deaths p.a.
- Huge financial burden to the society
- Current standards are by far not stringent enough

## Air pollution | Effects from road traffic

### Annual early deaths by region under baseline and accelerated policies

Countries: EU-28; USA, CA; JP; AU; KR



#### Lessons learned:

- European commission force the use of the best available technology (filter) to address UFP
- EURO I ... V without particle filters was not successful
- Broad retrofit activities started early 2000 in Europa, USA, Korea and Japan
- USA introduced EPA '07 -> Particle Filters

## ○ Current Actions ww to enforce BAT

### China

- Aggressively working on vehicle emissions reduction OEM and Retrofit New law and China 6 by 2019
- Technical Guide for Pollutants After-treatment of in-use Diesel Vehicles in China VECC-MEP, October 2015
- VERT-Regulations based on SN277206 are also recognized
- Research on particle filter: VEMC Beijing, VECC Xiamen, VEMC Jinan and CATARC, Beijing Institute of Technology BIT ...
- Bluetech International Clean Air Technology Award - Clean Air Alliance of China (CAAC)
- Strong requirement to secure emissions in use
- Prohibitions against defeat devices or OBD tampering

## ○ Current Actions ww to enforce BAT

### India

- Fuel roadmap to BS VI
- a) fuel with maximum sulfur content of **50 ppm** across the entire country by April 2017
- b) fuel with maximum sulfur content of **10 ppm** across entire country by April 2020
- Skip of BS V -> direct move to BS VI for all models starting April 2020



## ○ Current Actions ww to enforce BAT

### IRAN

- City Bus Retrofit program in Tehran
- City Bus retrofit program planned in Isfahan
- DPF + EURO IV for new heavy duty vehicles under very challenging fuel quality levels -> leads to innovations
- Project started for – Maintenance and Inspection

## ○ Current Actions ww to enforce BAT

### USA

- US EPA is proposing more HD CO<sub>2</sub> reductions
- Current discussions: -24% on Class 7 and 8 trucks
- Mandatory closed crank case ventilation (CCV)
- CARB low-Nox
- Transatlantic workshop has been started to define environmental PN values

## ○ Current Actions ww to enforce BAT

### Europe

- Implementation of RDE (Real Driving Emission)
- Implementation of particle filters for gasoline engines
- PN limits for nonroad machines stage V starting 2019
- Various “Low emission” construction machines programs (retrofit)
- VERT has started an international workforce for NPTI (New Periodic Technical Inspection)

## Best Available Technologies



➔ **B**est **A**vailable **T**echnologies is a GLOBAL challenge