Health impacts of planned coal-fired power plants in Japan

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PM2.5: tiny, toxic particles that enter deep into lungs and into the bloodstream

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Largest environmental health risk in the world

- Air pollution is responsible for 3 million premature deaths in the world each year, and 160,000 in Southeast Asia (Global Burden of Disease Study)
- WHO: Air pollution is officially classified as a carcinogen and labeled “a leading environmental cause of cancer deaths”

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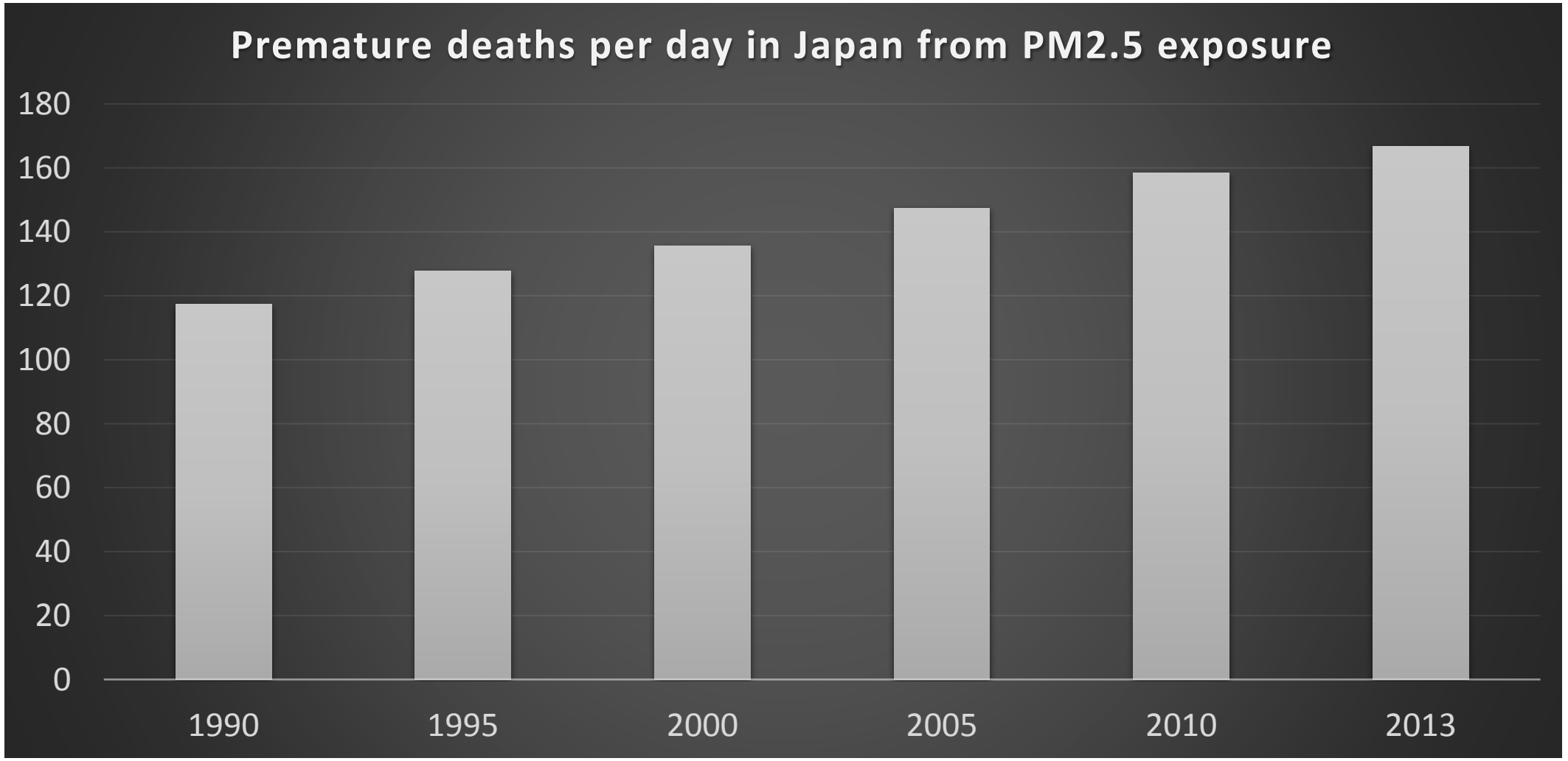
Health impacts of air pollution increasing in Japan: estimated 170 deaths per day in 2013



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Health impacts of coal power plant emissions

