



# FUNCTIONAL DAMAGE TO UTILITY LIFELINES AND THEIR RESTORATION PROCESSES IN THE 2016 KUMAMOTO EARTHQUAKE, JAPAN

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## **Abstract**

From April 14 on, a series of earthquakes hit the central Kyushu area in Japan causing major damage primarily to Kumamoto Prefecture. In this paper, functional damage and restoration processes of utility lifelines including electric power supply, water supply, city gas supply are compiled on the basis of documents published via press release or related websites by the central government office, related supervisory authorities, local government offices, service providers, and related association.

*Keywords: The 2016 Kumamoto Earthquake, utility lifelines, functional damage, initial outage, restoration process*

## **1. Introduction**

A series of earthquakes occurred in Kumamoto Prefecture in April 2016. Among them, two earthquake events occurred on April 14, 21:26 and April 16, 1:25 marked the Japan Meteorological Agency seismic intensity ( $I_{JMA}$ ) of 7. The authors compiled the functional damage and restorations of electric power supply, water supply and city gas supply systems with respect to the elapsed time after the earthquake. More detailed information can be found in the JSCE Disaster Factsheet by the authors [1].

## **2. Electric power supply system**

The number of disrupted customers in terms of contracts of electric power supply compiled by Kyushu Electric Power Co., Inc. [2] is employed in this paper. The maximum number of disrupted customers by the earthquake event on April 14 was 16.7 thousand (as of April 14, 22:00). At that time, the affected area was limited to the near-source region. The earthquake event on April 16, however, caused power outage of 476.6 thousand customers (as of April 16, 2:00). Figure 1 shows the electric power supplying ratios in Kumamoto Prefecture and their geographical illustrations.

## **3. Water supply system**

The number of disrupted households compiled by Kumamoto Prefectural Government [3] is investigated with respect to the elapsed time after the earthquake on April 14. The water supply system was interrupted for approximately 445 thousand households after the earthquake on April 16, and 97% of them were concentrated in Kumamoto Prefecture (Kumamoto Prefecture: 432 thousand, Oita Prefecture: 10 thousand, Miyazaki Prefecture: 2.8 thousand, etc.). Figure 2 shows the water supplying ratios in selected municipalities in Kumamoto Prefecture with respect to the elapsed time after the earthquake on April 14 and their geographical illustrations.

## **4. City gas supply system**

The number of disrupted houses compiled by Saibu Gas Co., Ltd. [4] is employed in this paper. The gas-supply area in Kumamoto Prefecture is divided into the seven blocks. The gas-supply area covers a small part of Mashiki Town, where severe ground motion from the JMA seismic intensity of 7 was observed. In the heavily affected area in Mashiki Town, the liquefied petroleum (LP) gas is supplied.

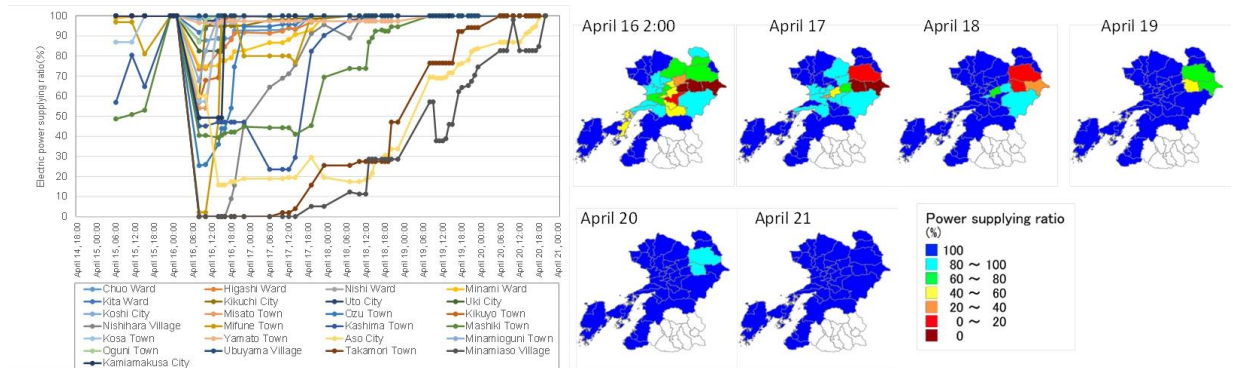


Fig. 1 – Electric power supplying ratios in Kumamoto Prefecture after the earthquake on April 14, 2016

