



# Training Workshop

## CDM Project Types and Technologies

### Fuel Switch

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# Table of Contents

1. Fundamentals of fuel switch
2. Fuel switch in power and heat stations
3. Fuel switch in road transport



# 1. Fundamentals of fuel switch



# CO<sub>2</sub> Emission Factors

- Burning of 1 mol Coal releases 1 mol CO<sub>2</sub> to the atmosphere!  
 $\Delta H = -393.5 \cdot 10^{-9} \text{ TJ / mol}$   
**Emission Factor (Coal)** =  $\frac{1 \cdot 44 \cdot 10^{-6} \text{ ton / mol}}{393.5 \cdot 10^{-9} \text{ TJ / mol}} = 111.8 \text{ t CO}_2 / \text{TJ}$
- Burning of 1 mol Heavy Oil releases 20 mol CO<sub>2</sub> to the atmosphere!  
 $\Delta H = -13\,300 \cdot 10^{-9} \text{ TJ / mol}$   
**Emission Factor (Heavy Oil)** =  $\frac{20 \cdot 44 \cdot 10^{-6} \text{ ton / mol}}{13300 \cdot 10^{-9} \text{ TJ / mol}} = 66.1 \text{ t CO}_2 / \text{TJ}$
- Burning of 1 mol Natural Gas releases 1 mol CO<sub>2</sub> to the atmosphere!  
 $\Delta H = -890.3 \cdot 10^{-9} \text{ TJ / mol}$   
**Emission Factor (Natural Gas)** =  $\frac{1 \cdot 44 \cdot 10^{-6} \text{ ton / mol}}{890.3 \cdot 10^{-9} \text{ TJ / mol}} = 48.4 \text{ t CO}_2 / \text{TJ}$



# Carbon Content of Fuels

$$1 \text{ mol Coal (C)} \longrightarrow \text{Carbon Content} = \frac{12\text{gC}}{12\text{gC}} * 100 = \underline{100\%}$$

$$1 \text{ mol Heavy Oil (C}_{20}\text{H}_{42}) \longrightarrow \text{Carbon Content} = \frac{240\text{gC}}{240\text{gC} + 42\text{gH}} * 100 = \underline{85\%}$$

$$1 \text{ mol Natural Gas (CH}_4) \longrightarrow \text{Carbon Content} = \frac{12\text{gC}}{12\text{gC} + 4\text{gH}} * 100 = \underline{79\%}$$



## 2. Fuel switch in power and heat stations



# Technology

Combusted fuel (coal) replaced by:

- fuel with a lower carbon content (including biomass and waste)
- by a (other) renewable energy source

Such projects is generally limited to boilers, turbines or engines used to produce heat, electricity, or both simultaneously in a combined heat and power (CHP) system.



# Submitted and approved methodologies and PDDs (April 05)

## Approved baselines and monitoring methodologies

- AM0007: Analysis of the least-cost fuel option for seasonally-operating biomass cogeneration plants
- AM0008: Industrial fuel switching from coal and petroleum fuels to natural gas without extension of capacity and lifetime of the facility

## Submitted methodologies under consideration

- NM0040: Replacement of Fossil Fuel by Palm Kernel Shell Biomass in the production of Portland Cement
- NM0048-rev: Indocement Sustainable Cement Production

Project - Alternative Fuel Component

- NM0077: Shell Fuel Switching and Cogeneration Project
- ~~NM0098: Nobreel Fossil to Biomass Fuel Switch Project in Brazil~~



# Suitability and obstacles of fuel switch in power and heat stations for CDM

- Establishment of baseline → easy
- Additionality → difficult
- Monitoring → manageable
- Potential project size → medium to large
- Practical perspective in the region → Armenia + Georgia low,  
Azerbaijan + Moldova moderate



## 3. Fuel switch in road transport



# Technology

Projects can include any switch to a lower GHG intensive fuel, expressed as [total grams CO<sub>2</sub>/km], including:

- Blend of biofuels (from biomass) and conventional fuels
- Gasoline/ diesel to natural gas/ biogas
- Gasoline/ diesel to hydrogen
- Gasoline/ diesel to hybrid-electric



# Infrastructure for gas vehicles

- Natural gas vehicles offer the lowest emission (90 percent less carbon monoxide) and pollution ratings but owners have few places to refuel their cars, a situation that is improving
- The use of natural gas prevents the pollution of environment which occurs in connection with fuel leakages. As with gasoline when it's transported there is no risk of oil spills in lakes or highways with this type of fuel that simply dissipate in the air



Source: <http://www.detnews.com/2002/wayne/0211/07/c03-1632.htm>



# Submitted and approved methodologies and PDDs (April 05)

**Approved baselines and monitoring methodologies**

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**Submitted methodologies under consideration**

- NM0082: Khon Kaen fuel ethanol project



# Suitability and obstacles of fuel switch in road transport for CDM

- Establishment of baseline → manageable
- Additionality → difficult
- Monitoring → manageable
- Potential project size → small to large
- Practical perspective in the region → moderate



# THANK YOU