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**Joint Public Hearing: Exploring solutions to the disproportionate impact of COVID-19 on minority communities**

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Good morning, I thank the various Chairs and all of the Senators and Members of the Assembly who have come together to examine the important issue of disproportionate adverse impacts of COVID-19 on minority communities. I am Dr. Jack Brouwer, I am a Professor at the University of California, Irvine with a focus on Sustainable Energy, Environmental Engineering, and Mechanical and Aerospace Engineering, in general. Among other things my current research projects include improving air quality using renewable power, electrolyzers and fuel cell systems, modeling criteria air pollutant reductions from renewable gas use in the natural gas system, how to achieve carbon neutrality by addressing renewable power intermittency, integration of hydrogen and electricity infrastructure with non-combustion and resilient power resources, and battery electric, plug-in hybrid electric, and fuel cell electric vehicle evaluation and infrastructure development.

Even before COVID-19 hit there was a growing body of evidence that local air pollution is more harmful to human health than was previously understood. Air pollution exposure has been revealed to be connected to increased risk of brain cancer, increased glaucoma risks, increased risk of ischemic stroke, heart failure, and preterm birth. Chronic exposure to air pollution has been found to be equivalent to smoking a pack of cigarettes a day - that's 365 packs each year of exposure. I have attached to my testimony a more complete list of over 15 new studies on the serious health impacts of local combustion related pollutants. *All of these studies were released within the last 18 months.*

An additional and even newer area of concern involves COVID-19 and its impacts on disadvantaged communities that are also impacted disproportionately by local combustion related pollutants. Although their studies have yet to be peer-reviewed and are therefore not final, Harvard researchers recently found that a long-term air pollution increase of 1 microgram per cubic meter of small particles can raise the risk of dying from COVID-19 by 15%. Separately, University of Siena researchers assert that because air pollution "impairs the first line of defense" of the upper respiratory tract, it likely explains why those who live in areas with higher air pollution fall prey to the disease more than others. Taken together these findings highlight what we already know – without access to clean air otherwise at-risk communities are more likely to contract this and many other illnesses.

Unfortunately, New York state policy has not yet caught up to the science on the issue of local air pollution.

For instance, the Clean Energy Fund, New York's flagship clean energy funding program, has four stated objectives. These include: 1) greenhouse gas emission reductions; 2) energy affordability; 3) statewide penetration and scale of energy efficiency and clean energy generation; and 4) growth in the state's clean energy economy. Reducing local combustion related pollutants is inexplicably not one of the program objectives. It should be. The Clean Energy Fund objectives drive program planning and they drive funding decisions. The objectives of the state's largest clean energy program, the Clean Energy Fund, should be quickly revised to include local combustion related pollutant emission reductions.

A second example involves the Public Service Commission's policy framework known as the Value of Distributed Energy Resources or VDER. This program was supposed to place actual values on the benefits of distributed energy resources. However, while the program has now assigned a value to CO<sub>2</sub> emission reductions, it places no value on reducing local air pollution like nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM). Similar to the other examples that I have described, the VDER program is creating distortions in the market, distortions that undervalue the kind of local air pollution improvements that should be a primary focus and that should not be ignored any longer in this program.

In the last session the legislature adopted the most aggressive set of climate policies in the nation, the Climate Leadership and Community Protection Act ("CLCPA"). This legislation is a fantastic leap forward in the fight against climate change. However, the operative elements of the CLCPA do not cover local combustion related pollutants like PM or NO<sub>x</sub>, both of which are instead classified as "criteria air pollutants." In other words, the mandatory objectives of the CLCPA – 70% by 2030 and 100% by 2040 - do not technically apply to the very kind of air pollution that most directly impacts disadvantaged communities the most. This is a major oversight, and a simple four-word revision ("criteria air pollution and") to the CLCPA definition of co-pollutant, would fix this problem.<sup>1</sup>

Finally, I would also like to highlight the impact of diesel back-up generators on local air pollution. It is important to focus on cleaning up the electric grid, but we also need to focus on cleaning up what backs up that electric grid and makes it resilient. Absent some change in course, even a 100% renewable grid will still use diesel generators for resilient back-up power unless we address this in the short-term with supportive policy. The most up-to-date study of diesel generation capacity in New York City, released in 2003, found that New York City alone had 1300 MW of diesel generation capacity. Imagine if there was a 1300MW diesel fired central power plant in NYC. Most

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<sup>1</sup> The new definition would be: "Co-pollutants" means criteria air pollutants and hazardous air pollutants produced by greenhouse gas emissions sources.

people would find that large diesel power plant to be unacceptable! So why is it acceptable to place many smaller and highly polluting diesel gensets in the neighborhoods immediately adjacent to where people live?