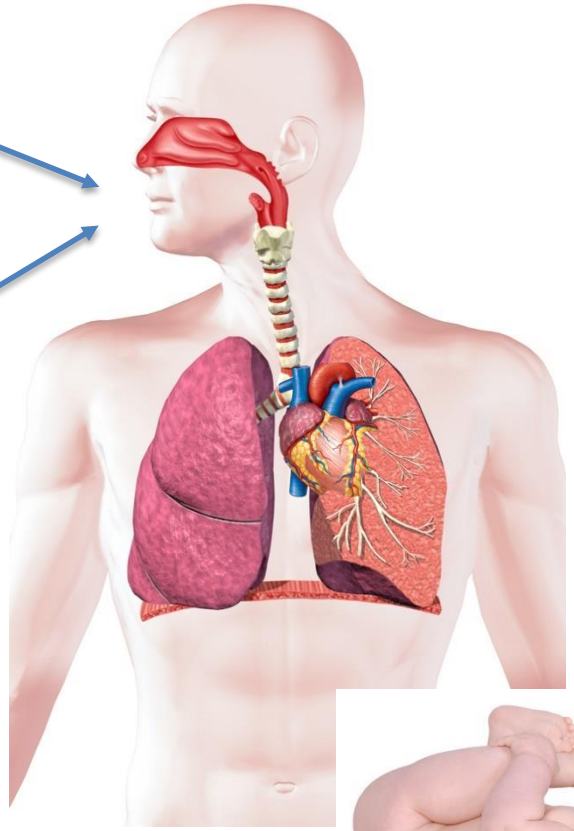
SO2

Dust

NOx

PM2.5

NO2



Lung cancer
Stroke
Heart disease
Respiratory disease
Asthma symptoms

Low birth weight

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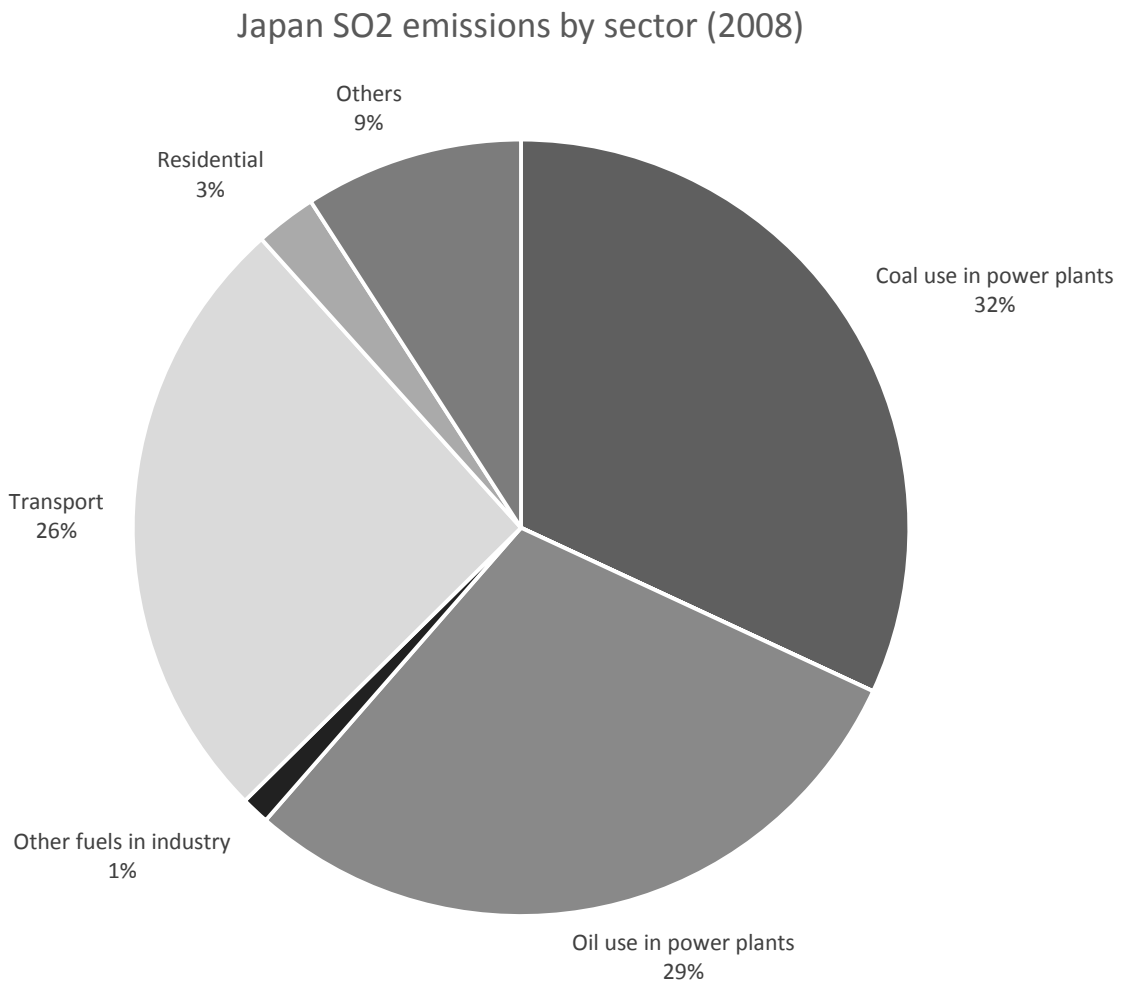
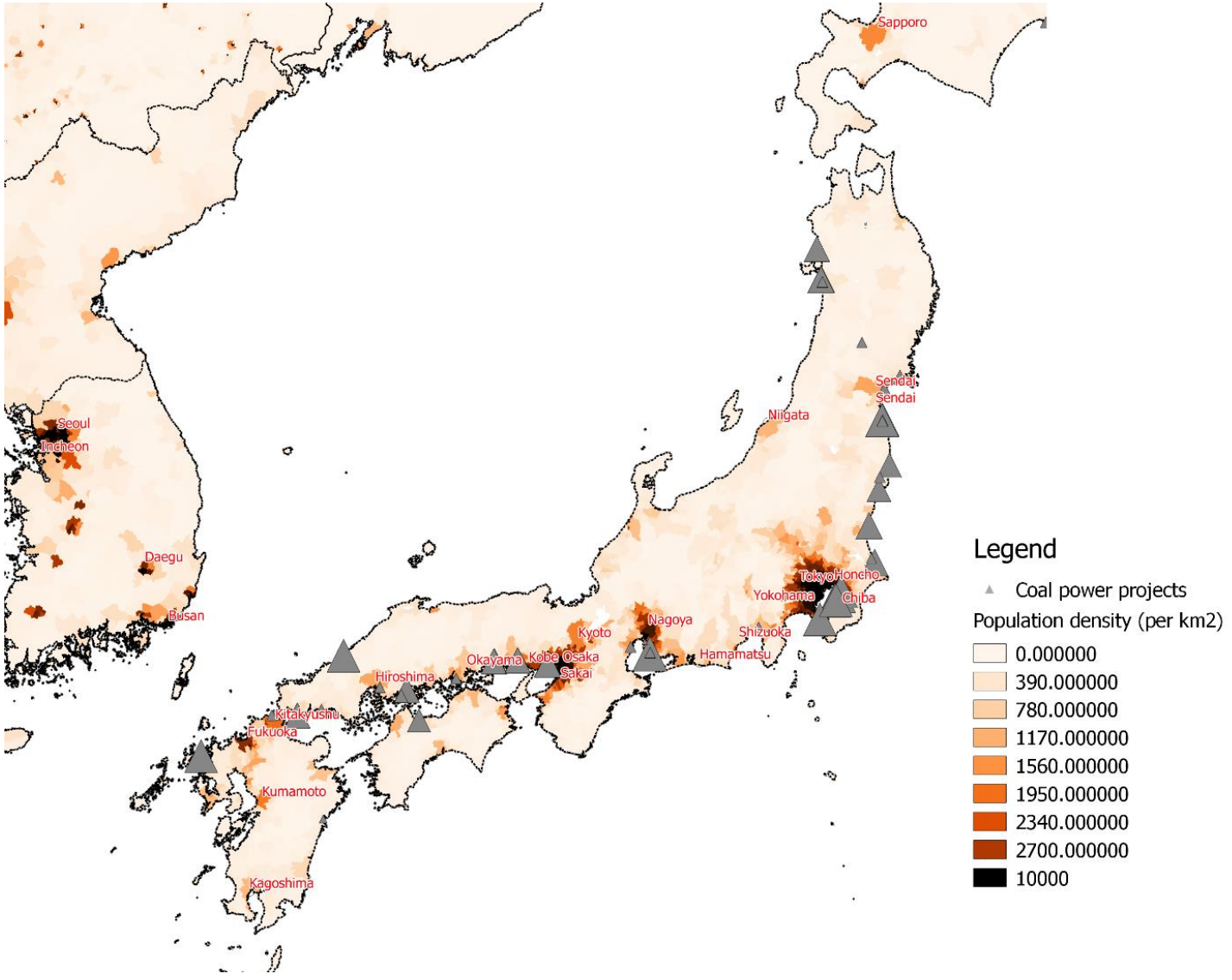
Power sector dominates SO2 emissions



