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BUILDING BACK BETTER: INVESTING IN A RESILIENT RECOVERY FOR WASHINGTON STATE

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ABSTRACT

This article analyzes the potential jobs and community health benefits created by a sample *Resilient Recovery Portfolio* of investments in Washington State. This type of investment mindset can kick-start job growth, shared economic prosperity, cleaner air, and climate-resilient communities, thereby serving as a template for Building Back Better in Washington and elsewhere. A *Resilient Recovery Portfolio* supports over ten jobs per million dollars invested in clean transportation, forest conservation and ecosystem restoration, clean energy, water and energy efficiency, low carbon agriculture, and sustainable industry programs. By comparison, the state's ten largest industries support 4.3 jobs per million dollars invested. This portfolio prioritizes labor-intensive productive businesses in the state, outperforming multiple benchmarks on contributions to employee compensation and gross state product. Additionally, we find that every million dollars invested in these programs accrues $2.4 million in clean air and climate benefits, with the most cost-effective returns from *wildfire prevention and preparedness*. Sustaining these and expanding to additional programs in order to meet the state's

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climate goals can unlock net health and climate benefits of $46 billion through 2050 while continuing demand for the types of jobs highlighted in this report.

INTRODUCTION

Washington has been hit hard by the COVID-19 health and economic crises. According to the Washington State Department of Health, deaths of Washingtonians from COVID-19 surpassed 2,000 in September of 2020.[2] A record 1.1 million Washington workers filed for unemployment in the first few months of the crisis, with unemployment reaching a record-high 16.3 percent in April and remaining above 10 percent in July.[3] The Puget Sound Clean Air Agency attributes over a thousand deaths each year in Washington to outdoor air pollution, which likely worsens impacts of COVID-19, while increasingly severe wildfire seasons are creating prolonged exposure to hazardous air quality.[4]

The urgent need to rebuild and create new economic growth and healthier communities in Washington State motivates this study. To meet this challenge, we analyzed the economic and health impacts of 14 different investment programs, which were selected based on available existing case studies, to cover all major facets of the energy system and natural resources. We analyzed programs for job creation, wage and benefit levels, and value added to the state economy using IMPLAN economic modeling. Programs were subsequently evaluated for community health and climate benefits per million dollars invested.

Our research demonstrates that Washington communities can recover from COVID-19 related crises while increasing resiliency against future crises. The ability to do so will hinge on immediate policy choices of federal, state, and local government. Decisionmakers need to efficiently target stimulus dollars and other budget allocations to maximize near-term, high-quality job creation alongside long-term durable health and climate benefits. This analysis is intended to propel recovery efforts towards achieving these outcomes by applying a multiple-benefits framework to program funding and other investment prioritization. The quantitative methodology developed for this research can be used as a screening tool for

[2] Washington State Dep't of Health, *COVID-19 Data Dashboard* (2020), https://www.doh.wa.gov/Emergencies/COVID19/DataDashboard.
[3] U.S. BUREAU OF LABOR STATISTICS, *Current Unemployment Rates for States and Historical Highs/Lows* (2020), https://www.bls.gov/web/laus/lauhsthl.htm.
[4] Jessica E. Halofsky et al., *Changing Wildfire, Changing Forests: The Effects of Climate Change on Fire Regimes and Vegetation in the Pacific Northwest, USA*, 16 FIRE ECOL. 1, 4 (2020).

policymakers and stakeholders to use in constructing a recovery plan at the nexus of jobs and community health that supports a healthier, more sustainable, and broadly prosperous future. In order to maximize Washington's potential, it will be essential to prioritize job quality within these programs and ensure that benefits are guided by and flow to communities with the greatest present barriers and needs stemming from historical conditions.

Based on our analysis, the most effective path to economic recovery prioritizes investments in what we call the *Resilient Recovery Portfolio.* The Resilient Recovery Portfolio includes programs in clean transportation, forest conservation and ecosystem restoration, clean energy, water and energy efficiency, low carbon agriculture, and sustainable industry. We find that the co-benefits these investments offer greatly outweigh their upfront costs, providing robust job creation and significant community health benefits. These programs will also move the state towards the jobs, industries, and services that will help it prosper throughout and beyond the transition towards a net zero-emissions future.

I. BACKGROUND

A. *Employment and Equity in the COVID-19 Context*

The COVID-19 public health and economic crises have left American families, businesses, and institutions financially vulnerable and uncertain about the future. The federal unemployment rate peaked at 14.7 percent in April, with more than 20 million Americans out of work—a number unprecedented since the Great Depression.[5] While unemployment has partially recovered to a national average of 10.3 percent in July, the impacts are likely to be felt for many more months or even years. The Federal Reserve projected that unemployment will stay between seven and eight percent by the end of 2020 and remain up to 40 percent higher through 2022 than forecast prior to the pandemic.[6]

Black, Indigenous, and People of Color ("BIPOC") across the U.S. already face systemic challenges to employment that are exacerbated in

[5] U.S. BUREAU OF LABOR STATISTICS, THE EMPLOYMENT SITUATION – AUGUST 2020, https://www.bls.gov/news.release/archives/empsit_09042020.htm (last modified Sep. 23, 2020).

[6] U.S. FED. RESERVE BD., CHAIR'S FOMC PRESS CONFERENCE PROJECTIONS MATERIALS, *September 16, 2020* (Sep. 16, 2020), https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20200916.pdf (the "central tendency" of the September 2020 forecasted unemployment is 4.0 to 5.0 percent through 2022, compared to a December 2019 "central tendency" forecast of 3.5 to 4.0 percent).

times of crisis. Black, Asian, and Latinx workers experienced respective peak unemployment rates between 15 and 18.9 percent in the Spring, compared to a peak of 14.2 percent for White workers.[7] On a year-over-year basis compared to November 2019, Black unemployment was 4.7 percentage points greater, Asian unemployment 4.1 percentage points greater, Hispanic or Latinx unemployment 4.2 percentage points greater, and White unemployment 2.7 percentage points greater in November 2020.[8]

The greater spike in Black and Latinx unemployment is due to the higher share of jobs in service industries, which were hit first and worst by stay-at-home measures.[9] At the same time, those who have not lost their jobs are more likely to work on the frontlines in essential services, increasing their exposure to COVID-19 and risking their health to earn a living — often without paid sick days or health insurance.[10] Black workers make up 17 percent of frontline jobs, despite making up just under 12 percent of the labor force.[11] Washington State has not been immune to these employment and health disparities. Yakima County, with an agriculture and food processing workforce made up largely of People of Color, has the highest rate of COVID-19 cases and deaths per capita in Washington State as of September 2020.[12,13]

B. *Clean Energy Employment and Job Losses*

Despite growth well above statewide trends in recent years, Washington's clean energy industries have also been hit hard. Energy