The need to address local air pollution in existing policy becomes particularly stark when we consider the Department of Environmental Conservation's (DEC) most recent proposed rule on the matter. On April 29, 2020 the DEC proposed a rule that would revise the air pollution permitting program to allow so called "emergency power generating stationary internal combustion engines," which used to be limited to running for up to *20 days* in a year, to run *indefinitely* during a declared state of disaster. To be clear diesel backup generators do not run only when there is a blackout. They run during blackouts and on regular intervals throughout the year for required testing, and during local grid interruptions (e.g., when customer on-site electrical work is done). The local air pollution generated from customer-sited power generation like diesel generators has not received enough attention.

The good news is that there are alternatives like microgrids comprised of non-combustion resources that do not emit this kind of pollution like solar, fuel cells, and battery energy storage devices. The increased use of these technologies can allow New York to protect its citizens against the risk of electric grid outages and reduce the use of diesel generators in urban areas.

Air pollution has real consequences, it's not just numbers on a spreadsheet – or who gets to enjoy blue skies. It is high time that the current inequities in the system be addressed in a meaningful way that places formerly disadvantaged communities in the driver's seat – to obtain better energy services through microgrids, insulate their communities from violence, and the negative spiral of loss of life, wellbeing and income from adverse health events from avoidable air pollution exposure.

Thank you for the opportunity to provide testimony this morning.

## Air Pollution Studies

Various studies have already described that combustion-related Particulate Matter, including Black Carbon, is associated with lower birth weight<sup>2,3</sup>, preterm birth<sup>4,5</sup>, and intrauterine growth restriction<sup>6,7</sup>.

As if this body of evidence for the deleterious effects of combustion related pollution wasn't enough to spur action a new and growing body of research now suggests that air pollution is more harmful than ever understood before. For example:

- “By optimizing for both [reduction in climate forcing gases and criteria air pollution], energy planners can better prioritize specific power plant retirements and unlock even greater health benefits than with climate policy alone. Rather than creating health benefits as a “co-benefit” of climate action, this kind of co-optimized energy policy can unite the two goals intentionally.”<sup>8</sup>
- Researchers, looking to explain the observed detrimental effects of combustion related pollutants on fetal development over and above that which is accounted for by simple maternal exposure, found that Black Carbon crosses the placental barrier, even concentrating at detrimental levels in the earliest stages of pregnancy.<sup>9,10</sup> Ultrafine black carbon particulates are spawned by coal-fired power plants, diesel engines and other sources that burn fossil fuels; inhalation is linked to cancer, respiratory problems and birth defects, according to an EPA website.<sup>11</sup>
- Colorado State University Study Finds Short-term Exposure to air pollution is Strongly Linked with Violent Behavior. The research results show a 10 microgram-per-cubic-meter increase in same-day exposure to PM2.5 is associated with a 1.4% increase in violent crimes, nearly all of which is driven by crimes categorized as assaults. Researchers also found that a 0.01 parts-per-million increase in same-

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<sup>2</sup> Pedersen, M. et al. Ambient air pollution and low birthweight: a European cohort study (ESCAPE). *Lancet Respir. Med.* **1**, 695–704 (2013).

<sup>3</sup> Slama, R. et al. Traffic-related atmospheric pollutants levels during pregnancy and offspring's term birth weight: a study relying on a land-use regression exposure model. *Environ. Health Perspect.* **115**, 1283–1292 (2007).

<sup>4</sup> Ritz, B., Wilhelm, M., Hoggatt, K. J. & Ghosh, J. K. C. Ambient air pollution and preterm birth in the environment and pregnancy outcomes study at the University of California, Los Angeles. *Am. J. Epidemiol.* **166**, 1045–1052 (2007).

<sup>5</sup> Rudra, C. B., Williams, M. A., Sheppard, L., Koenig, J. Q. & Schiff, M. A. Ambient carbon monoxide and fine particulate matter in relation to preeclampsia and preterm delivery in western Washington State. *Environ. Health Perspect.* **119**, 886–892 (2011).

