# Keeping It on a Score of 1,5ºc with Zero Points to Methane

Maria- Eleftheria Kokkini

## Key points

To keep global temperature on $1,5^{\circ}$C and to minimize the extreme weather events, action must be taken to keep greenhouse gases at bay. Short-lived climate pollutants, such as methane, pose a greater short-term threat. By combating them first, the short-term success will lead to long-term investments.

The aim of this policy brief is to propose solutions to the reduction of methane emissions:

- With organic diversion,
- With new manure management practices,
- With the application of new strategies to enteric fermentation practices.

*Maria -Eleftheria Kokkini is an undergraduate student at the Department of International and European Studies, University of Piraeus.*

Πανεπιστήμιο Πειραιώς
University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
Department of International & European
Studies

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## 1. Introduction

Methane is a short-lived pollutant, accounted for about 25% of the manmade global warming. The Greek National Strategy for climate change should focus on combating it first, because of its already low levels, in order to reach long-term investments and the aim of 1,5°C.

## 2. Methane

Methane ($CH_4$) is considered one of the most important greenhouse gases and climate change contributors, and comes second in consequences after carbon dioxide ($CO_2$). Even though its lifespan is shorter than that of $CO_2$, the warming effect of a tonne of methane is much bigger than of the equivalent of $CO_2$ for the first decades after emission. That is a fact that should not be ignored.

In Greece, in 2012 for example, methane emissions were 8,254.87kt of $CO_2$ equivalent according to KNOEMA data, while $CO_2$ emissions were 80,043.28.

## 3. Sources, Uses, Consequences

**Anthropogenic sources**: Methane is released in the environment during the extraction of fossil fuels such as oil, coal and gas, industrial activities, agriculture, building construction and decaying rubbish in landfills.

**Uses:** Generation of electricity, production of other chemicals, natural gas for heating.

The main anthropogenic sources of methane emissions in Greece, as EUROSTAT suggests, are:

- Agriculture

**Air emissions accounts by NACE Rev. 2 activity**
Last update: 17-12-2018
Table Customization show

TIME | GEO | Air pollutants and greenhouse gases: Methane

Classification of economic activities - NACE Rev.2: Agriculture, forestry and fishing | Unit of measure: Tonne

| GEO | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | 196,675.88 | 195,745.17 | 199,243.55 | 198,485.92 | 196,429.35 | 192,596.74 | 185,276.8 | 182,196.77 | 179,286.14 | 178,338.79[8] |

- Livestock

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**Greenhouse gas emissions by source sector (source: EEA)**
Last update: 12-09-2018
Table Customization show

| TIME | | GEO | | Unit of measure |
| --- | --- | --- | --- | --- |
| | | | | Thousand tonnes |

Air pollutants and greenhouse gases: Greenhouse gases ($CO_2$, $N_2O$ in $CO_2$ equivalent, $CH_4$ in $CO_2$ equivalent, HFC in C ▼)

Source sectors for air emissions (Common reporting format, IPCC 2006): Livestock

| GEO ▼ / TIME ▶ | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Greece | 5,136.33 | 5,061.61 | 5,017.53 | 5,112.39 | 5,080.02 | 5,018.91 | 4,946.69 | 4,767.92 | 4,664.83 | 4,590.11 |

- Landfills

**Air emissions accounts by NACE Rev. 2 activity**
Last update: 17-12-2018
Table Customization show

| TIME | | GEO | | Air pollutants and greenhouse gases |
| --- | --- | --- | --- | --- |
| | | | | Methane |

Classification of economic activities - NACE Rev.2: Water supply; sewerage, waste management and remediation activities ▼

Unit of measure: Tonne ▼

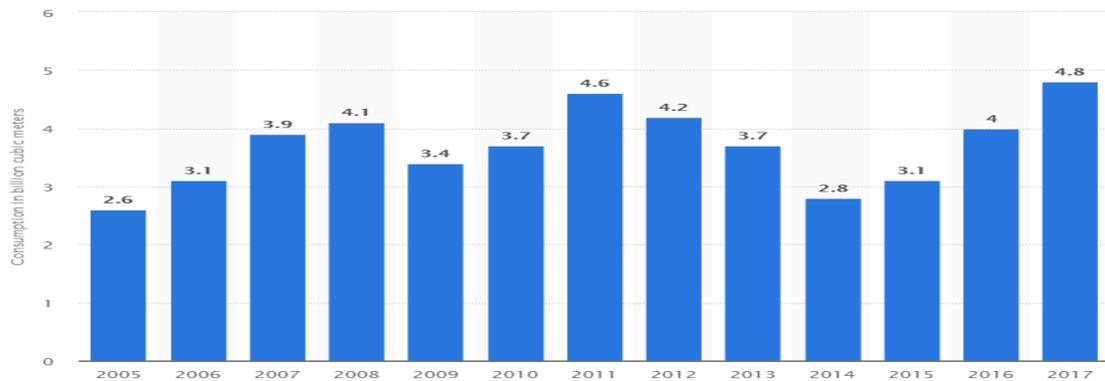| GEO ▼ / TIME ▶ | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Greece | 180,043.98 | 168,548.23 | 179,622.64 | 170,924.7 | 162,206.24 | 166,420.49 | 169,073.88 | 168,718.53 | 169,249.57 | 169,834.29[s] |