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[7] U.S. BUREAU OF LABOR STATISTICS, *supra* note 5.
[8] U.S. BUREAU OF LABOR STATISTICS, THE EMPLOYMENT SITUATION – NOVEMBER 2020, https://www.bls.gov/news.release/archives/empsit_12042020.htm (last modified Dec. 4, 2020).
[9] Steven Brown, *How COVID-19 Is Affecting Black and Latino Families' Employment and Financial Well-Being*, URBAN INSTITUTE (May 6, 2020), https://www.urban.org/urban-wire/how-covid-19-affecting-black-and-latino-families-employment-and-financial-well-being.
[10] HYE JIN RHO ET AL, A BASIC DEMOGRAPHIC PROFILE OF WORKERS IN FRONTLINE INDUSTRIES, CTR. FOR ECONOMIC AND POLICY RESEARCH (Apr. 7, 2020), https://cepr.net/a-basic-demographic-profile-of-workers-in-frontline-industries/.
[11] ELISE GOULD & VALERIE WILSON, BLACK WORKERS FACE TWO OF THE MOST LETHAL PREEXISTING CONDITIONS FOR CORONAVIRUS-RACISM AND ECONOMIC INEQUALITY, ECONOMIC POLICY INST. (Jun. 1, 2020), https://www.epi.org/publication/black-workers-covid/.
[12] N. Y. TIMES, *COVID in the US: Latest Map and Case Count* (2020), https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html.
[13] YAKIMA HEALTH DIST., *COVID-19 Data Summary*, https://www.yakimacounty.us/2404/Data-Summary (last updated Dec. 24, 2020).

efficiency, renewable energy, clean vehicles, clean fuels, and grid storage employed more than 85,000 workers in Washington prior to the COVID-19 crisis, compared to 7,651 employees in the fossil fuel industry.[14,15] In just three months, more than 21,200 clean energy workers lost their jobs, constituting 24 percent of the state's clean energy workforce.[16] King County has been particularly hard hit, with more than 6,400 clean energy workers remaining unemployed through August, the second highest level of clean energy job loss of any county in the nation.[17]

The experience of clean energy industries in Washington aligns with national trends. More than 620,000 clean energy workers lost their jobs, totaling 18 percent of the industry's workforce.[18] Less than one in six jobs lost in the state's clean energy industries has returned as of August 2020, and over 20 percent of Washington's clean energy workforce remains out of work.[19]

In Washington, 70 percent of pre-COVID clean energy workers were employed by businesses with fewer than 20 employees.[20] These small firms are less resistant to financial shocks than larger counterparts and are disproportionately impacted by the slowdown in commerce.[21] In addition to clean energy industries, Leisure and Hospitality, Education and Health Services, and Construction have also experienced particularly large job losses.[22]

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[14] E2, *Clean Jobs America 2020: Repowering America's Economy in the Wake of COVID-19* (Apr. 2020), https://e2.org/wp-content/uploads/2020/04/E2-Clean-Jobs-America-2020.pdf (a majority of Washington clean energy jobs are in the energy efficiency sector, which particularly features electricians and construction workers, sales and marketing associates, and technicians).

[15] E2, *Clean Jobs Washington: Primed to Lead Washington's Economic Recovery* 3 (Nov. 2020), https://e2.org/wp-content/uploads/2020/11/E2-Clean-Jobs-Washington-2020.pdf.

[16] E2, *Clean Energy & COVID-19 Crisis | May 2020 Unemployment Analysis* (May 2020), https://e2.org/reports/clean-jobs-covid-economic-crisis-may-2020/.

[17] Philip Jordan, *Clean Energy Employment Initial Impacts from the COVID-19 Economic Crisis, August 2020*, BW RESEARCH PARTNERSHIP (Sep. 14, 2020), https://e2.org/wp-content/uploads/2020/09/Clean-Energy-Jobs-August-COVID-19-Memo-Final.pdf.

[18] E2, *supra* note 16.

[19] Philip Jordan, *supra* note 17, at 5-16. Appendix G shows 17,979 cumulative clean energy job losses in Washington from pre-COVID through August, down from a 21,242 peak in May. Appendix B shows this is a 20.2% decline in the state's clean energy workforce relative to pre-COVID levels.

[20] E2, *Clean Jobs Washington 2019* (Dec. 18, 2019), https://e2.org/reports/clean-jobs-washington-2019/.

[21] E2, *Clean Jobs America 2020* (Apr. 15, 2020), https://e2.org/reports/clean-jobs-america-2020/.

[22] WASH. STATE EMP. SEC. DEP'T, *Unemployment Insurance Claims and Benefits Data*, https://esd.wa.gov/labormarketinfo/unemployment-insurance-data (select "May 2020").

C. *Health and Equity Impacts of Air Pollution*

In the U.S., more than 100,000 people die each year from overexposure to airborne pollutants such as fine particulate matter ("$PM_{2.5}$"), at a societal cost of $886 billion per year.[23] More recent evidence suggests this may be an underestimate of the lethality of air pollutants, with around twice as many air pollution related premature deaths nationally.[24] Acute exposure to $PM_{2.5}$ can cause lung irritation and exacerbate pre-existing respiratory diseases. Chronic prolonged exposure to $PM_{2.5}$ and other air pollutants, such as nitrogen oxides ("NO_x"), sulfur dioxide ("SO_2"), volatile organic compounds ("VOCs"),[25] and ammonia ("NH_3") can cause decreased lung function and other respiratory diseases, diabetes, hypertension and increased risk of heart attack or stroke, cancer, and premature death.

Children and infants are particularly vulnerable to air pollution, which can harm lung development. Exposure to air pollutants is linked to higher rates of asthma, which affects more than six million American children.[26] Prenatal exposure to air pollution can also impact fetal development and has been linked to low birth weight and premature birth, which further decreases lung function.[27]

In the U.S. communities of color and low-income communities bear the overwhelming burden of air pollution and its health impacts despite contributing significantly less to air pollution emissions.[28,29] Black and Latinx Americans bear the burdens of pollution at a rate that is approximately 60 percent higher on average than their contribution to pollution, while White Americans experience 17 percent less air pollution

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[23] Andrew L. Goodkind et al., *Fine-Scale Damage Estimates of Particulate Matter Air Pollution Reveal Opportunities for Location-Specific Mitigation of Emissions*, 116 PNAS 8775 (Apr. 30, 2019) ("Fine-scale damage estimates of particulate matter air pollution reveal opportunities for location-specific mitigation of emissions.").
[24] Drew Shindell, *Health and Economic Benefits of a 2°C Climate Policy* (Aug. 5, 2020), https://oversight.house.gov/sites/democrats.oversight.house.gov/files/Testimony%20Shindell.pdf.
[25] Ground-level ozone, commonly known as "smog," is created by chemical reactions between NOx, VOCs and sunlight. Exposure to ground-level ozone can trigger asthma attacks and other respiratory issues by irritating lungs and airways.
[26] Allison J. Burbank & David B. Peden, *Assessing the Impact of Air Pollution on Childhood Asthma Morbidity: How, When, and What to Do,* 18 ALLERGY AND CLINICAL IMMUNOLOGY 124 (Apr. 2018).
[27] Xiaoli Sun et al., *The Associations Between Birth Weight and Exposure to Fine Particulate Matter (PM2.5) and its Chemical Constituents During Pregnancy: A Meta-Analysis*, 211 ENVTL. POLLUTION 38 (Apr. 2016).
[28] Robert J. Brulle & David N. Pellow, *Environmental Justice: Human Health and Environmental Inequalities*, 27 ANN. REV. OF PUBLIC HEALTH 103 (Apr. 21, 2006).
[29] Christopher W. Tessum et al., *Inequity in Consumption of Goods and Services Adds to Racial-Ethnic Disparities in Air Pollution Exposure*, 116 PNAS 6001 (Mar. 11, 2019).