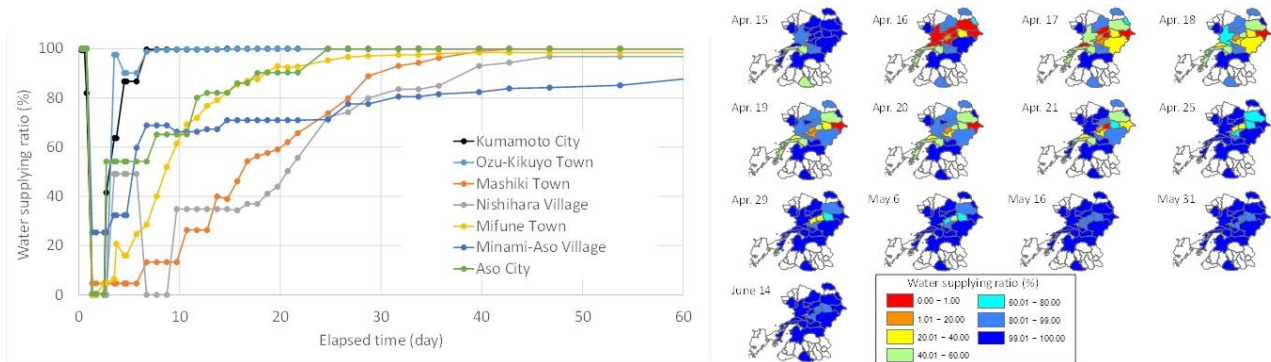


Fig. 2 – Water supplying ratios in Kumamoto Prefecture after the earthquake on April 14, 2016

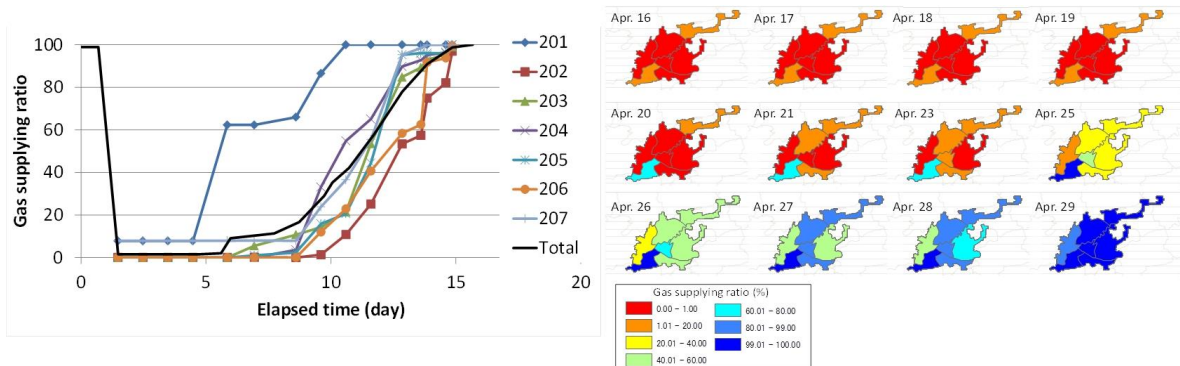


Fig. 3 – Gas supplying ratios in Kumamoto Prefecture after the earthquake on April 14, 2016

The gas supply was interrupted for 100,884 households after the earthquake on April 16. Figure 4 shows the gas supplying ratios with respect to the elapsed time after the earthquake on April 14 and their geographical illustrations.

## 5. References

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