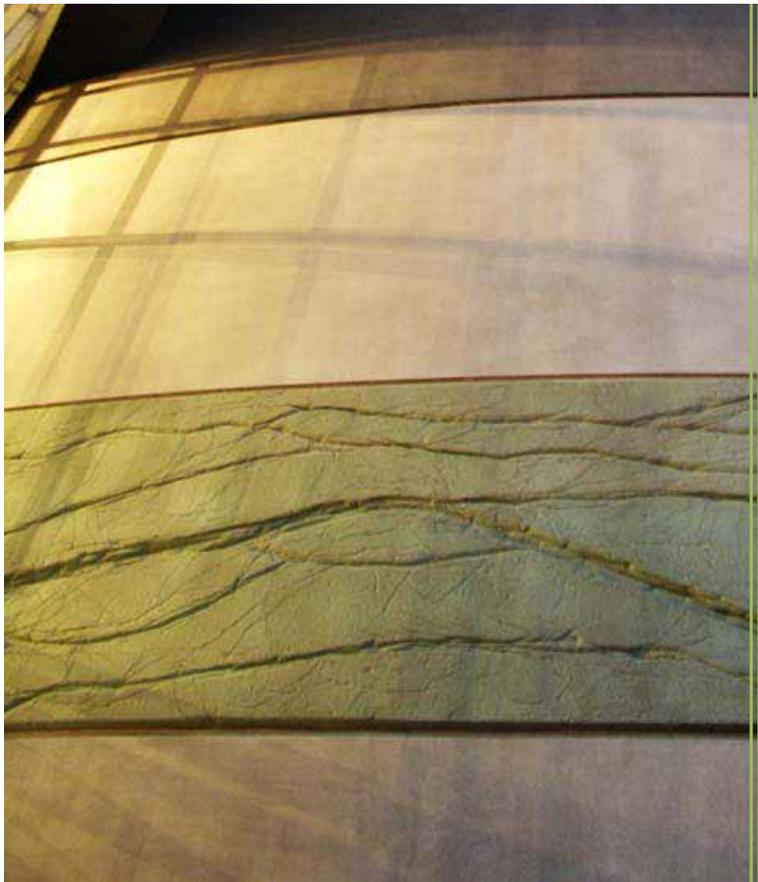




2015

PCI SUSTAINABLE PLANT PERFORMANCE REPORT



PCI SPP 15-04



NORTH AMERICAN
PRECAST CONCRETE
SUSTAINABLE PLANT PROGRAM

INTRODUCTION

The goal of the North American Precast Concrete Sustainable Plant Program (NAPCSPP) is to benchmark the precast industry's impact on the environment in the areas of global warming, energy, water use, waste, dust and noise generation. Ultimately, the precast industry is striving to reduce the environmental impact at the manufacturing level while creating a culture of sustainability. The PCI Life Cycle Assessment study for Commercial Buildings (2013) helped identify where the industry can improve its impacts at the manufacturing stage of the life cycle, with a goal to positively influence the impacts at the end of a project's life.

The benefits of sustainable business practices are well documented. As the leading technical resource for the precast concrete industry in the United States, the PCI has provided the tools for its member plants to measure and implement improvements that will have a measurable impact on their environmental and economic performance, using the customized industry software, *North American Plant Sustainability Tracking Program*.

The software program, developed by the Athena Sustainable Materials Institute (ASMI), enables individual manufacturers to measure their "cradle to gate" environmental footprint (with cradle being raw material resource extraction and gate being the finished product leaving the precast plant for the construction site).

Once a manufacturing facility enters their raw data for material usage, electricity, natural gas, gas, diesel, heavy fuel oil and liquefied propane gas usage the software uses the ASMI database to calculate the sustainability indicators – global warming potential (GWP), total primary energy (TPE) and water usage for the plant. The facility also self-evaluates and reports their environmental performance indicators – dust, noise and waste materials.

Participating plants report their tracked results to PCI on a quarterly basis, the results of which are presented in this report along with the year to date results. Individual plants are also provided a customized report on a quarterly basis for their own internal benchmarking. Specifiers and owners can request the sustainability impacts on a project-to-project basis and are also encouraged to include this requirement in their contract specifications.

The industry has now been reporting for 18 months, beginning first quarter 2015. The following report reflects the first 12 months ending December 2015; the report includes moving averages for the industry during this period. All participating plants are assigned unique identification numbers in order to maintain confidentiality.

For more information on the NAPCSPP, contact Emily Lorenz at elorenz@pci.org.

A. SUSTAINABILITY IMPACT MEASURES

A.1 Global Warming Potential

Global warming potential (GWP) is reported in kg CO₂equivalent (eq.) and is the reference measure used to report the amount of greenhouse gases created in the extraction, processing and transportation of each material. The following figures and tables express GWP as kg CO₂eq per metric ton (tonne) of precast concrete produced.