than what they produce.[30] Asthma "hotspots" around the country are most often found in communities of color, and Black children have a 250 percent higher hospitalization rate and 500 percent higher death rate from asthma compared to White children nationwide.[31] Analyzing the distributional impacts of pollution across geography, demographics, and socioeconomic status is therefore critical to a comprehensive understanding of air pollution and community health.[32]

The Puget Sound Clean Air Agency estimates that poor air quality causes around 1,100 deaths annually in Washington State.[33] Using current EPA estimates, these mortality damages exceed $10 billion per year.[34] Wildfire smoke is a notable contributor to compromised air quality across the state, emitting a wide range of compounds harmful to human health, including $PM_{2.5}$ and VOCs.[35] The U.S. Forest Service found that the most at-risk Washington cities from wildfire damages are located in Central and Eastern Washington, and that $PM_{2.5}$ concentrations reach "very unhealthy" levels in many sites.[36] As Washington continues to feel the impacts of global climate change, more frequent and larger fires pose greater health risks to Washingtonians throughout the state.[37] A recent survey of BIPOC communities concentrated in King County finds that wildfires are the highest-ranking concern among all climate-related impacts. The authors note that "[g]iven that the majority of our survey respondents are low income, and over one-third identify as disabled, wildfire incidents carry an increased health risk for our community members compared to the general

[30] *Id*.
[31] Lara J. Akinbami, *The State of Childhood Asthma, United States, 1980-2005*, CTR. FOR DISEASE CONTROL (Dec. 12, 2006), https://www.cdc.gov/nchs/data/ad/ad381.pdf.
[32] Esther Min et al., *Washington Environmental Health Disparities Map Project* (2019), https://deohs.washington.edu/washington-environmental-health-disparities-map-project.
[33] PUGET SOUND CLEAN AIR AGENCY, *Air Pollution & Your Health*, https://pscleanair.gov/161/Air-Pollution-Your-Health.
[34] The statistical value of life (VSL) is an economic measure of mortality in dollar terms that governments use for cost-benefit analysis purposes. We use a VSL of $9.4 million in our analysis, mirroring estimates used by the EPA adjusted to inflation.
[35] U.S. ENVTL. PROTECTION AGENCY, *2017 National Emissions Inventory (NEI) Data*, https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data (under the "data queries" tab, selecting Washington for "geographic aggregation", and wildfires for "sector" will show all pollutants from wildfires).
[36] BUREAU OF LAND MGMT. & USDA FOREST SERV., *2018 Pacific Northwest Wildland Fire Season: Summary of Key Events and Issues* (2018), https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd611322.pdf.
[37] *See generally* Halofsky, *supra* note 4.

population."[38]

D. *Relation of Air Pollution Exposure to COVID-19 Infection and Mortality Rates*

For decades, researchers have understood the definitive link between air pollution and higher mortality rates from respiratory illnesses. As with the Severe Acute Respiratory Syndrome (SARS) outbreak,[39] research demonstrates that exposure to air pollution can cause pre-existing conditions, including asthma, diabetes, and heart disease, and are the most at risk of fatality from COVID-19. Researchers from the Harvard T.H. Chan School of Public Health quantified this relationship, citing that a one microgram per cubic meter increase in long-term exposure to $PM_{2.5}$ leads to an eight percent increase in the COVID-19 death rate.[40,41] The study also notes that African Americans are more likely than other racial and ethnic groups to live in counties with elevated levels of $PM_{2.5}$.

Over 2,800 Washingtonians died from COVID-19 between February and November 2020.[42] Many of the worst impacts were concentrated in communities identified as the most overburdened by environmental risks.[43,44] Hispanic individuals constitute 35 percent of total confirmed cases and 27 percent of hospitalizations in the state, despite constituting only 13 percent of the state's population.[45] Yakima County, for example, where 50 percent of the population is Latinx or Hispanic and one-sixth of all residents live in poverty, has the highest COVID-19 cases and deaths

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[38] Debolina Banerjee et al., *Powering the Transition: Community Priorities for a Renewable and Equitable Future*, PUGET SOUND SAGE (2020), https://www.pugetsoundsage.org/research/clean-healthy-environment/community-energy/.
[39] Yan Cui et al., *Air Pollution and Case Fatality of SARS in the People's Republic of China: An Ecologic Study*, 15 ENVTL. HEALTH 2 (2003), https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-2-15.
[40] Xiao Wu et al., *Exposure to Air Pollution and COVID-19 Mortality in the United States: A Nationwide Cross-Sectional Study* (2020), https://projects.iq.harvard.edu/files/covid-pm/files/pm_and_covid_mortality_med.pdf.
[41] U.S. ENVTL. PROTECTION AGENCY, *Revised Air Quality Standards for Particle Pollution and Updates to the Air Quality Index (AQI)* (2012), https://www.epa.gov/sites/production/files/2016-04/documents/2012_aqi_factsheet.pdf. The EPA established the National Ambient Air Quality Standards to improve air quality and public health. The long-term standard (annual average) for a "safe" level of exposure to PM2.5 is 12 micrograms per cubic meter, however even this level can cause lung and eye irritation.
[42] WASH. STATE DEP'T OF HEALTH, *COVID-19 Data Dashboard* (2020), https://www.doh.wa.gov/Emergencies/COVID19/DataDashboard.
[43] *Id.*
[44] Esther Min et al., *supra* note 32.
[45] WASH. STATE DEP'T OF HEALTH, *supra* note 42.

per capita in the state, with an infection rate exceeding New York City's.[46] [47]

E. *Building Back Better*

The economic and public health crises signal a clear imperative to prioritize disadvantaged and vulnerable populations when promoting job-centric industries and delivering positive health outcomes. On top of high unemployment rates and energy insecurity burdens, BIPOC communities face an inequitable public health reality stemming from decades of structural racism through the built environment and the disproportionate zoning of polluting industries and activities.[48]

Existing literature on economic recovery strategies can help inform this unique moment. According to a global survey of economic experts, clean physical infrastructure investment, efficiency spending for existing buildings, education and training programs, natural capital investments for ecosystem resilience and regeneration, and clean R&D spending rank as top-performing recovery measures from COVID-19.[49] The co-benefits of these investments are cited as key drivers of long-term economic benefits, including reduced waste, reduced congestion and inefficiencies, improved health outcomes, preserved biodiversity, and ecosystem sustainability.[50]

In the U.S., the Rocky Mountain Institute identifies building retrofit programs, transportation expansion and electrification, sustainability-tied debt forgiveness, and new finance mechanisms for clean energy and transportation as key programs for an adequate and equitable federal recovery strategy.[51] For example, a national low-carbon financing bank

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[46] Danny Westneat, *'Getting Sick Has Gotten Political': One Yakima Woman's Struggle to Say the Coronavirus' Hurt is Real*, SEATTLE TIMES (Jun. 17, 2020), https://www.seattletimes.com/seattle-news/westneat-17/.