Most coal-fired power plants planned near large population centers



Case studies

Tokyo: 10 projects with 7500MW of capacity are planned within 200 kilometers of Tokyo
Osaka-Hyogo: 15 projects planned with 6500MW of capacity

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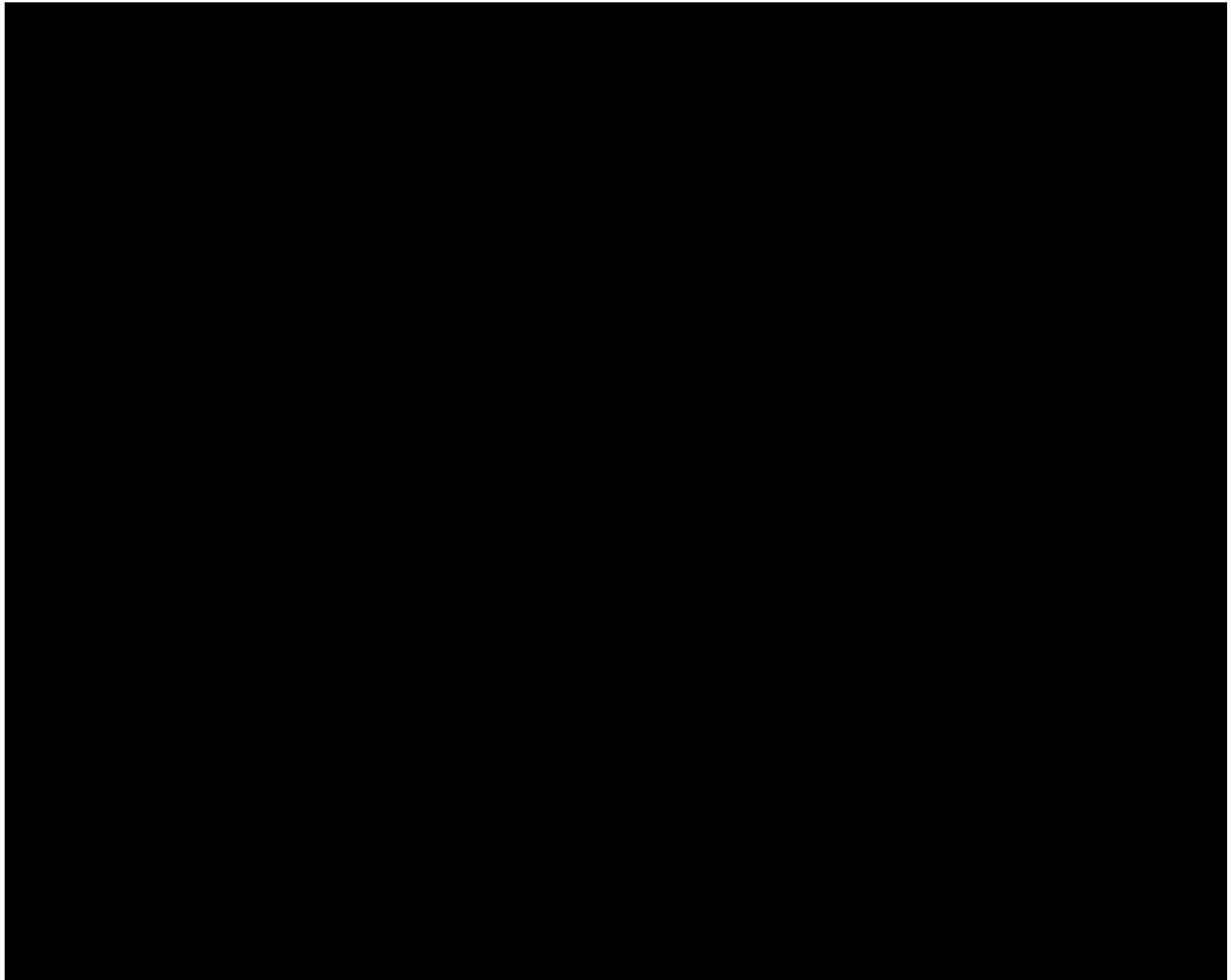
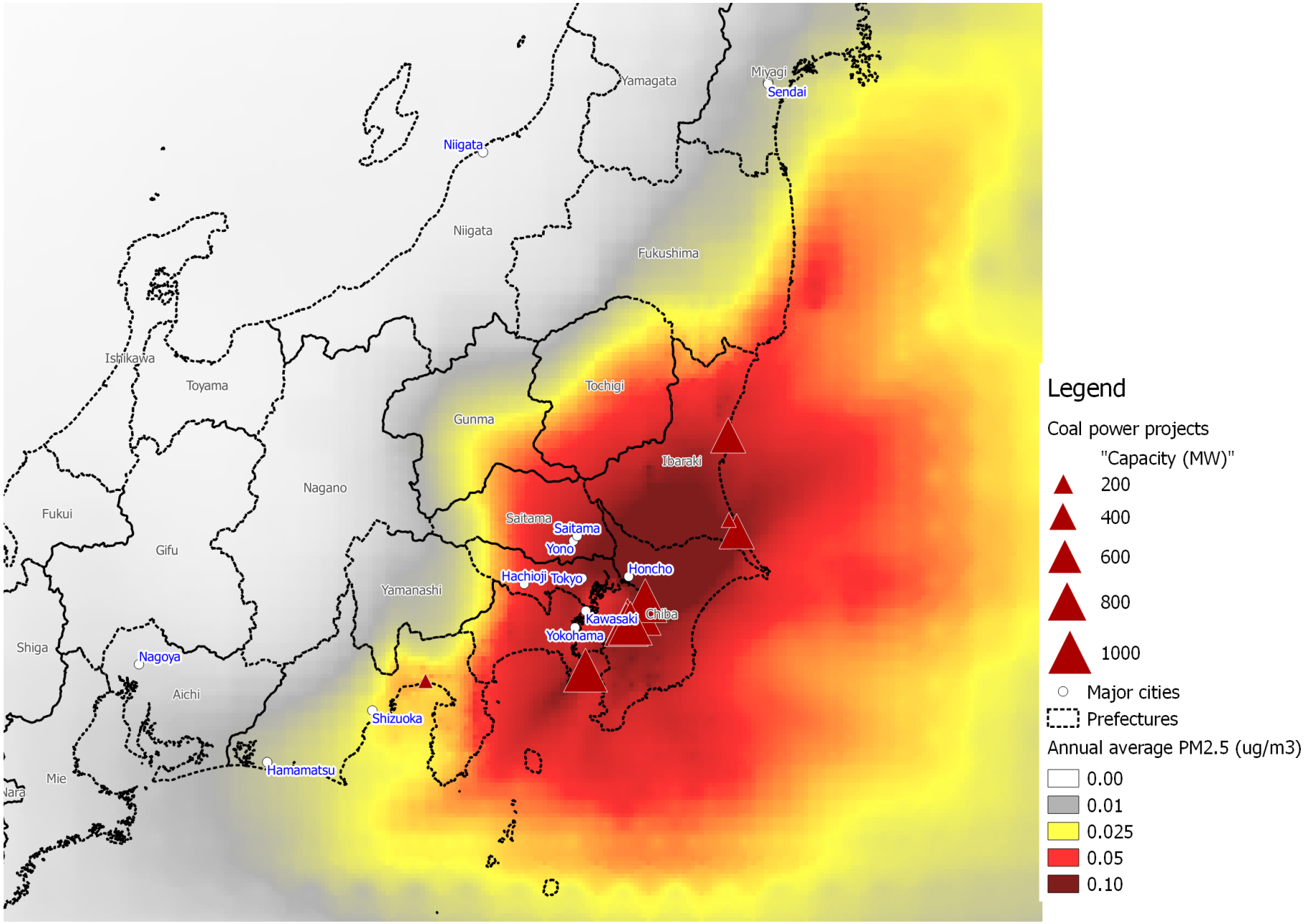
Methodology