Table 1: Global Warming Potential - Four Quarter Average (January 2015 to December 2015)

Sample Size: 263

Average Global Warming Potential (kgCO ₂ /tonne precast)	Standard Deviation (kgCO ₂ /tonne precast)	Coefficient of Variation(%)	High (kgCO ₂ /tonne precast)	Low (kgCO ₂ /tonne precast)
392	336	85.7	4406	79

Table 2: Global Warming Potential - Most-recent Quarter Average (4th Quarter 2015)

Sample Size: 64

Average Global Warming Potential (kgCO ₂ /tonne precast)	Standard Deviation (kgCO ₂ /tonne precast)	Coefficient of Variation(%)	High (kgCO ₂ /tonne precast)	Low (kgCO ₂ /tonne precast)
394	262	66.5	2224	125

Table 3: Global Warming Potential – By Contribution (as a percentage of total) – 4th Quarter 2015

Sample Size: 64

Average Global Warming Potential (kgCO ₂ /tonne precast)	Contribution from Raw Materials	Contribution from Raw Material Transportation	Contribution from Precast Plant Operations
Industry Average	84.5%	5.3%	10.2%
High	96.1%	36.1%	36.5%
Low	53.7%	1.3%	0.5%

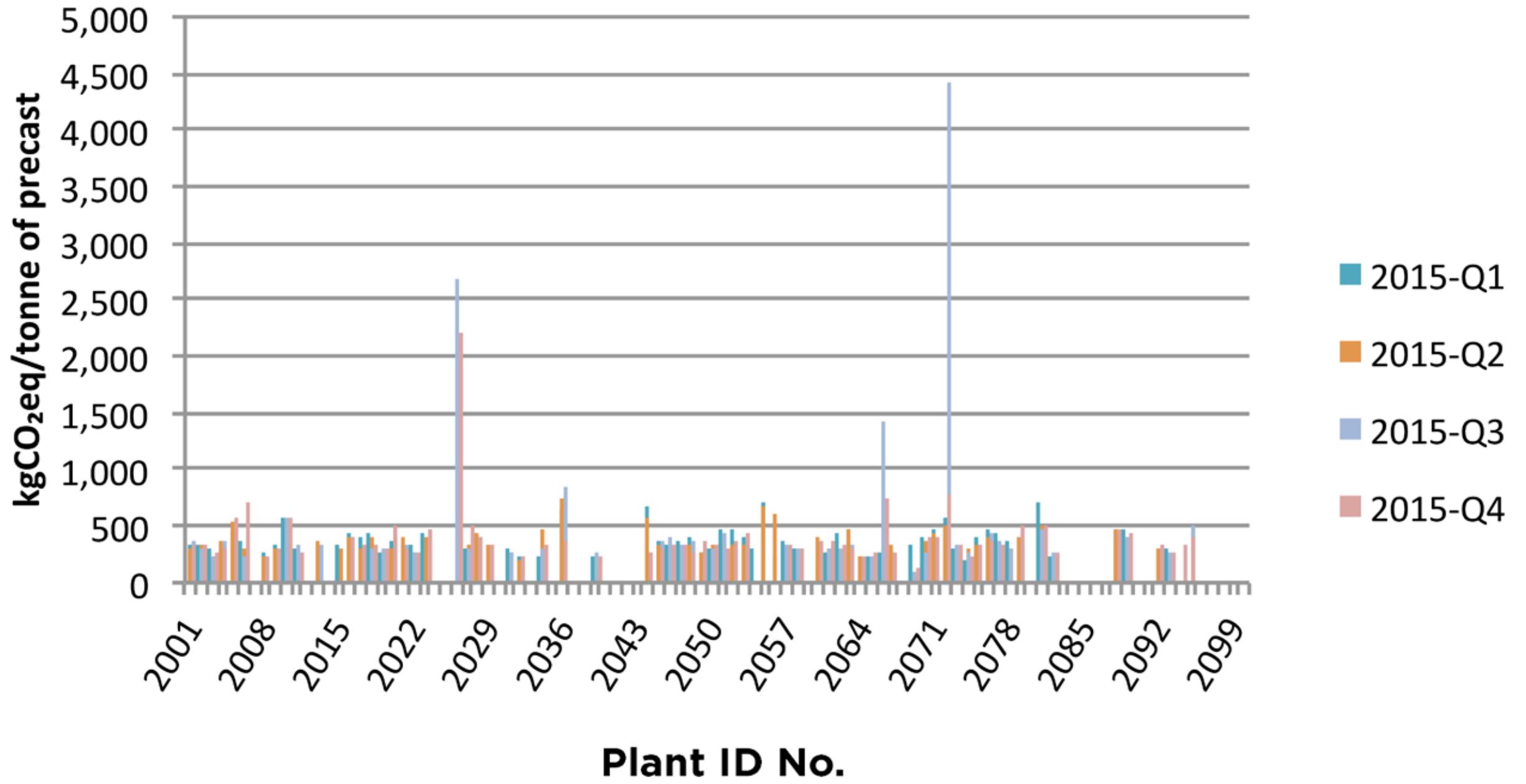


Figure 1: Global Warming Potential by Quarter for Each Plant

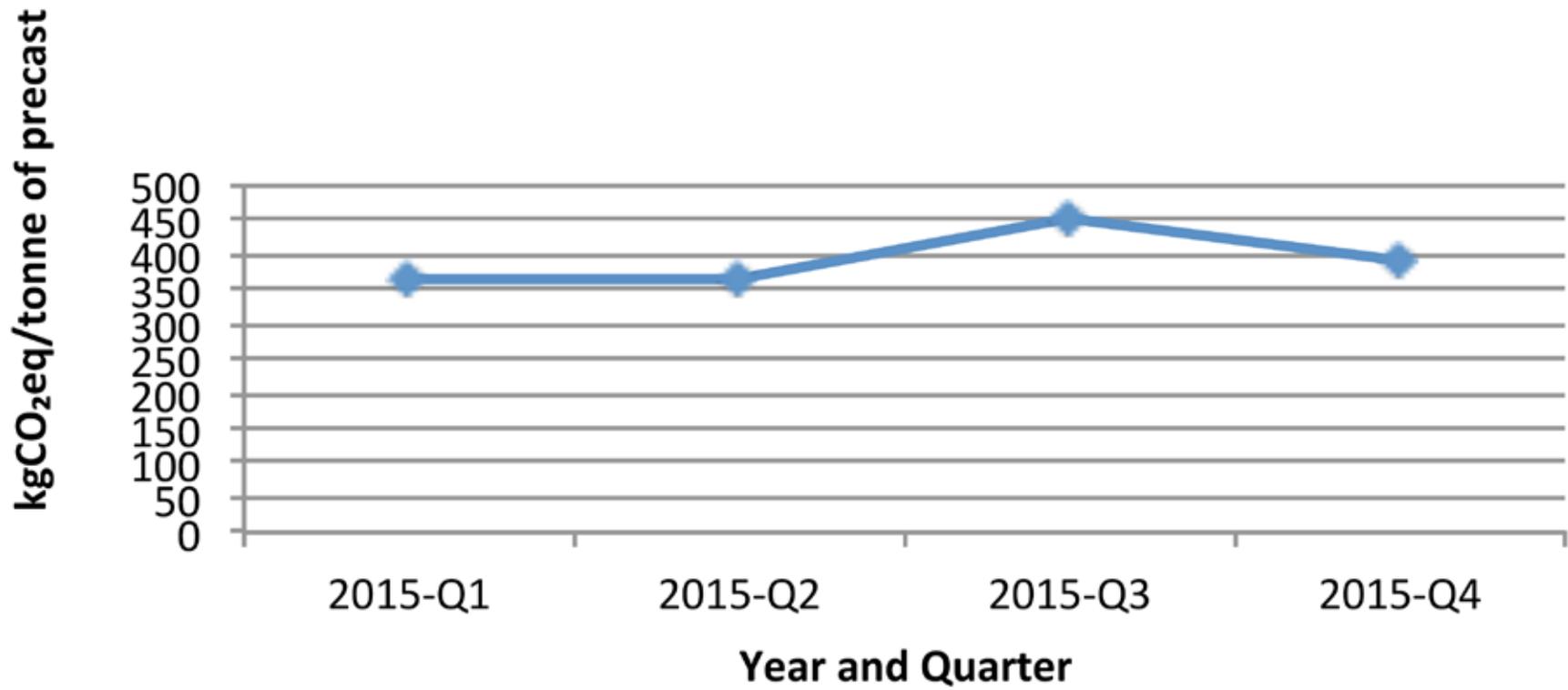


Figure 2: Global Warming Potential - 12 Month Industry Moving Average

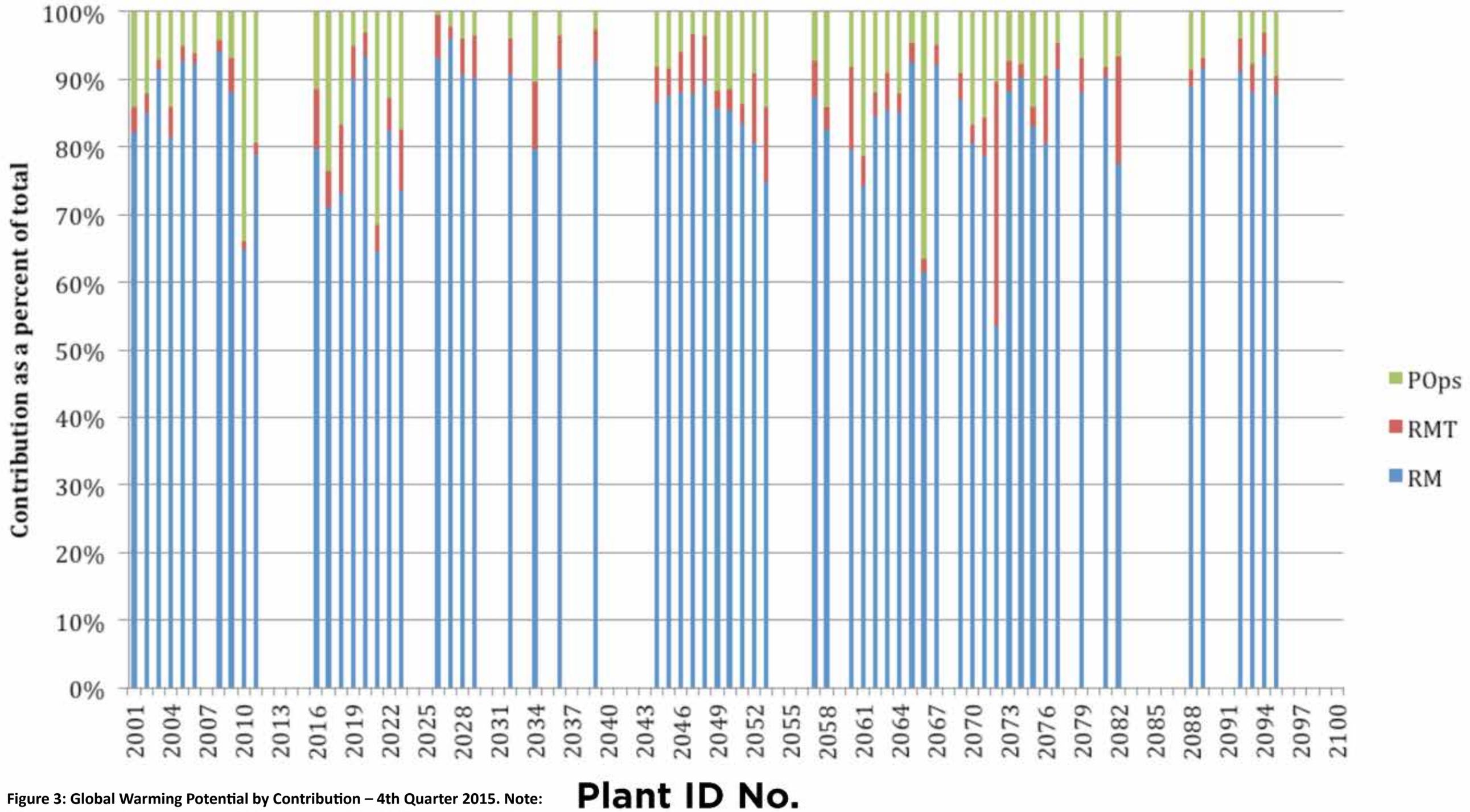


Figure 3: Global Warming Potential by Contribution – 4th Quarter 2015. Note: POp = precast plant operations; RM = raw materials; RMT = raw materials transportation.

B. RESOURCE MEASURES

B.1 Total Primary Energy

Total Primary Energy (TPE) is reported in mega-joules (MJ) and is a measure of all primary energy consumed (direct and indirect) to transform or transport raw materials into products. This includes inherent energy in raw or feedstock materials that are also used as common energy sources. In addition, the measure also captures the pre-combustion (indirect) energy associated with processing, transporting, converting and delivering fuel and energy. The following tables and figures show the TPE expressed as MJ per metric ton (tonne) of precast produced.

Table 4: Total Primary Energy - Four Quarter Average (January 2015 to December 2015)

Sample Size: 263

Average Total Primary Energy (MJ/tonne precast)	Standard Deviation (MJ/tonne precast)	Coefficient of Variation(%)	High (MJ/tonne precast)	Low (MJ/tonne precast)
3737	3626	97.0	41061	549

Table 5: Total Primary Energy - Most-recent Quarter Average (4th Quarter 2015)

Sample Size: 64

Average Total Primary Energy (MJ/tonne precast)	Standard Deviation (MJ/tonne precast)	Coefficient of Variation(%)	High (MJ/tonne precast)	Low (MJ/tonne precast)
3562	3057	85.8	24244	973

Table 6: Total Primary Energy – By Contribution (as a percentage of total) – 4th Quarter 2015

Sample Size: 64

Average Total Primary Energy (MJ/tonne precast)	Contribution from Raw Materials	Contribution from Raw Material Transportation	Contribution from Precast Plant Operations
Industry Average	72%	8.4%	19.6%
High	91.4%	46.3%	61.4%
Low	36.0%	1.4%	0.7%