Source: eurostat

### 3.1. Ozone

Methane contributes to the levels of Ozone ($O_3$) in the atmosphere, which actually poses a serious problem in Greece from time to time. In 2017, according to newspapers, Attiki was alarmed due to ozone exceeding the limit of 180μg/m3, reaching 216-228μg/m3 in a day, while the alarm was set to ''ring'' when 240μg/m3 is reached. Fortunately, the levels were reduced later that day but the Greek Ministry of Health stated that people with cardiovascular diseases or susceptibility to air pollution should not go out that day. Ozone impacts human health in various ways: it can cause asthma, lead to hospitalization and, in extreme cases, to premature death.

### 3.2. Methane in natural gas

The use of natural gas has become quite popular in Greece nowadays, because of its cost-efficiency. In addition, it contributes to the reduction of air and water pollution and of CO emissions.

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University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
Department of International & European Studies

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This Statista graph shows the natural gas consumption in Greece in billion cubic meters, for the period 2005-2017. It is clear that the use of natural gas has increased as it is way more profitable and ecologically friendly than petroleum.

What made an impression is that during the economic crisis, researches on air quality for the period 2010-2014 which focused on domestic energy use for heating, showed that there was a decline to the levels of air pollutants. They showed that even though 2011 and 2012 had the coldest winters, the Greek domestic energy consumption was 37% less than expected due to the lack of sufficient incomes. Also, the use of private cars was minimized. Due to high fuel energy taxes, Dr. Karamanoli stated that in the province of Athens, people burned anything that could be used for heating apart from heating oil. Immigrants were forced to live in small apartments with poor ventilation, exposed to harmful particles. Even though air pollutants such as $NO_2$, $SO_2$ and CO were in lower levels during that period, the economic crisis should not be considered a valid solution to the air pollution problem. Such poor living standards cannot solve any environmental problem. They only mean to intensify them along with other health problems.

So, even though the use of natural gas increased rapidly throughout the years, the economic crisis and the high taxation are discouraging. UNICEN stated that: ''Gas prices in Greece are among the highest in EU and above the European average. In addition, gas for industrial consumption is burdened with the highest effective excise duty of 5,4 €/MWh, with no relief for energy intensive industries''.
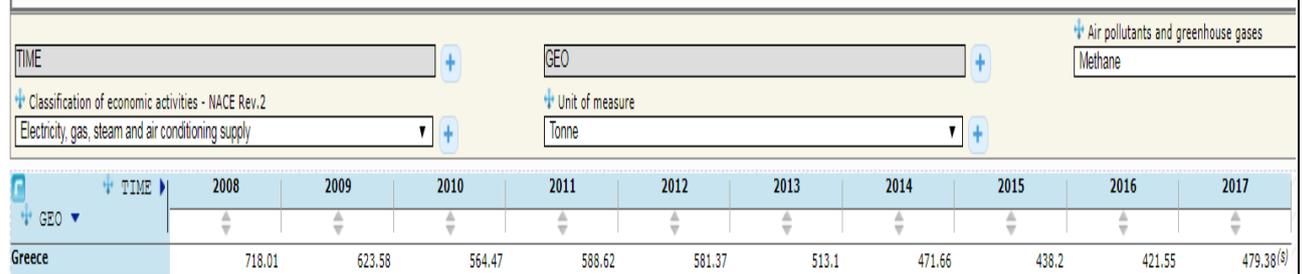
Moreover, small gas leakages from weathered pipelines are a common occurrence that should not be ignored. Fortunately, in Greece, as a 2018 EUROSTAT calculation suggests, methane emissions from electricity, gas, steam and air conditioning supply are in low levels, so its use is being encouraged.

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University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
Department of International & European Studies

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**Air emissions accounts by NACE Rev. 2 activity**

Last update: 17-12-2018

Table Customization show

Air pollutants and greenhouse gases
Methane

TIME

GEO

Classification of economic activities - NACE Rev.2
Electricity, gas, steam and air conditioning supply

Unit of measure
Tonne

| TIME / GEO | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | 718.01 | 623.58 | 564.47 | 588.62 | 581.37 | 513.1 | 471.66 | 438.2 | 421.55 | 479.38 (s) |

Source: eurostat

## 4. What has been done for the reduction of CH₄ in Greece

Our country is a strong supporter of the environmental protection and has taken part in various actions on international level, such as the Paris Agreement, UNFCCC and its COPS and the Kyoto Protocol.

- The Paris agreement was ratified with Law 4426/2016, which proposes that the Ministry of Environment and Energy coordinates its application. Its main goal, which covers the period from 2020 and onward, is to keep the average global temperature below 2°C.
- Greece also participates in The EU Emissions Trading System (EU ETS) for $CO_2$.
- In 2016, Greece submitted a National Strategy for the climate change adaptation for the drafting of relevant policies.
- In addition, Greece submitted a Strategic Research for the Environmental consequences of the National Plan for Harmful Waste management with the aim of a non-toxic environment.