[47] WASH. STATE EMP. SEC. DEP'T, *Yakima County Profile*, https://esd.wa.gov/labormarketinfo/county-profiles/yakima (updated Nov. 2020).

[48] Esther Min et al., UNIV. OF WASH. DEP'T OF ENVTL. & OCCUPATIONAL HEALTH SCIENCES, *Washington Environmental Health Disparities Map* (2019), https://deohs.washington.edu/sites/default/files/images/Washington_Environmental_Health_Disparities_Map.pdf.

[49] Cameron Hepburn et al., *Will COVID-19 Fiscal Recovery Packages Accelerate or Retard Progress on Climate Change?* (May 4, 2020), https://www.smithschool.ox.ac.uk/publications/wpapers/workingpaper20-02.pdf.

[50] *Id*.

[51] BEN HOLLARD ET AL., ROCKY MOUNTAIN INST., GLOBAL STIMULUS PRINCIPLES: THE ECONOMY WE BUILD SHOULD NOT BE THE SAME ECONOMY WE DECARBONIZE, 5-6 (2020), https://rmi.org/insight/global-stimulus-principles-the-economy-we-build-should-not-be-the-same-economy-we-decarbonize.

capitalized at $5 billion would create 388,000 jobs and reduce energy costs for nearly 800,000 homes.[52] However, the success of these programs hinges on how policymakers prioritize job creation potential, cleaner air, and economic, energy, and climate resilience.[53]

The American Recovery and Reinvestment Act of 2009 ("ARRA"), the largest single investment in clean energy in U.S. history,[54] provides key lessons for utilizing clean energy and ecosystem restoration investments as tools for efficient economic recovery. Investments enabled by the ARRA laid the groundwork for unprecedented growth in clean energy and energy efficiency in the decade following.[55,56]

Notable investments and job creation from the American Recovery and Reinvestment Act of 2009 include:

Clean energy-related programs supported 900,000 job-years between 2009 and 2015 and were some of the most cost-effective job creators across all ARRA measures.[57]

Nearly $60 million for weatherizing homes in Washington was accessible within weeks, leading to money-saving improvements for 7,000 low-income homes and hundreds of new jobs.[58,59]

Shovel-ready habitat restoration projects from $167 million in funding to NOAA created more than 1,400 jobs within 18 months of administering the projects.[60]

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[52] ROCKY MOUNTAIN INST., US STIMULUS STRATEGIES: RECOMMENDATIONS FOR A ZERO-CARBON ECONOMIC RECOVERY 17 (2020), https://rmi.org/insight/recommendations-for-a-zero-carbon-economic-recovery/.

[53] *Id.* at 5.

[54] EXEC. OFFICE OF THE PRESIDENT OF THE U.S., A RETROSPECTIVE ASSESSMENT OF CLEAN ENERGY INVESTMENTS IN THE RECOVERY ACT 2 (2016), https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160225_cea_final_clean_energy_report.pdf.

[55] *Id.* at 2.

[56] Solar electricity generation increased by more than 30 times between 2008 and 2016, adding workers at a pace 12 times faster than the overall economy, and wind generation more than tripled during that time period. *Id.* at 5, 20. The Department of Energy estimates that more than 1 million homes benefitted from energy efficiency improvements between 2009 and 2012 with federal support, primarily through the Weatherization Assistance Program. *Id.* at 8.

[57] *Id.* at 2.

[58] OFFICE OF GOVERNOR CHRIS GREGOIRE, GOV. GREGOIRE ANNOUNCES NEARLY $30 MILLION IN RECOVERY FUNDS TO WEATHERIZE LOW-INCOME HOMES (2009).

[59] OFFICE OF GOVERNOR CHRIS GREGOIRE, GOV. GREGOIRE DETAILS WASHINGTON STATE JOB CREATION THROUGH RECOVERY FUNDS (2010).

[60] Peter E. T. Edwards, Ariana E. Sutton-Grier, G. E. Coyle, *Investing in Nature: Restoring Coastal Habitat Blue Infrastructure and Green Job Creation,* 38 MARINE POLICY 65-71 (2012) at 66-68, https://doi.org/10.1016/j.marpol.2012.05.020.

Each dollar invested in public transit supported nearly twice as many jobs as each dollar invested in new roads. However, most states prioritized building new roads instead of repairing deteriorating infrastructure and building out public transit.[61] In Washington, 95 percent of flexible transportation funding was spent on highways and roads, as opposed to 0.3 percent spent on public transit and three percent spent on active transportation.[62]

A key element of ARRA clean energy-related investments was a focus on "shovel ready" projects, as 80 percent of all clean energy jobs created from ARRA investments occurred within the first three years of spending.[63,64] If anything, ARRA has been criticized for fiscal austerity, resulting in slower than necessary economic recovery.[65] Early rescue packages to address COVID-19 fall-out have been much larger than ARRA. The Coronavirus Aid, Relief and Emergency Security (CARES) Act provided Washington with more than $6 billion in funds for state and local governments, childcare and education, housing protection, and expanded unemployment benefits.[66] However, **barely one percent ($26 billion)** of stimulus funding in the United States has been allocated to green spending, **an order of magnitude less than the 20 percent share ($249 billion)** of EU stimulus spending.[67]

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[61] SMART GROWTH AMERICA & TRANSP. FOR AMERICA, *Learning From the 2009 Recovery Act: Lessons and Recommendations for Future Infrastructure Stimulus* 4-5 (2020), https://smartgrowthamerica.org/resources/learning-from-the-2009-recovery-act/.

[62] SMART GROWTH AMERICA, *Recent Lessons from the Stimulus: Transportation Funding and Job Creation,* 12 (2011), https://smartgrowthamerica.org/app/legacy/documents/lessons-from-the-stimulus.pdf.

[63] "The allocations focused as much as possible on projects that were "shovel-ready" and could be deployed relatively quickly, in order to take advantage of resources in the economy that were under-utilized due to the Great Recession." EXEC. OFFICE OF THE PRESIDENT OF THE U. S., *supra* note 54, at 13.

[64] Of an estimated 900,000 job-years supported between 2009 and 2015 by ARRA clean energy-related programs, roughly 720,000 occurred in 2009 through 2012. *Id.* at 4.