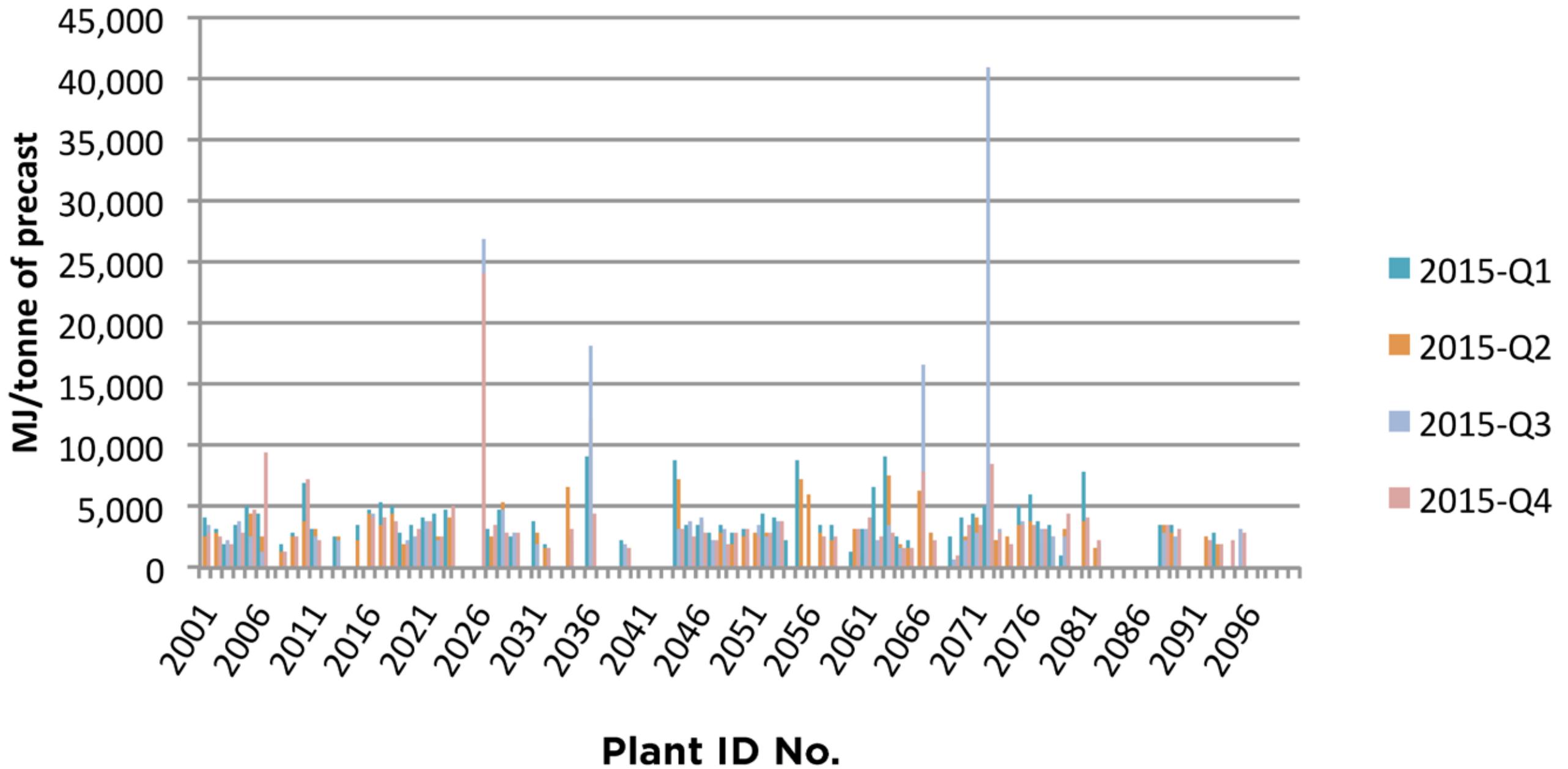


Figure 4: Total Primary Energy by Quarter for Each Plant

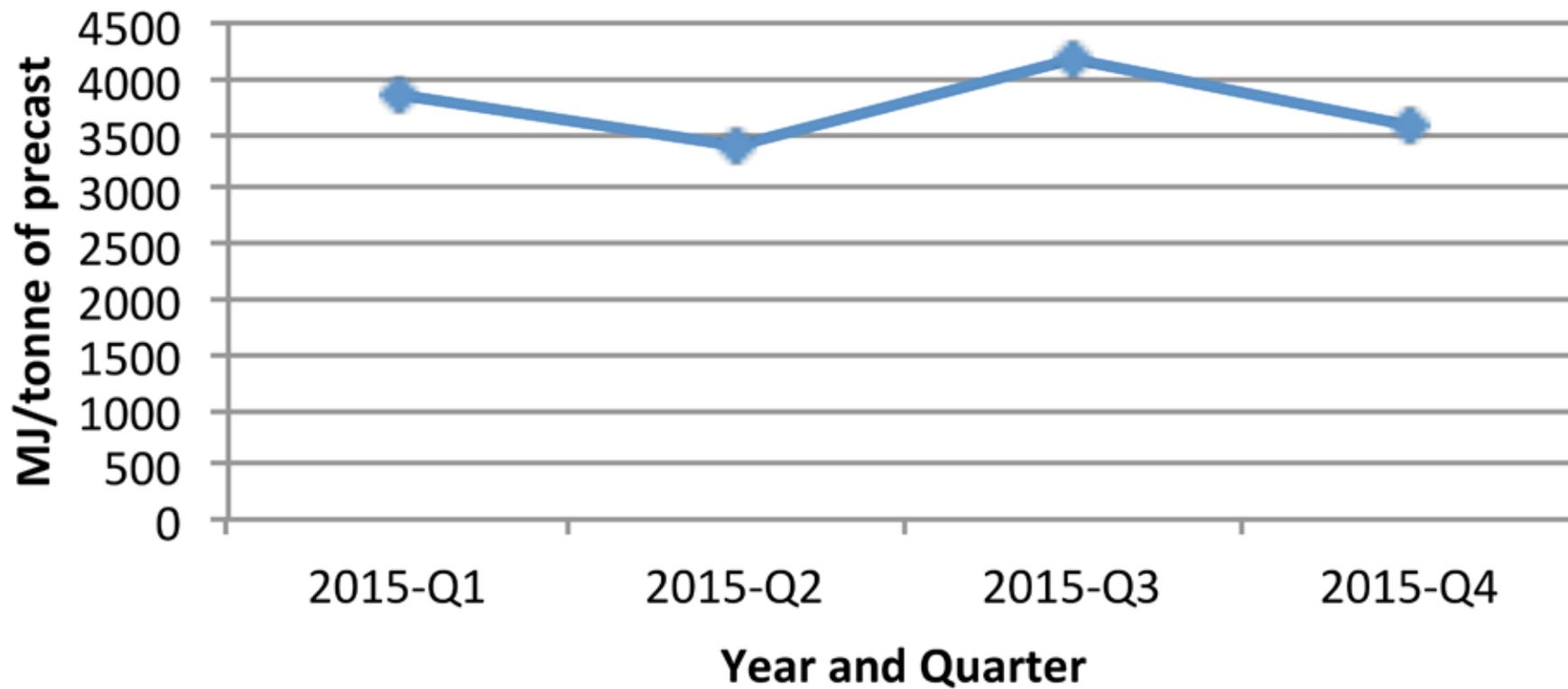


Figure 5: Total Primary Energy - 12 Month Industry Moving Average

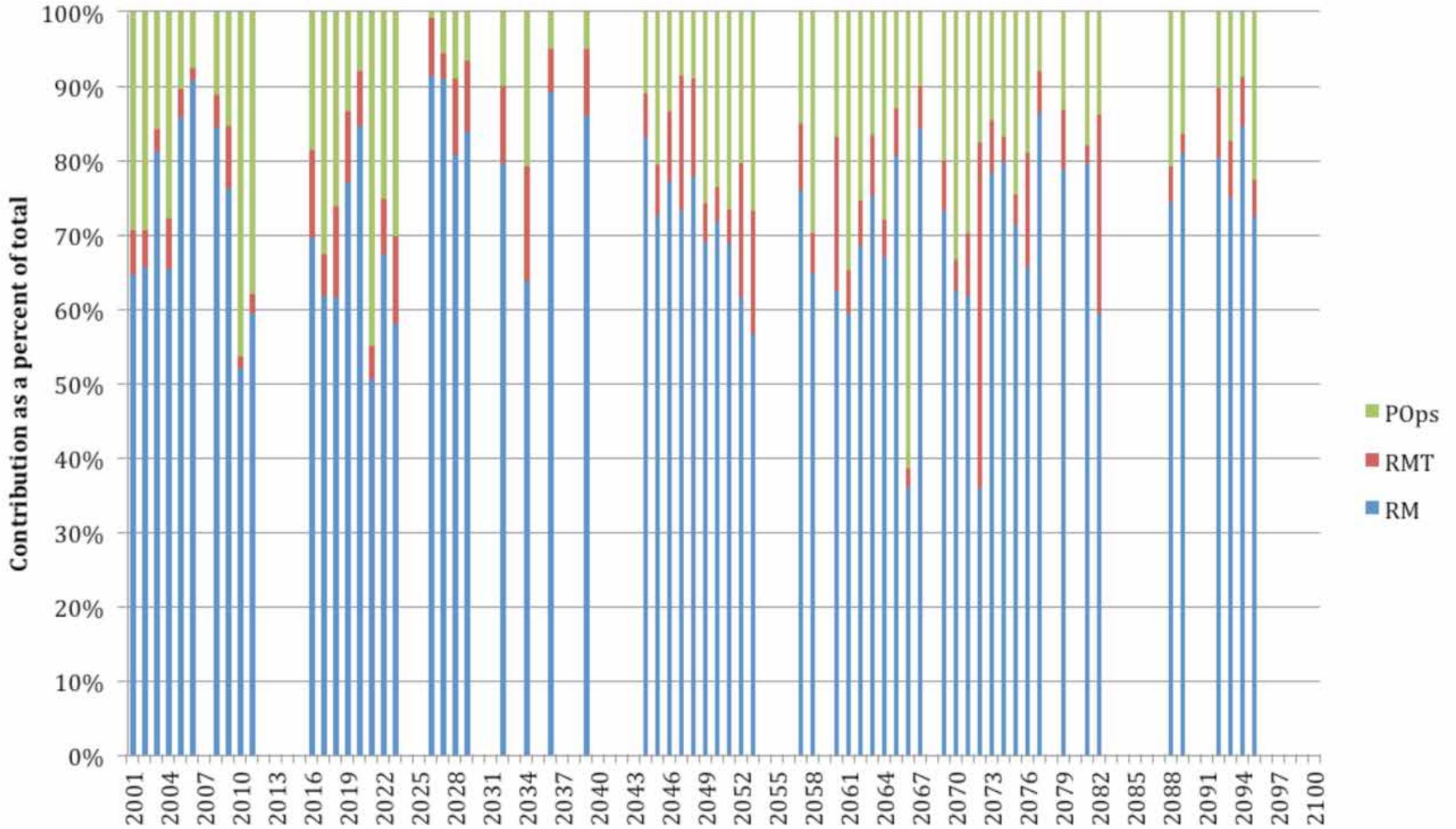


Figure 6: Total Primary Energy by Contribution – 4th Quarter 2015. Note: POp = precast plant operations; RM = raw materials; RMT = raw materials transportation.

Plant ID No.

B.2 Water Use

The water consumption is tracked in the plant as water for batching concrete (also known as mix water) and water used to wash-out mixers and general clean-up in the plant. Included in the total water consumption is the water in upstream processing of all raw materials, for example washing of coarse and fine aggregates. Water is expressed as litres per tonne of precast produced.

Table 7: Water Consumption - Four Quarter Average (January 2015 to December 2015)

Sample Size: 263

Average Water Consumption (litre/tonne precast)	Standard Deviation (litre/tonne precast)	Coefficient of Variation(%)	High (litre/tonne precast)	Low (litre/tonne precast)
160530	491999	306.5	3632196	258

Table 8: Water Consumption - Most-recent Quarter Average (4th Quarter 2015)

Sample Size: 64

Average Water Consumption (litre/tonne precast)	Standard Deviation (litre/tonne precast)	Coefficient of Variation(%)	High (litre/tonne precast)	Low (litre/tonne precast)
76780	347409	452.5	2439628	672

Table 9: Water Consumption by Contribution (as a percentage of total) – 4th Quarter 2015

Sample Size: 64

Average Water Consumption (litre/tonne precast)	Contribution from In-Plant Fresh Batch Water	Contribution from In-Plant Washing	Contribution from Upstream Raw Material Processing
Industry Average	3.7%	15.3%	81.0%
High	8.4%	99.8%	100.0%
Low	0.0%	0.0%	0.2%