## 5. What can be further done

It is clear that our country has taken multiple actions regarding the preservation of the environment and, generally speaking, the results are sufficient enough.

What our country lacks are **methane-oriented policies**. As this EUROSTAT graph shows, CH₄ is in lower levels than other gases, but it is, actually, 34 times more effective than $CO_2$ in trapping heat, in a 100-year period.

1. $CO_2$

Πανεπιστήμιο Πειραιώς
University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
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**Air emissions accounts totals bridging to emission inventory totals**
Last update: 17-12-2018

Table Customization show

| TIME | | GEO | | Air pollutants and greenhouse gases |
|------|--|-----|--|-------------------------------------|
| Environment indicator: All NACE branches plus households | | Unit of measure: Tonne | | Carbon dioxide |

| GEO ▼ / TIME ▶ | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | 111,112,528 | 104,340,534 | 97,342,976 | 94,531,703 | 91,417,801 | 81,722,579 | 78,655,816 | 74,962,452 | 71,373,081 | 74,631,613 (s) |

2. CH$_4$

**Air emissions accounts totals bridging to emission inventory totals**
Last update: 17-12-2018

Table Customization show

| TIME | | GEO | | Air pollutants and greenhouse gases |
|------|--|-----|--|-------------------------------------|
| Environment indicator: All NACE branches plus households | | Unit of measure: Tonne | | Methane |

| GEO ▼ / TIME ▶ | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | 446,647.01 | 432,945.9 | 440,796.14 | 433,707.76 | 426,809.4 | 417,311.31 | 408,668.39 | 402,212.47 | 388,432.68 | 393,020.7 (s) |

3. N$_2$O

**Air emissions accounts totals bridging to emission inventory totals**
Last update: 17-12-2018

Table Customization show

| TIME | | GEO | | Air pollutants and greenhouse gases |
|------|--|-----|--|-------------------------------------|
| Environment indicator: All NACE branches plus households | | Unit of measure: Tonne | | Nitrous oxide |

| GEO ▼ / TIME ▶ | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greece | 19,003.2 | 17,803.35 | 18,479.91 | 17,668.16 | 16,233.13 | 15,239.93 | 14,546.21 | 14,343.57 | 14,482.3 | 13,571.62 (s) |

Source: eurostat

Thus, the recommendations listed below focus on the optimization of the main Greek anthropogenic sources of methane emissions. By eliminating this short-term risk first, initiatives on the reduction of other pollutants can be supported.

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University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
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## Recommendation 1
### **Landfills**

1. **Diversion of the organics from landfills.** A regulation should be adopted which will propose the elimination of the disposal of organics in landfills by 2025. The existing National plan stated above, has marked an application period by 2050. These organics will be recycled into compost, fuel and energy.
2. **Financial incentives regarding organic diversion.** New or expanded facilities are needed to recycle diverted organic waste through composting or other methods. State funding is crucial. At the same time, a waste management fee should be applied to discourage organic waste from being disposed in landfills.
3. **Raise awareness for landfill emissions.** The state should support research to achieve better understanding of emissions from landfills. New actions should be considered to further reduce methane emissions from landfills.

## Recommendation 2
### **Dairies**

1. **Regulate new dairies.** Dairy methane emissions in North Greece can be reduced by developing a regulation by 2020 that would set requirements for new practices for dairy production and manure management.
2. **Financial incentives for manure management practices.** State support is critical to build the necessary infrastructure, to access technologies and market opportunities. Research is mandatory for identifying opportunities that maximize value and minimize costs. A coordinated group of agencies can identify structures for composting, anaerobic digestion, organics and manure management.
3. **Foster markets.** Installing anaerobic digesters and other infrastructures may not be cost-effective as of yet, due to the economic crisis. Environmental credits and soil products if monetized, may offer returns to both farmers and investors. These projects need further support in order to finance the necessary infrastructures for dairies afterwards. Healthy soils through composting and dairies-based markets can be supported by other agencies. Moreover, biomethane pipeline injection and minimization of its costs will help dairy biogas to enter the transportation sector. As a result, a ''manure-to-methane-to-transportation'' fuel pathway will be achieved.

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University of Piraeus
Τμήμα Διεθνών & Ευρωπαϊκών Σπουδών
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Recommendation 3
**Livestock**

Enteric fermentation is the digestive process of ruminants in which the microorganisms involved produce methane. These emissions should be reduced according to the GHG emissions standards.

Strategies have been developed for this purpose, including:

1. Increase of rumen effectiveness and diminishment of methane generation for a given sum of feed admissions.
2. Animal breeding for lower methane generation.
3. Gut microbial intercessions.
4. Changes to nourishment and animal management.

Further research is essential to evaluate the viability of these strategies in Greece and to assess their costs and benefits on human and animal health, animal productivity and their environmental impact. To prevent emissions from other sectors to increase, expansive lifecycle emission assessments on regional level are mandatory.

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