[65] Josh Bivens, *Why is Recovery Taking So Long—and Who's to Blame?* ECON. POLICY INST. (2016), https://www.epi.org/publication/why-is-recovery-taking-so-long-and-who-is-to-blame/.

[66] OFFICE OF GOVERNOR JAY INSLEE, INSLEE STATEMENT ON FEDERAL STIMULUS PACKAGE (2020), https://www.governor.wa.gov/news-media/inslee-statement-federal-stimulus-package.

[67] KATE LARSEN ET AL., RHODIUM GRP., IT'S NOT EASY BEING GREEN: STIMULUS SPENDING IN THE WORLD'S MAJOR ECONOMIES 1 (2020), https://rhg.com/research/green-stimulus-spending/.

As of September 2020, the U.S. Federal Reserve maintains a long-term interest rate of 0 to 0.25 percent.[68] Real government bond rates in developed countries are near zero or negative, reflecting limited concerns at present about devaluation or default. These indicators point to greater 'fiscal space' for government borrowing and short-term public debt to inject the capital necessary for this recovery.[69] Whether from further federal government packages or other revenue sources, Washington will soon need to implement rescue and recovery stimulus measures at a scale far beyond ARRA and build a comprehensive vision for what a post-COVID Washington could look like.

This report places an analytical lens to these principles by modeling what a specific, instructive portfolio of clean jobs and healthy community investments would mean in terms of sustainable job creation and community well-being for recovery.

F. *Funding a Resilient Recovery*

This report does not assume a specific funding or financing mechanism for the upfront and ongoing capital required. The likelihood and scale of incoming funding for *Resilient Recovery* investments is unknown, but will not occur in a vacuum. Moving forward with planning for such investments is essential in order to unlock and maximize whatever resources become available to Washington state in the years to come.

The most likely sources for these investments include federal, including both stimulus measures and funding of ongoing and new programs, and state revenue streams. Programs could either specifically target greenhouse gases and air pollutants (e.g. a carbon fee or cap on emissions maintained through an auction mechanism) or harness more general or established revenue streams and budget processes to make investment priorities, such as through a state green bank.[70]

These investments have a proven track-record of leveraging additional private funds. A report from *E2* and *E4TheFuture* on extending existing federal funding sources for energy efficiency, renewable energy, and grid modernization finds that each dollar of public investment results in $3.33 in

[68] *Open Market Operations*, BD. OF GOVERNORS OF THE FED. RESERVE SYS., https://www.federalreserve.gov/monetarypolicy/openmarket.htm (last updated Mar. 16, 2020).
[69] JENNIFER ALLAN ET AL., A NET-ZERO EMISSIONS ECONOMIC RECOVERY FROM COVID-19 at 20-21 (2020), https://www.smithschool.ox.ac.uk/publications/wpapers/workingpaper20-01.pdf.
[70] *Green Banks*, NAT. RENEWABLE ENERGY LAB'Y, https://www.nrel.gov/state-local-tribal/basics-green-banks.html (last visited Dec. 22, 2020).

combined private and public investment.[71] The statewide California Climate Investment program reports leveraging an additional $3.70 for every state dollar invested.[72]

To date, initial stimulus funding for green spending priorities in the U.S. has lagged far behind the EU.[73] Proposals are emerging to prioritize funding at the federal level towards the dual aim of job creation and climate action, although these are concentrated on one side of the aisle. The Senate Democrats' Special Committee on the Climate Crisis calls for an increase of federal spending on climate action to two percent of GDP to achieve net-zero emissions by 2050, create ten million jobs, and direct 40 percent investment benefits to help communities of color and low-income, deindustrialized, and disadvantaged communities.[74] The House Select Committee on the Climate Crisis proposed a plan that is estimated to provide nearly $8 trillion in cumulative climate and health benefits by 2050.[75] Part of President-Elect Joe Biden's Build Back Better platform is a $2 trillion investment over four years with the aims of job creation, sustainable infrastructure, and equitable clean energy to meet ambitious climate targets.[76]

In order to execute on a comprehensive vision of recovery and meeting ambitious emission targets that return positive economic and health benefits throughout the upcoming years and decades, Washington will need durable and scalable investment mechanisms. As one example, California has leaned heavily on revenue from a Cap-and-Trade program to provide targeted benefits across a range of priority areas beyond greenhouse gas

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[71] The economic activity (GDP), also referred to as total economic stimulus or Total Capital Leverage, over five years of $330 billion from $99.2 billion directed by Congress is $3.33 dollars of total investments for each dollar of public stimulus. E2 & E4, THE FUTURE, BUILD BACK BETTER, FASTER: HOW A FEDERAL STIMULUS FOCUSING ON CLEAN ENERGY CAN CREATE MILLIONS OF JOBS AND RESTART AMERICA'S ECONOMY 4 (2020), https://e2.org/wp-content/uploads/2020/07/E2E4-Build-Back-Better-Faster-Stimulus-Projection-Report-July-2020.pdf.

[72] CAL. AIR RESOURCES BD., CALIFORNIA CLIMATE INVESTMENT 2020 ANNUAL REPORT, Appendix A (2020), https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/2020_cci_annual_report.pdf.

[73] KATE LARSEN ET AL., *supra* note 67, at 1.

[74] SENATE DEMOCRATS' SPECIAL COMM. ON THE CLIMATE CRISIS, THE CASE FOR CLIMATE ACTION: BUILDING A CLEAN ECONOMY FOR THE AMERICAN PEOPLE 8 (2020), https://www.democrats.senate.gov/climate-report.

[75] HOUSE SELECT COMM. ON THE CLIMATE CRISIS, SOLVING THE CLIMATE CRISIS: THE CONGRESSIONAL ACTION PLAN FOR A CLEAN ENERGY ECONOMY AND A HEALTHY, RESILIENT, AND JUST AMERICA 3 (2020), https://climatecrisis.house.gov/report.

[76] *The Biden Plan to Build a Modern, Sustainable Infrastructure and an Equitable Clean Energy Future*, BIDEN FOR PRESIDENT, https://joebiden.com/clean-energy/#.

reductions.[77] Programs that establish scalable sources of revenue open opportunities for a resilient recovery framework that brings return on investment across multiple priorities.

Recent research suggests that the California-Quebec Cap-and-Trade program was effective in reducing emissions alongside improving economic growth.[78] Those results hold true for the Regional Greenhouse Gas Initiative ("RGGI"), whose member states have experienced faster power sector emission reductions and greater economic growth since the start of the program relative to other states.[79] The impact of the RGGI and California programs has been strengthened from the investment of auction proceeds back into climate, equity, and clean energy investment priorities. Through 2018, cumulative RGGI investments were nearly $2.6 billion.[80] In California $12.8 billion, including $3.3 billion for high-speed rail, has been allocated through California Climate Investments as of the end of May 2020, including $1.1 billion implemented for almost 28,000 new projects in the prior six months.[81]

Washington attempted various revenue-generating carbon fees and cap programs in recent years. Among the most prominent was Initiative 1631, a carbon fee and investment program that voters defeated at the ballot in 2018. Several attempts for a fee and invest program were made in the legislature, including Senate Bill 5930 in 2017 and Senate Bill 6203 and House Bill 1646 in 2018, with Senate Bill 6203 the only carbon tax bill to make it to the floor of the Senate. In 2019 and 2020, legislative priority shifted away from revenue-generating programs to sector specific approaches including the Clean Energy Transformation Act (2019 Senate

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[77] CAL. CLIMATE INVESTMENTS, ANNUAL REPORT TO THE LEGISLATURE ON CALIFORNIA CLIMATE INVESTMENTS USING CAP-AND-TRADE AUCTION PROCEEDS, at ii-v (2020), https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/2020_cci_annual_report.pdf.https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/2020_cci_annual_report.pdf.