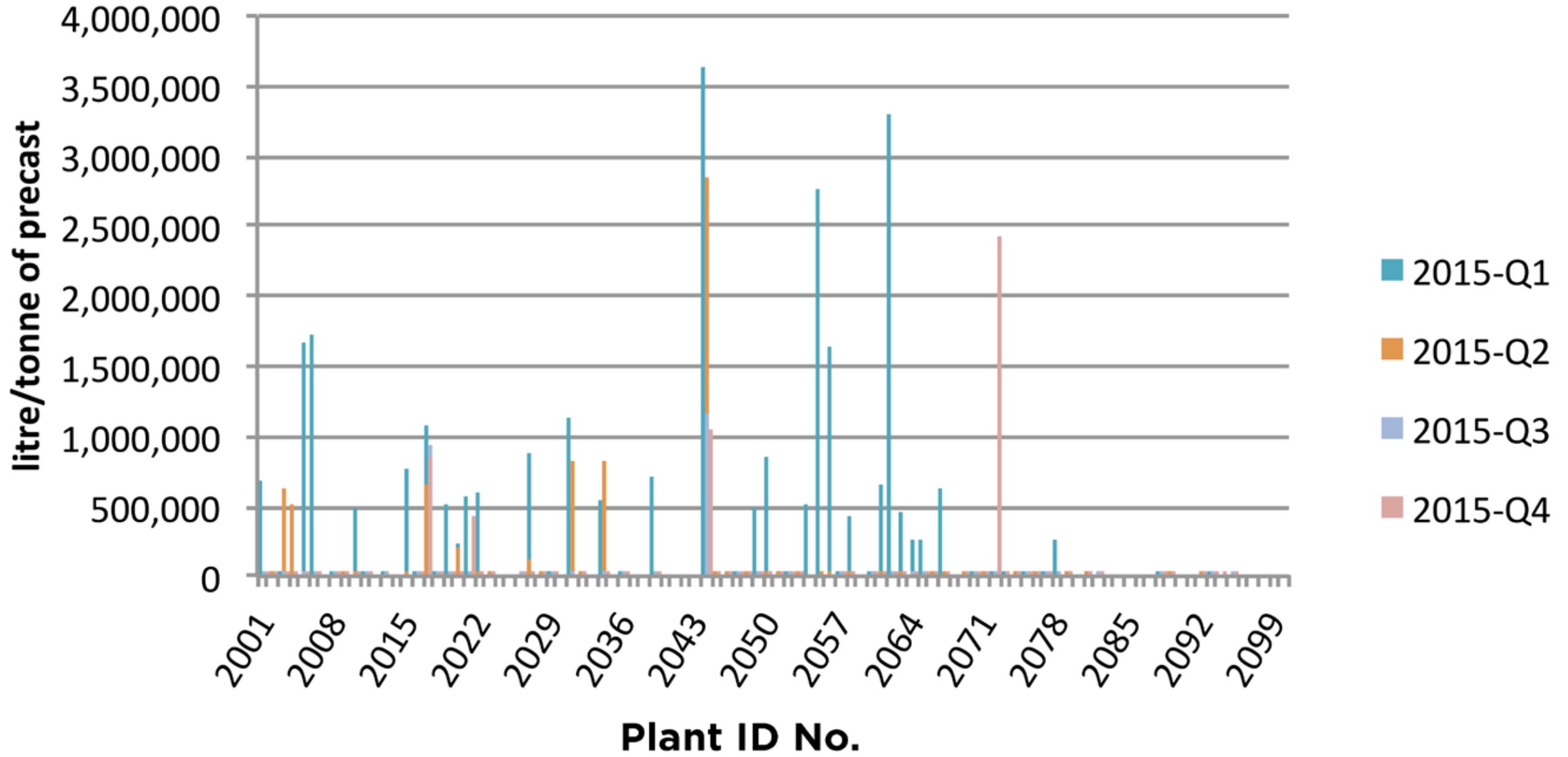


Figure 7: Water Consumption by Quarter for Each Plant

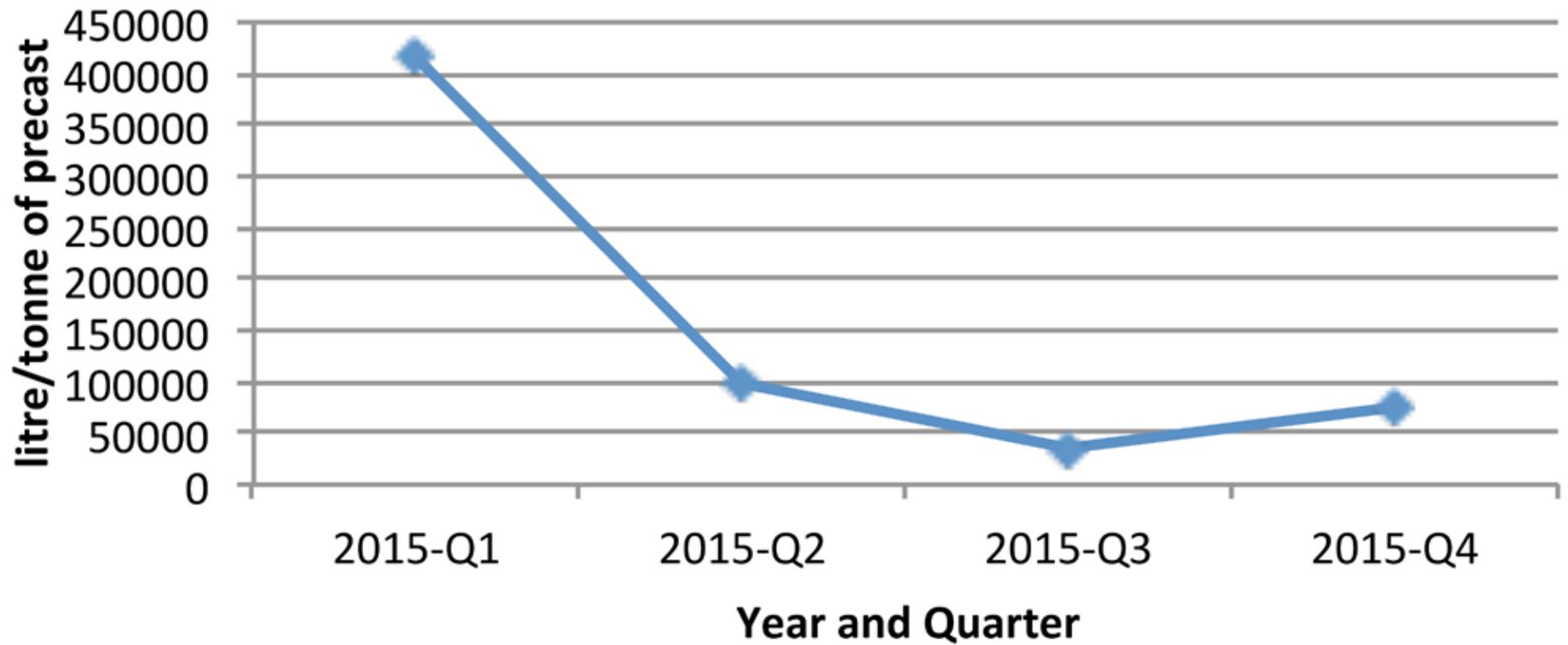


Figure 8: Water Consumption - 12 Month Industry Moving Average