- SO2, NOx and dust emission estimates for all new power plants based on emission limits and projected fuel usage
- Stack characteristics (height, diameter, flue gas temperature and velocity) from project documents
  - Generalized from other projects when project-specific information not available
- Pollutant dispersion modeling using the CALMET-CALPUFF modeling system recommended by U.S. EPA
- Health impact assessment using the largest available studies on link between air pollutant exposure and risk of death from different diseases

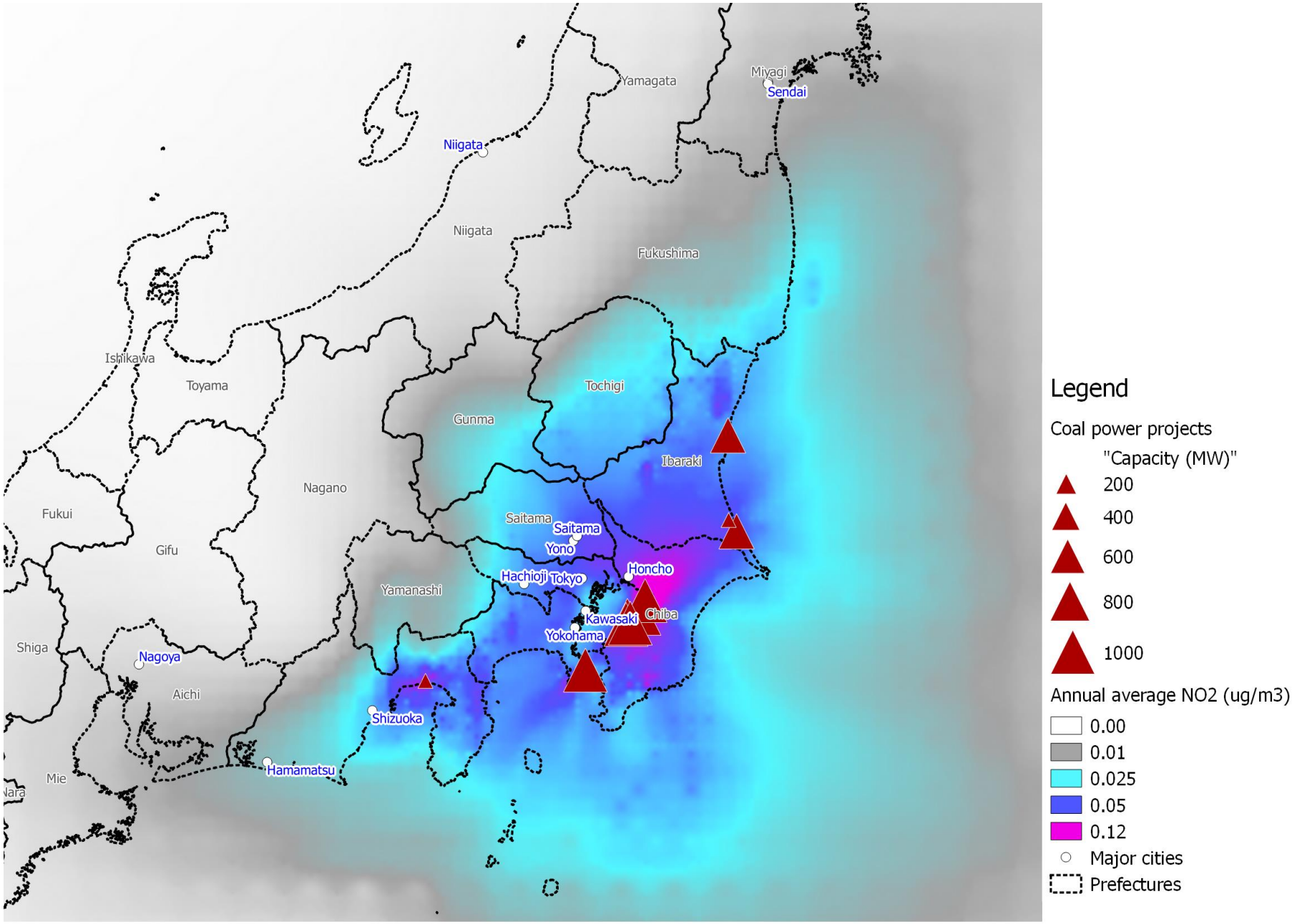
Tokyo-Chiba case study:
Projected increase in daily average PM2.5 levels