[78] DINARA MILLINGTON ET AL., CANADIAN ENERGY RESEARCH INST., THE ECONOMIC EFFECTIVENESS OF DIFFERENT CARBON PRICING OPTIONS TO REDUCE CARBON DIOXIDE EMISSIONS, at xi (2020), https://ceri.ca/assets/files/Study_189_Full_Report.pdf.

[79] JORDAN STUTT ET AL., ACADIA CENTER, OUTPACING THE NATION: RGGI'S ENVIRONMENTAL AND ECONOMIC SUCCESS 3 (2017), https://acadiacenter.org/wp-content/uploads/2017/09/Acadia-Center_RGGI-Report_Outpacing-the-Nation.pdf.

[80] THE REGIONAL GREENHOUSE GAS INITIATIVE, THE INVESTMENT OF RGGI PROCEEDS IN 2018, at 13 (2020), https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2018.pdf.

[81] CAL. AIR RESOURCES BD., CALIFORNIA CLIMATE INVESTMENTS UPDATED DATA RELEASE 7, 1 (2020), https://ww2.arb.ca.gov/sites/default/files/classic//cc/capandtrade/auctionproceeds/2020-sar-data-release.pdf.

Bill 5116) and Zero Emission Vehicle standards (2020 House Bill 2311), as well as increased ambition on greenhouse gas limits (2020 Senate Bill 5811).

Efforts in the Senate to create a Cap-and-Invest program, (Senate Bill 5981), and in the House to create a Low Carbon Fuel Standard ("LCFS"), (House Bill 1110), were not ultimately successful in 2020 but are likely to be seriously considered once again in 2021.[82] Even with Initiative 976, which would have substantially reduced revenue from car tabs, ruled unconstitutional in October 2020, major revenue shortfalls forecast as a result of the COVID-19 economic contraction have shifted the table towards a renewed focus on revenue-generating solutions, particularly within the transportation budget.[83,84] Cap-and-Invest would be a revenue generating program, while LCFS is a cap-and-trade program specific to transportation fuels but does not raise revenue for the state.

II. STUDY OVERVIEW

This report analyzes full-time-equivalent ("FTE") job-years created and community health and climate benefits from an investment portfolio of 18 projects across 14 program areas, as listed in the Program Description section below.[85] Within the portfolio, seven projects pull from existing financial data on major programs proposed, planned, or underway across the state.[86] Programs lacking available in-state financial documentation

[82] *See 2020 Legislative Session Report on Cap & Invest*, LOW CARBON PROSPERITY INST. (Mar. 23, 2020), https://www.lowcarbonprosperity.org/2020/03/23/2020-legislative-session-report-on-cap-invest/.

[83] According to new analysis from TransitCenter, "[a]gencies across the U.S. are warning of service cuts as deep as 40%" and for Seattle those cuts risk transit access for 350 thousand people and 250 thousand jobs. This includes disproportionate impacts on non-white and hispanic people and nearly 17 thousand households without access to a private vehicle. TRANSITCENTER, STRANDED 18 (2020), https://transitcenter.org/wp-content/uploads/2020/09/StrandedFinal2.pdf.

[84] Forecasts are given both with and without the impacts of Initiative 976. On October 15, 2020, Initiative 976 was ruled unconstitutional and overturned. 1 WASH. TRANSP. REVENUE FORECAST COUNCIL, SEPTEMBER 2020 TRANSPORTATION ECONOMIC AND REVENUE FORECASTS 4 (2020), https://www.ofm.wa.gov/sites/default/files/public/budget/info/transpo/Sept2020VolumnI.pdf.

[85] Jobs in this study are measured as full-time-equivalent (FTE) job-years, which are the equivalent of one person working full-time for one year. These are not permanent jobs and are tied to continued funding.

[86] These are Wildfire Prevention and Preparedness, Sound Transit Expansion, Yakima Basin Ecosystem Restoration, High-Speed Rail, Electric Ferries, and the Low Carbon Freight Operations sub-projects for Sustainable Industrial Manufacturing Zones and Rail-Bed Replacement.

were approximated using data from the UCLA Luskin Center for Innovation and National Renewable Energy Laboratory with Washington-specific adjustments.[87] This study consists of three stages.

First, all 18 projects were deconstructed into line-item expenditures using available budgetary data and run through IMPLAN — an economic input-output model that maps the flow of economic activity between 546 sectors and institutions in the state of Washington. IMPLAN allows each dollar invested to ripple throughout the state economy and measures resulting employment, output, labor income, and fiscal impacts.[88]

Next, a cost-benefit model was constructed that compares the health and climate benefits of each investment to upfront costs. This was achieved using a combination of county-level air pollution databases, reduced-complexity models ("RCMs") to calculate down-wind health impacts of air pollution, and project-specific literature on pollution reduction potential. Of 18 total projects, 14 have sufficient data to derive metric tons of carbon dioxide equivalent ("$mtCO_2e$") reduced per million dollars invested, and 10 have sufficient data to derive statewide health benefits, in dollar terms, per million dollars invested.[89]

Finally, to supplement our ground-up health and climate models, we conducted a top-down system analysis of health and climate benefits from deep decarbonization in Washington. Using recent literature from Energy and Environmental Economics ("E3") and the Clean Energy Transition Institute, we derived a detailed decarbonization pathway and the approximate net energy system costs of achieving it. We applied air pollution data and RCMs from step two to this decarbonization scenario to derive cumulative health and climate outcomes in comparison to a business-as-usual projection of state emissions through 2050.

We weighted and aggregated these investment programs into a sample *Resilient Recovery Portfolio* with significant flexibility for adjustments and future iterations. Each program was assigned its respective share of the portfolio through a combined weighting of job impacts, community health outcomes, and climate benefits.[90] This portfolio is not intended to

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[87] JASON KARPMAN et al., UCLA LUSKIN CENTER FOR INNOVATION, EMPLOYMENT BENEFITS FROM CALIFORNIA CLIMATE INVESTMENTS AND CO-INVESTMENTS (2018), https://innovation.luskin.ucla.edu/wp-content/uploads/2019/03/Employment_Benefits_from_CA_Climate_Investments_and_Co-investments.pdf.