<sup>6</sup> Liu, S., Krewski, D., Shi, Y., Chen, Y. & Burnett, R. T. Association between maternal exposure to ambient air pollutants during pregnancy and fetal growth restriction. *J. Expo. Sci. Environ. Epidemiol.* **17**, 426–432 (2007).

<sup>7</sup> Winckelmans, E. et al. Fetal growth and maternal exposure to particulate air pollution—More marked effects at lower exposure and modification by gestational duration. *Environ. Res.* **140**, 611–618 (2015).

<sup>8</sup> Olson, Erik In *Climate Action, Don't Neglect Air Pollution*, The Breakthrough Institute (2019)

<sup>9</sup> Bové, H., Bongaerts, E., Slenders, E. et al. Ambient black carbon particles reach the fetal side of human placenta. *Nat Commun* **10**, 3866 (2019). <https://doi.org/10.1038/s41467-019-11654-3>

<sup>10</sup> Royal College of Physicians. Every breath we take: the lifelong impact of air pollution. Report of a working party. London: RCP, <https://www.rcplondon.ac.uk/file/2914/download> (2016).

<sup>11</sup>EPA, Black Carbon Research, <https://www.epa.gov/air-research/black-carbon-research>, (Site Accessed Jan 2020)

day exposure to ozone is associated with a 0.97% increase in violent crime, or a 1.15% increase in assaults.<sup>12</sup>

- Personal Exposure to Particulate Matter Is Associated With Worse Health Perception in Adult Asthma.<sup>13</sup>
- National Institutes of Health, finding that Local Air Pollution Increases Preterm Birth Risk. Researchers examined exposure to sulfur dioxide, ozone, nitrogen oxides, nitrogen dioxide, carbon monoxide and particles. For nearly all pollutants, exposure was more likely to decrease over time, but 7 to 12% of women in the study experienced a higher exposure to air pollution during their second pregnancy. The highest risks were with increasing exposure to carbon monoxide (51%) and nitrogen dioxide (45%), typically from emissions from motor vehicles and power plants; ozone (48%), a secondary pollutant created by combustion products and sunlight; and sulfur dioxide (41%), mainly from the burning of fossil fuels that contain sulfur, such as coal or diesel fuel.<sup>14</sup>
- University of Minnesota Study finds Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. On average, non-Hispanic whites experience a “pollution advantage”: They experience ~17% less air pollution exposure than is caused by their consumption. Blacks and Hispanics on average bear a “pollution burden” of 56% and 63% excess exposure, respectively, relative to the exposure caused by their consumption. The total disparity is caused as much by how much people consume as by how much pollution they breathe. Differences in the types of goods and services consumed by each group are less important. PM2.5 exposures declined ~50% during 2002–2015 for all three racial–ethnic groups, but pollution inequity has remained high.<sup>15</sup>
- Air Pollution May Be As Harmful To Your Lungs As Smoking Cigarettes, Long-term exposure to ambient air pollutants, especially O<sub>3</sub>, was significantly associated with increasing emphysema assessed quantitatively using CT imaging and with worsening lung function. Emphysema is considered a smoker's disease. But it turns out, exposure to air pollution may lead to the same changes in the lung that give rise to emphysema. "We found that an increase of about three parts per billion [of ground-level ozone] outside your home was equivalent to smoking a pack of cigarettes a day for 29 years," "And so as climate change progresses, we expect that vulnerable populations and — even healthy populations — are going to see increased effects," Brigham says. Chronic respiratory disease (which includes chronic obstructive pulmonary disease and emphysema) is a leading cause of death in the U.S. The World Health Organization estimates that each year [7 million premature deaths around the world are linked to air pollution](#).<sup>16</sup> Thurston says if these long-term cumulative effects were to be included in

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<sup>12</sup> Jesse Burkhardt et al. The effect of pollution on crime: Evidence from data on particulate matter and ozone, *Journal of Environmental Economics and Management* (2019). DOI: 10.1016/j.jeem.2019.102267

<sup>13</sup> Maestrelli, P. et al. Personal Exposure to Particulate Matter Is Associated With Worse Health Perception in Adult Asthma. *J Investig Allergol Clin Immunol* 2011; Vol. 21(2): 120-128

<sup>14</sup> Mendola, P. et al. Air pollution and preterm birth: Do air pollution changes over time influence risk in consecutive pregnancies among low-risk women? *International Journal of Environmental Research and Public Health*, 2019.