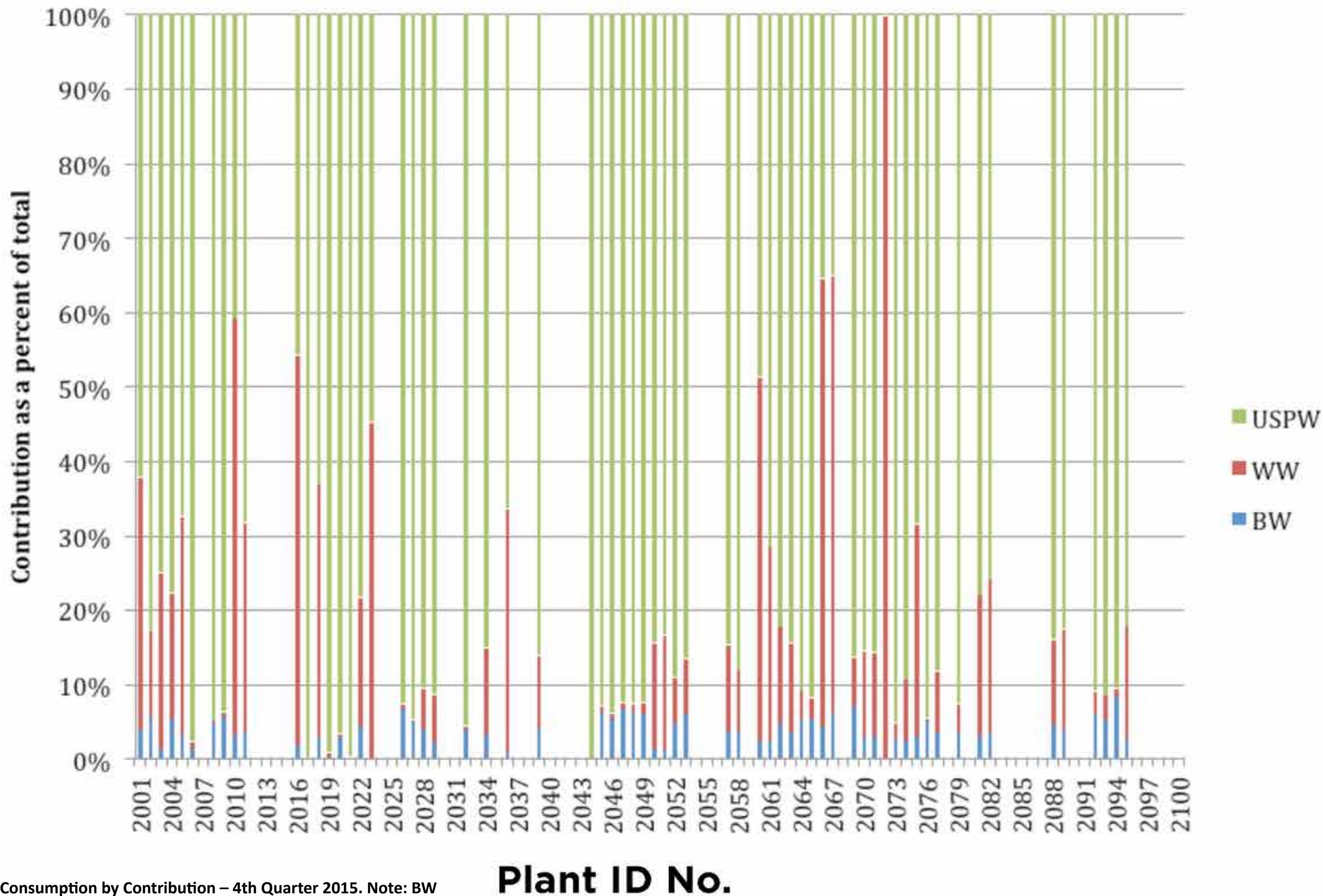


Figure 9: Water Consumption by Contribution – 4th Quarter 2015. Note: BW = batch water; USPW = upstream processing water; WW = wash water.