[88] See the methodology section for details on the jobs impact methodology and IMPLAN.

[89] See the methodology section for details on the health and climate benefit multipliers.

[90] Jobs impacts were given a 50 percent weighting, of which 65 percent is tied to relative rank FTE job creations and 35 percent tied to relative rank in employee compensation. Community health multipliers and greenhouse gas reduction potential were given 25 percent weighting respectively. For more information on portfolio assembly, *see* JONAH KURMAN-

prescribe a precise allocation for Washington policymakers, but is instead designed to be illustrative of what this type of investment approach could achieve in Washington.

We did not include all initially examined projects. For example, a program mirroring California's Clean Vehicle Rebate Program for electric vehicles was an outlier in terms of low jobs potential. It was excluded from the final portfolio on the grounds that it is an insufficient stimulus measure.[91]

III. PROGRAM DESCRIPTIONS

Here we describe each of the 18 projects making up 14 programs, sorted across five investment areas (Table 1). Additional detail, including IMPLAN inputs, are in section VII of the initial *Building Back Better: Investing in a Resilient Recovery for Washington State* report.[92]

A. *Clean Transportation Investments*

1. High-Speed Rail (2.3% of portfolio)

The *High-Speed Rail Program* looks at existing proposals for Ultra-High-Speed Ground Transportation in the Cascadia megaregion. Upon completion, the project would provide the ability to travel between Seattle, Portland, and Vancouver, B.C. in less than one hour per segment. The project is currently still in the "project initiation" phase (two to three years), requiring further project development (approximately three years) prior to construction and subsequent operation and maintenance.

2. Light Rail – Sound Transit Expansion Federal Way (6.7% of portfolio)

The *Sound Transit Expansion Program* specifically looks at the ongoing extension of the existing light rail network to Federal Way, WA

FABER ET AL., LOW CARBON PROSPERITY INST., BUILDING BACK BETTER: INVESTING IN A RESILIENT RECOVERY FOR WASHINGTON STATE 43-45 (2020) [hereinafter KURMAN-FABER ET AL., INITIAL REPORT], https://www.lowcarbonprosperity.org/project/building-back-better/.

[91] The CVRP created only 1.2 FTEs per million dollars invested, largely due to the lack of any clean vehicle manufacturing in the state.

[92] *See* KURMAN-FABER ET AL., INITIAL REPORT, *supra* note 90, https://www.lowcarbonprosperity.org/project/building-back-better/.

from just south of Sea-Tac airport.[93] The Federal Way extension serves one of the most diverse corridors in the light rail system, including a high proportion of low-income and communities of color along the busy Interstate 5 corridor. This extension is currently scheduled to open in 2024 with three new stations in a 7.8 mile stretch of light rail. The concept and rationale for including this specific portion of light rail are to ensure that the timeline does not lapse, and if possible, to accelerate construction such that the Federal Way extension can open earlier than currently scheduled.

3. Low Carbon Buses and Trucks (12.8% of portfolio)

The *Low Carbon Buses and Trucks Program* focuses on expanding low-emission and zero-emission heavy-duty vehicle use in Washington, particularly in public transit. This includes funding for transit agencies to establish new or expanded bus services, expanded intermodal transit facilities, vouchers for the purchase of hybrid and zero-emission trucks and buses, and competitive grants to truck and bus operators to replace or expand their fleets with commercially available vehicles in strategic hubs.

4. Clean Vehicle Program (4.3% of portfolio)

The *Clean Vehicle Program* expands zero-emission vehicles and low-emission vehicles use in the state. This includes funding to lending institutions, auto dealerships, community groups, and other organizations that help low-income individuals finance the cost of cleaner vehicles. The program also includes financial assistance for lower- income individuals who replace their vehicles with cleaner ones, new or used. In addition, this program provides funding for the establishment of plug-in hybrid vehicles and zero-emission vehicles car-sharing fleets and mobility options in disadvantaged communities.

5. Transit-Oriented Community Development (5.2% of portfolio)

The *Transit-Oriented Community Development Program* provides grants and loans for development and land-use projects that increase the accessibility of affordable housing, employment centers, and key destinations via low-carbon transportation. This includes transit-oriented development of affordable housing and transportation-related infrastructure, as well as both urban and rural integrated connectivity

[93] *Federal Way Link Extension: Building Light Rail Further into South King County*, SOUND TRANSIT, https://www.soundtransit.org/system-expansion/federal-way-link-extension (last visited Dec. 22, 2020).

projects that provide high-quality transit access to existing affordable housing.

B. *Water, Power, and Energy Efficiency Investments*

1. Water-Energy Program (4.7% of portfolio)

The *Water-Energy Program* provides funding for local governments and organizations to implement water efficiency projects that reduce water use, energy use, and greenhouse gas emissions for residential, commercial, and institutional consumers. The program also funds consumer-facing rebate programs to reduce cost barriers for efficient household appliances, bathroom fixtures, and commercial and institutional cooking equipment.

2. Home Energy Efficiency and Renewables (6.3% of portfolio)

The *Home Energy Efficiency and Renewables Program* provides weatherization, energy efficiency, and localized renewable energy installations for single and multi-family homes. Efficiency and weatherization improvements include weather stripping, insulation, caulking, water heater blankets, fixing or replacing windows, refrigerator replacement, water heater repair/replacement, heating and cooling system repair/replacement, and solar water heater installation. The program also provides low-income households and large apartment buildings with solar photovoltaic ("PV") systems to lower cost barriers to adopting renewable solar energy, using a barn-raising model to give volunteers and job trainees hands-on experience which can be used to help start careers in the solar industry.

3. 100% clean power readiness

Under the Clean Energy Transformation Act of 2019 ("CETA"), each utility in the state must transition off of coal power by 2025, move to net carbon neutral electricity by 2030, and reach carbon-free without offsets by 2045 as long as certain cost constraints are not exceeded.[94] While not exhaustive, these sub-projects are envisioned as part of the enabling environment to ensure the state reaches the CETA goalposts:

[94] *Clean Energy Transformation Act (CETA)*, WASH. STATE DEP'T OF COMMERCE, https://www.commerce.wa.gov/growing-the-economy/energy/ceta/ [hereinafter *CETA*] (last visited Dec. 22, 2020).

a. Grid Resiliency and Optimization (1.2% of portfolio)

The *Grid Resiliency and Optimization Project* provides expanded transmission lines, battery storage, and microgrid funding to improve the connectivity and resilience of the state's electricity grid. This project solely focuses on capital costs of building new grid infrastructure, rather than future operation and maintenance costs.

b. Hydro Expansion and Upgrades (2.5% of portfolio)

The *Hydro Expansion and Upgrades Project* provides funding for new high-efficiency turbines to replace or add to existing capacity at Washington's hydroelectric generating plants. This includes the purchase of new turbines, engineering and scoping services, as well as construction and installation of the new turbines and associated grid infrastructure.