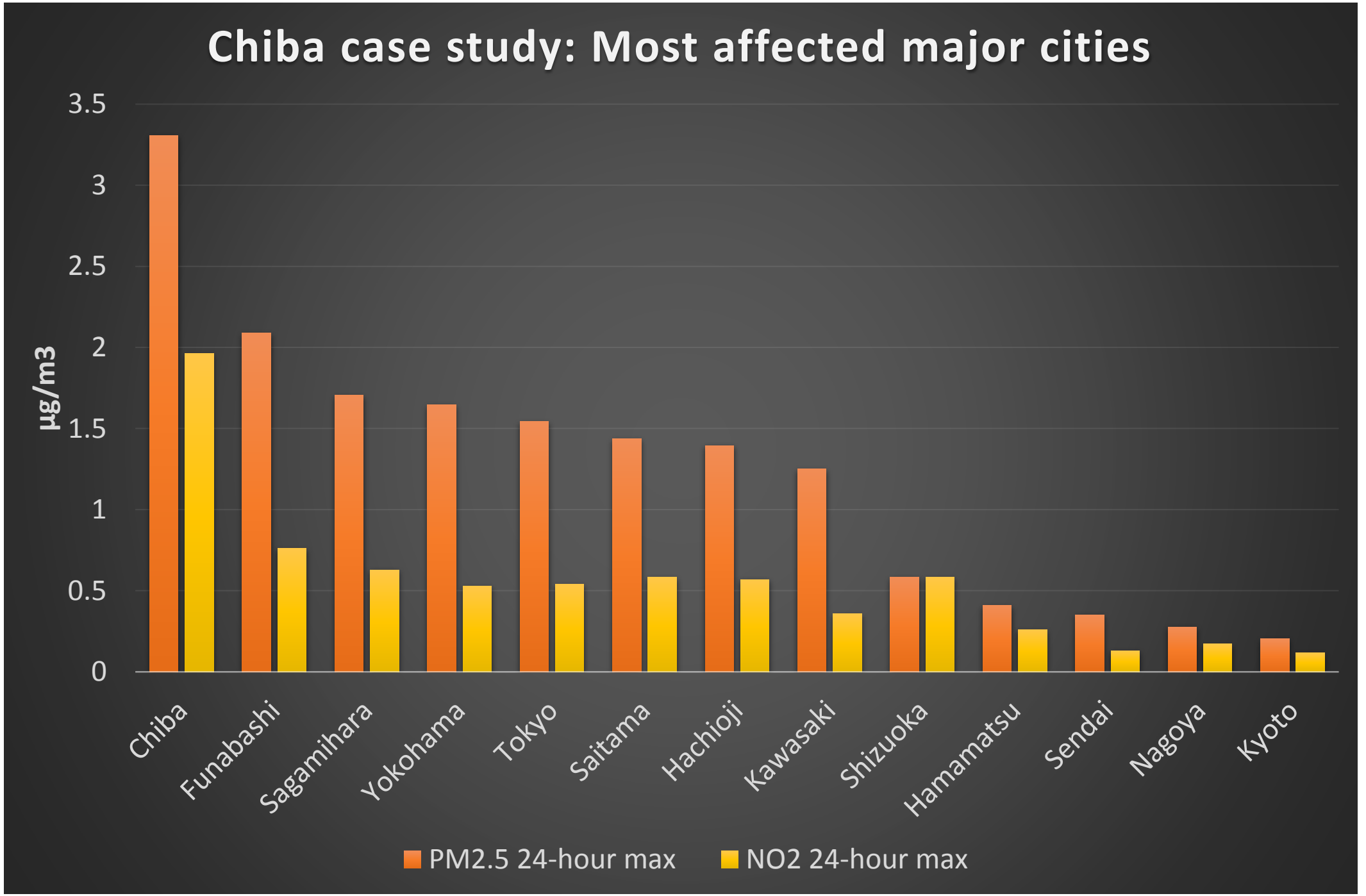
Projected increase in annual average PM2.5 concentrations (µg/m3)



Projected increase in annual average NO2 concentrations (µg/m3)