<sup>15</sup> Tessum et al. Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. *PNAS* March 26, 2019 116 (13) 6001-6006; first published March 11, 2019 <https://doi.org/10.1073/pnas.1818859116>

<sup>16</sup> World Health Organization, 7 million premature deaths annually linked to air pollution, <https://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>, March 25, 2014 (Site Accessed May 2020)

policymakers' cost-benefit calculations, "the benefits will even more so outweigh the cost of moving forward on cleaning the air." <sup>17,18</sup>

- Air pollution may have killed 30,000 people in a single year, study says. Those deaths came even as almost every county in the United States remained within federal air quality standards. That suggests more stringent regulations are needed to protect human health, researchers say. "I think the big conclusion is that lowering the limits of air pollution could delay in the US, all together, tens of thousands of deaths each year," said Majid Ezzati, the study's lead author and a professor of global environmental health at Imperial College London. While researchers were confident in the link between air pollution and death rates, they found that the effect was greatest in areas with lower incomes, in places with a higher proportion of black Americans and in regions where fewer people graduated from high school. This "inequality in mortality burden," researchers wrote, may be explained by systematic challenges faced by those demographic groups, including higher rates of preexisting medical conditions. <sup>19</sup>
- Study Finds MORE THAN 100,000 Americans each year die of heart attacks, strokes and other illnesses caused by air pollution spewed from factories, motor vehicles and even bucolic-seeming farmland, according to a new report that contradicts an EPA panel whose members downplayed the risks during a public meeting last month. "We estimate that anthropogenic PM<sub>2.5</sub> was responsible for 107,000 premature deaths in 2011, at a cost to society of \$886 billion." <sup>20</sup>
- European Society of Cardiology finds that Air pollution causes 8.8 million extra early deaths a year. As a result of these findings, the researchers say that national governments and international agencies must take urgent action to reduce air pollution, including re-evaluating legislation on air quality and lowering the EU's current limits on the annual average levels of air pollution to match the WHO guidelines. <sup>21</sup>
- The Evidence Is Strong: Air Pollution Seems to Cause Dementia <sup>22,23</sup>

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<sup>17</sup> Wang M, Aaron CP, Madrigano J, et al. Association Between Long-term Exposure to Ambient Air Pollution and Change in Quantitatively Assessed Emphysema and Lung Function. *JAMA*. 2019; 322(6):546–556. doi:10.1001/jama.2019.10255

<sup>18</sup> NPR, All Things Considered, August 13, 2019, <https://www.npr.org/sections/health-shots/2019/08/13/750581235/air-pollution-may-be-as-harmful-to-your-lungs-as-smoking-cigarettes-study-finds>

<sup>19</sup> Bennett JE, Tamura-Wicks H, Parks RM, Burnett RT, Pope CA III, et al. (2019) Particulate matter air pollution and national and county life expectancy loss in the USA: A spatiotemporal analysis. *PLOS Medicine* 16(7): e1002856. <https://doi.org/10.1371/journal.pmed.1002856>

<sup>20</sup> Andrew L. Goodkind, Christopher W. Tessum, Jay S. Coggins, Jason D. Hill, Julian D. Marshall Proceedings of the National Academy of Sciences, Fine-scale damage estimates of particulate matter air pollution reveal opportunities for location-specific mitigation of emissions, Apr 2019, 116 (18) 8775-8780; DOI: 10.1073/pnas.1816102116

<sup>21</sup> European Society of Cardiology. "Air pollution causes 8.8 million extra early deaths a year." *ScienceDaily*. ScienceDaily, 12 March 2019. <[www.sciencedaily.com/releases/2019/03/190312075933.htm](http://www.sciencedaily.com/releases/2019/03/190312075933.htm)>.

<sup>22</sup> Carey IM, Anderson HR, Atkinson RW, et al Are noise and air pollution related to the incidence of dementia? A cohort study in London, England *BMJ Open* 2018;8:e022404. doi: 10.1136/bmjopen-2018-022404

<sup>23</sup> Arron Reuben, *Wired*, The Evidence Is Strong: Air Pollution Seems to Cause Dementia, May 2019, <https://www.wired.com/story/air-pollution-dementia/>