Chiba case study: Most affected major cities



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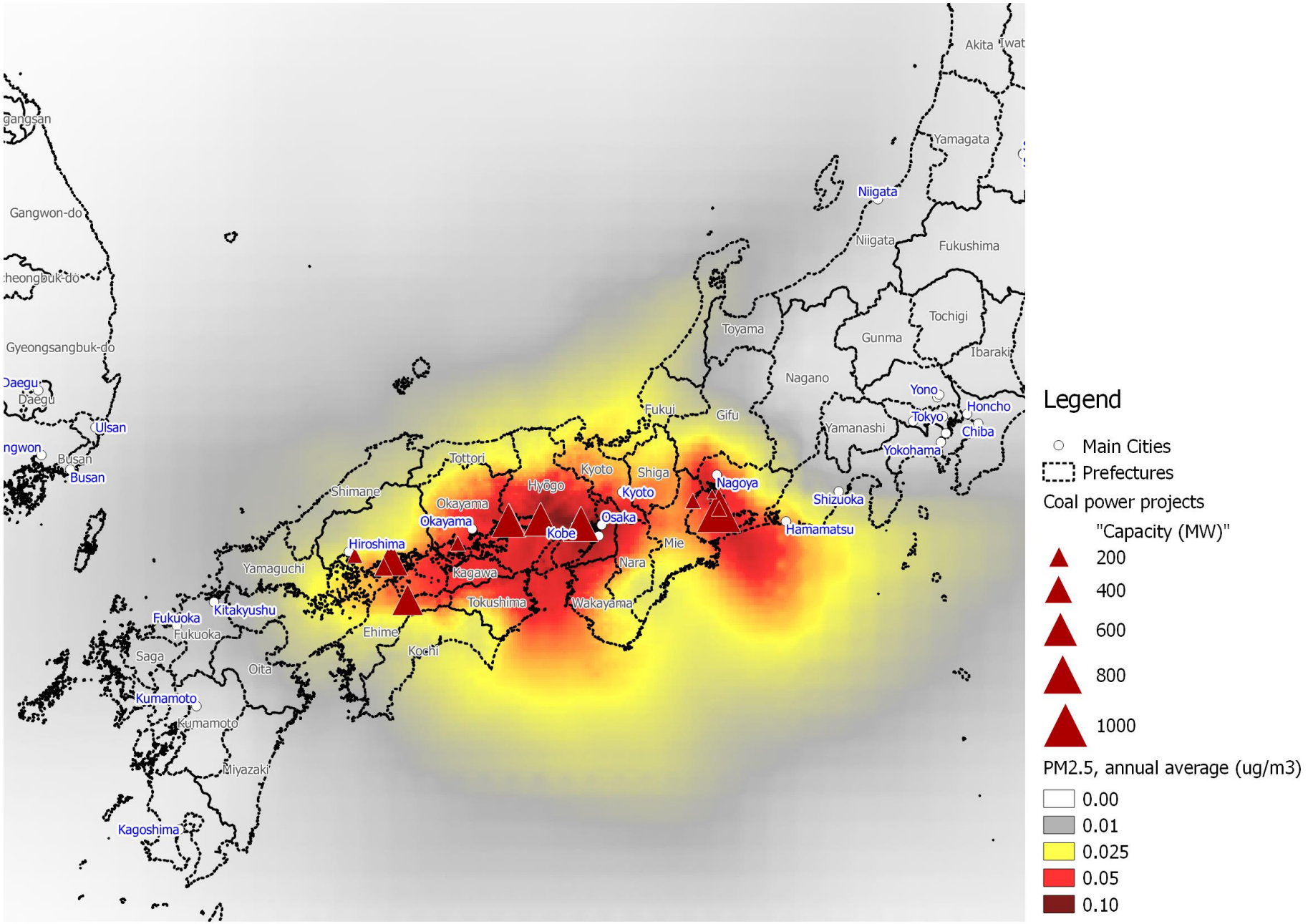
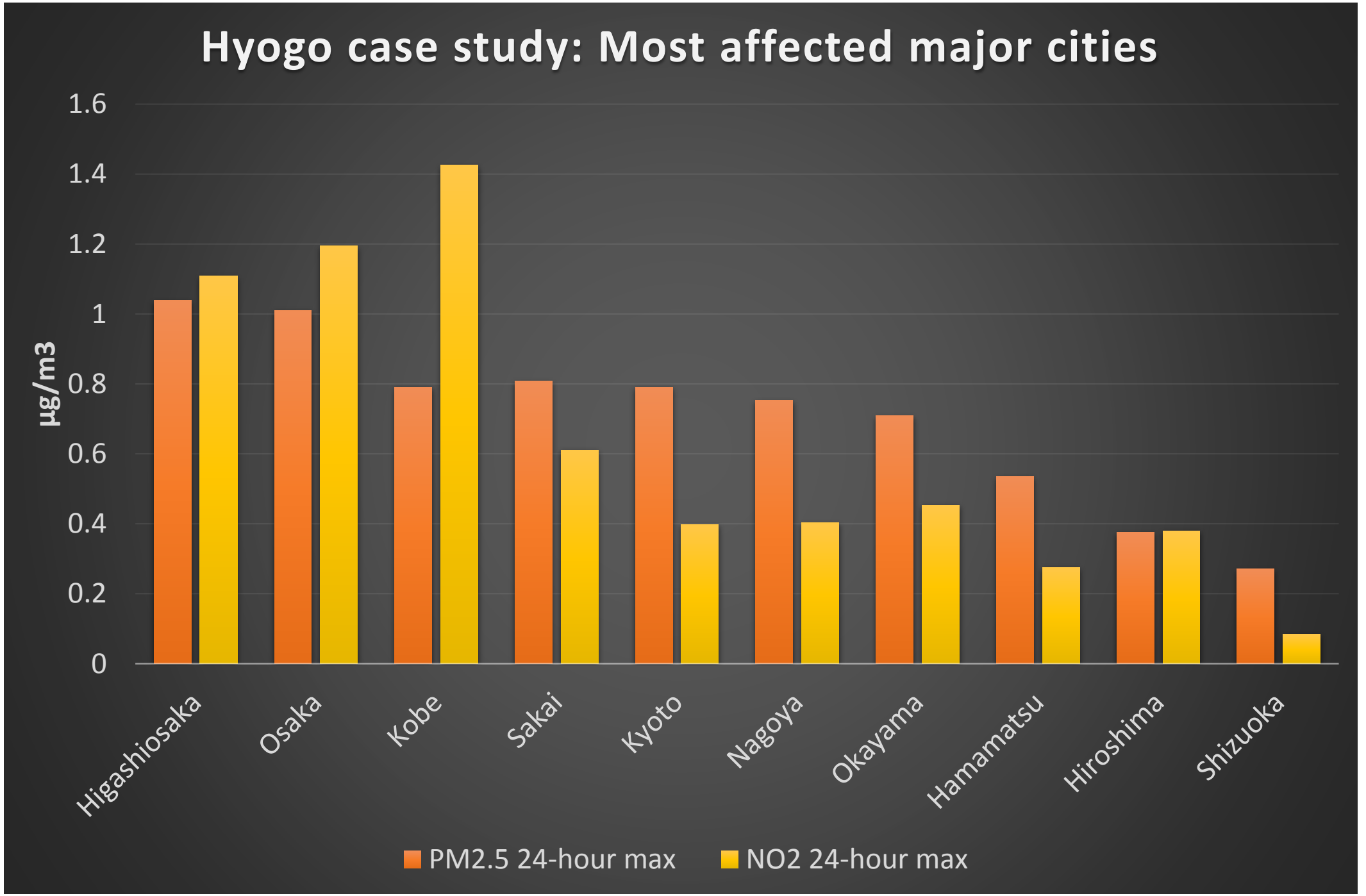
Projected increase in annual average PM2.5 concentrations (µg/m3)



Hyogo case study: Most affected major cities



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Projected health impacts of power plants included in case studies

Cause	Tokyo-Chiba case study	Confidence interval	Osaka-Hyogo case study	Confidence interval
Exposure to PM2.5				
Lung cancer	29	(12-46)	21	(9-33)
Ischemic heart disease	54	(35-73)	39	(25-53)
Stroke	32	(19-44)	23	(14-32)
Other cardiovascular diseases	37	(23-51)	26	(16-36)
Chronic obstructive pulmonary disease	7	(4-10)	5	(3-7)
Other respiratory diseases	24	(15-34)	17	(11-24)
Exposure to PM2.5 total	183	(109-258)	131	(78-185)
Exposure to NO2				
All causes	115	(45-166)	102	(39-146)
Total	**260**	**(138-368)**	**199**	**(104-282)**

	Tokyo-Chiba case study	Confidence interval	Osaka-Hyogo case study	Confidence interval
Low birth weight births	30	(9-52)	21	(7-37)

Impact over 40 years of operation:
18,000 premature deaths

Impacts of Japanese overseas coal power projects

Projected health impacts of proposed coal-fired power plants in Southeast Asia

Preliminary results from ongoing research

Country	Projected premature deaths per year of operation	Study
Vietnam	21,000	Burden of Disease from Rising Coal Emissions in Vietnam (Koplitz et al. 2015)
Indonesia	19,000	The Human Cost of Coal (Greenpeace Southeast Asia 2015)
Thailand	3,800	Cost of living: Coal power plant with a threat to the health of Thailand (Greenpeace Southeast Asia 2015)
Philippines	2,400	Coal: A Public Health Crisis (Greenpeace Southeast Asia 2016)

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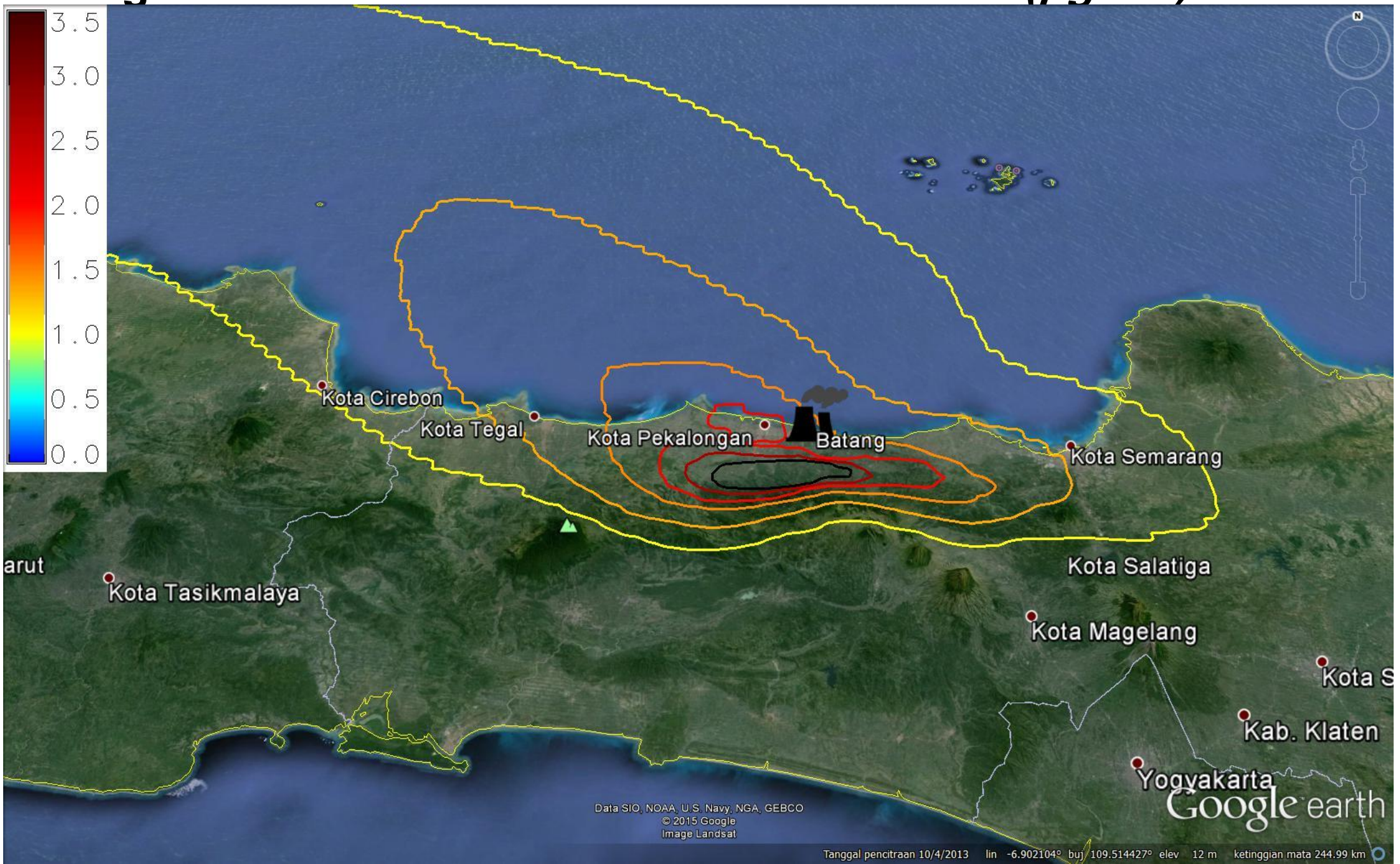
Batang: Modeled annual PM2.5 concentrations *(µg/m3)*



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Projected premature deaths from Batang coal power plant

cases per year

	Best estimate	95% confidence interval
Stroke	340	210-480
Ischemic heart disease	300	190-410
Chronic obstructive pulmonary disease	50	30-68
Lung cancer	40	17-66
Other chronic cardiovascular and respiratory diseases	20	14-32
Children's lower respiratory infections	10	4-34
Total	780	470-1090

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RE the mainstay of power generation investments

- Globally, 2014 was the first year when renewable energy use grew more than fossil fuels
- In U.S. and Europe, majority of new generating capacity is powered by renewable energy; coal is on the decline
- China’s coal use is falling and all of electricity demand growth is being covered from non-fossil sources, mainly renewable energy

Recommendations

- Cumulative health impact assessment needed
- Building new coal-fired power plants would lock Japan into the highest-emitting power generation option for decades. The long-term health impacts should be fully assessed and factored in.
- Air pollutant emissions from all large pollution sources should be disclosed in real-time and on annual basis, like the U.S. already does.
- Re-think coal-based electricity investment plan in light of health impacts, and rapidly improving economics of renewable energy

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Thank you!

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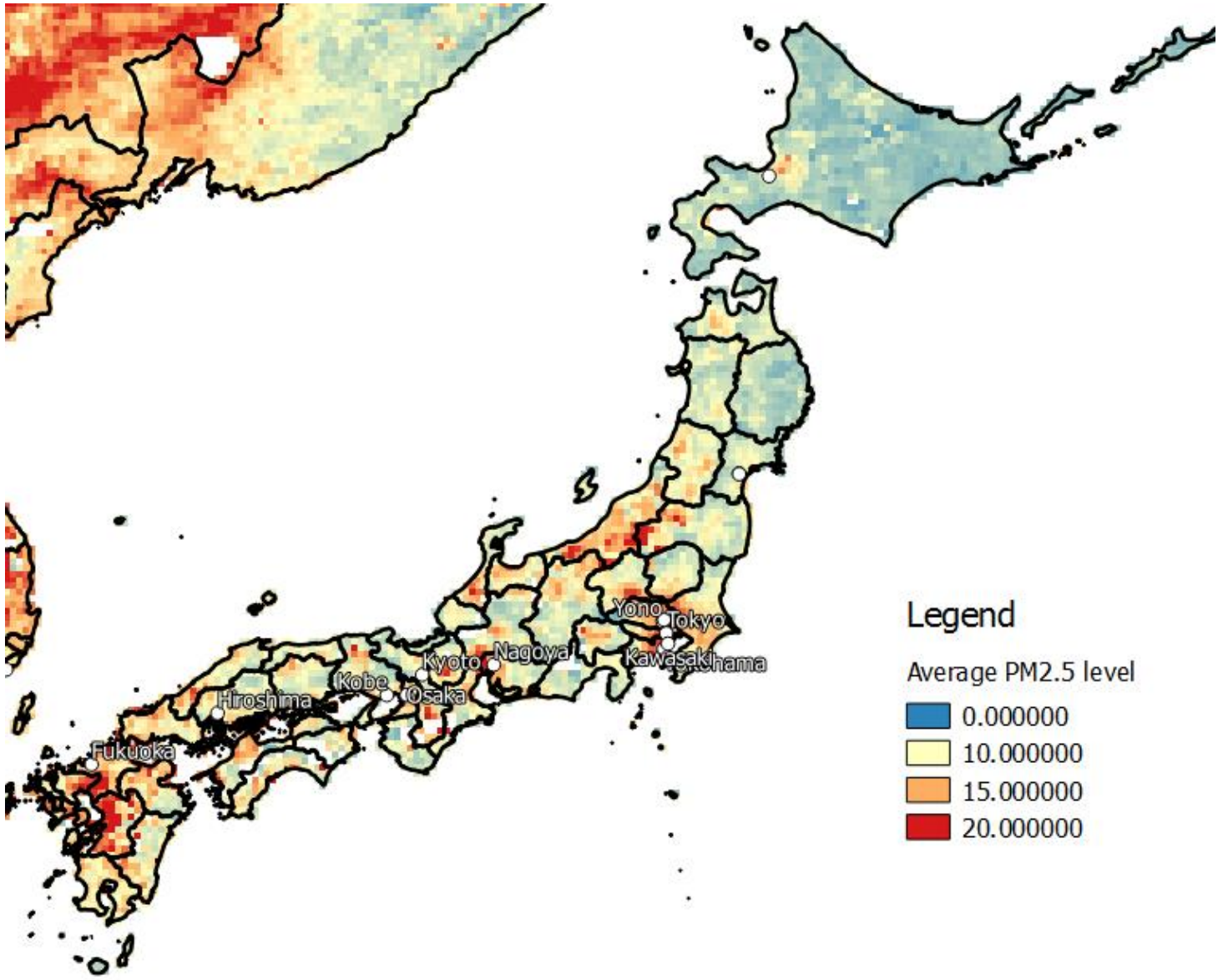
Tokyo, Osaka and Nagoya areas already among most polluted in Japan



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Evidence of health risks

- “American Cancer Society study”: The largest and most well-known study on particulate air pollution and risk of death.
- 500,000 adults in 50 U.S. states with different air pollution levels were followed between 1982 and 1998.
- People living in more polluted environments have a significantly higher risk of fatal heart and lung disease and lung cancer.

Backup slide: Key emission data for the study

Plant name	CO2 emission (k-tonne-CO2/year)	CO2 emission rate (g-CO2 / kWh）	SOX emission concentration （ppm）	NOX emission concentration （ppm）	Dust emission concentration （mg/m3）	Stack height(m)	Chimney Diameter(m)	Gas Temperature （℃）	Gas velocity (m/s)
Taketoyo No.5	6420		25	15	6.461538				
Takehara New No.1	3160	766	18	20	7	200		90	35.9
Saijo New No.1	3000		21.0625	19.125	6.461538				
Osaki Cool Gen	706	692	8	5	3				
Unknown	672		19	40	10				
Kaita biomass blend firing power station	672		19	40	10				
Nagoya No.2	660		19	40	10				
Mizushima Energy Center	660		19	40	10				
Unknown	187		19	40	10				
Ako No.1	3350	800	19	16	8				
Ako No.2	3350	800	19	16	8				
Takasago New-No.1	3600		18	22	8	180		70	20
Takasago New-No.2	3600		18	22	8	180		70	20
Kobe Works New-No.2	3900		13	20	5	150		90	30
Kobe Works New-No.1	3900		13	20	5	150		90	30
Ichihara	6000		25	15	5	180	7	90	30
Kashima No.2	3439	767	25	15	5	180		90	30
Chiba Sodegaura No.2 (tentative)	6000		22	15	5	200	7.25	90	30
Chiba Sodegaura No.1 (tentative)	6000		22	15	5	200	7.25	90	30
Hitachinaka Kyodo No.1	3900		22	15	5	180		90	31.5
Unknown	6000		21.0625	19.125	6.461538				
Yokosuka Power Plant	6000		21.0625	19.125	6.461538				
Unknown	6000		21.0625	19.125	6.461538				
Unknown	600		19	40	10				
Suzukawa Energy Center	600		19	40	10				