C. *Forest Conservation and Ecosystem Restoration*

1. Wildfire Prevention and Preparedness (16.9% of portfolio)

The *Wildfire Prevention and Preparedness Program* provides funding for the Department of Natural Resources' 20-year strategic plan for wildfire preparedness and prevention and was included in proposed House Bill 2413. The plan includes the following major program buckets by share of funding: Staffing and Aircraft for Fire Preparedness (39 percent), Treating Unhealthy Forests (22 percent), Local Fire Service Capacity and Fire Prevention (18 percent), Resilient Communities and Landscapes (16 percent), Landscape Risk Assessment (three percent), and Post-wildfire recovery (two percent).

2. Yakima Basin Ecosystem Restoration (6.1% of portfolio)

The Yakima Basin Integrated Plan is a 30-year water restoration and conservation plan for the Yakima Basin watershed in central Washington.[95] The phased implementation plan includes significant state as well as leveraged federal funds among other sources. The following seven key elements are part of the plan: fish passage, fish habitat enhancement, modification of existing irrigation structures and operations, surface storage, groundwater storage, enhanced water conservation, and market-based water reallocation. This report focuses on the nearly $400 million in planned funding for 2020-2023, based on the Department of Ecology's 2018 Cost Estimate and Financing Plan.

3. Urban and Community Forestry (6.3% of portfolio)

The *Urban and Community Forestry Program* provides funding for projects to optimize the benefits of green space in urban settings. This includes expanding urban forestry, implementing forward-thinking green infrastructure, reclaiming and restoring abandoned land, establishing new forestry management practices, and diverting dead urban trees from landfills to new wood products or biomass energy. Local governments and nonprofits organizations can administer the projects.

D. *Low Carbon Agriculture*

1. Agriculture Water Efficiency (4.3% of portfolio)

The *Agriculture Water Efficiency Program* provides competitive grants to implement irrigation systems that save water and reduce greenhouse gas emissions. Qualified water-saving measures include micro-irrigation drip systems, irrigation sensors that are responsive to soil moisture and weather, energy-efficient pump replacement, fuel-switching to renewable sources, switching to lower pressure pumping systems, variable frequency drives, and improved irrigation scheduling.

2. Dairy Digesters (5.1% of portfolio)

The *Dairy Digester Program* provides competitive grants to support projects that reduce methane emissions from dairy waste. Applicants can use funds to install new covered lagoon digesters, which funnel produced methane through a gas line to be burned to generate electricity or stored as a transportation fuel. The program also provides research and demonstration grants to examine scientific and technical methods to enhance the efficiency and economic viability of dairy digester technology.

E. *Sustainable Industry*

1. Low carbon freight operations

a. Multi-Source Facilities (1.9% of portfolio)

The *Multi-Source Facilities Project* provides competitive grants that support the adoption of low-emission or zero-emission technologies at freight facilities with multiple sources of emissions. Eligible facilities include distribution centers, warehouses, ports, intermodal rail yards, or other similar freight support facilities. The project aims to accelerate the deployment of pre- commercial clean technologies and improve local air quality.

[95] *Yakima River Basin Integrated Plan*, WASH. STATE DEP'T OF ECOLOGY, https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-supply-projects-EW/Yakima-River-Basin-projects/Yakima-integrated-plan (last visited Dec. 22, 2020).

b. Sustainable Industrial Manufacturing Zones (1.1% of portfolio)

The *Sustainable Industrial Manufacturing Zones* ("*SIMZ*") *Project* funds areas zoned for light manufacturing supported by rail. Rail replaces heavy-duty truck transportation of goods. The budget is based on capital material and construction costs associated with buildings, new rail spurs, and associated infrastructure to transfer goods on and off of rail cars. It is supported by construction to connect the SIMZ with long haul rail.

c. Rail-Bed Replacement (4.2% of portfolio)

The *Rail-Bed Replacement Program* provides funding to re-construct existing rail lines to accommodate a wider array of train cars, top speeds, and both passenger and industrial freight transportation use. Funds are predominantly directed to construction and capital material costs associated with re-laying rock rail beds, fixing ditches, installing new ties, and installing new rails in order to improve the functionality of vintage rail. The program takes advantage of existing rights of way and land ownership, which is a typical financial and administrative obstacle of new rail projects.

2. Electric Ferries (8.1% of portfolio)

The *Electric Ferries Program* accelerates the first wave of Washington State ferry retirements to be replaced with hybrid-electric ferries and ferry terminal electrification. The ferries are contracted to be built locally by Vigor Shipyards. This report considers six new ferry builds and two conversions along with ferry terminal electrification projects currently scheduled through 2027, with the intent of accelerating the $1.5 billion budget to complete those builds earlier than scheduled.

IV. METHODOLOGY

A. *Jobs and Economic Modelling Overview*

Each program and sub-project in the *Resilient Recovery Portfolio* was deconstructed into line-item expenditures using available budgetary data and run through the 2018 Washington State IMPLAN package. While economic input-output models provide meaningful insights into economy-wide employment and useful forecasting metrics, they are not without limitations. Industries in this model are constructed as single, snapshot-level relationships rather than time-sensitive and evolving. Investment

impacts scale linearly without sensitivity to the magnitude of investment and the dataset used lacks geographic specificity to the location of investments, as well as additional metrics on job quality that are described elsewhere in this section.

A widely-used output from IMPLAN is the employment multiplier, often expressed as the number of job-years per million dollars spent. A job-year, due primarily to part-time or seasonal employment, is slightly less than a "full-time-equivalent" or FTE. Throughout this report, the term "FTE job" is used as a short-hand for full-time-equivalent job-years.

1. IMPLAN overview

Obtaining a complete picture of jobs and economic impacts requires tracking the direct, indirect, and induced impacts of each investment, which is nearly impossible with observational methods as it would require verifying the unique supply chain of every impacted firm, as well as the unique spending pattern of every impacted worker.

For each program described in this report, we collected detailed project-level expenditures that we entered into an economic input-output model called IMPLAN (Version 5). IMPLAN is a commonly used job creation tool. It includes technical reports for government agencies and academic papers in peer-reviewed journals. Economic input-output models such as IMPLAN are often used to evaluate the impact of a policy or investment, particularly when empirical data gathering is difficult or impossible.

IMPLAN maps the flow of economic activity between 546 industries and institutions, with each dollar tracked throughout the state economy with resulting employment, output, labor income, and fiscal impact estimates. All eighteen projects in this study were deconstructed into line-item expenditures using available budgetary data and run through IMPLAN's 2018 Washington State dataset to subsequently ripple throughout the state economy.

2. Scope of study

Proper application of our jobs and economic analysis requires a careful understanding of the scope of the study. Economic input-output models provide meaningful insights into economy-wide employment, but are not without limitations.

a. Static and linear relationships

Industries in this model are constructed as single, snapshot-level relationships rather than time-sensitive evolving businesses with ever changing conditions. Thus, changing technologies and supply chains may lead to different employment outcomes in particular industries compared to what this study estimates.

Investment impacts scale linearly without sensitivity to the magnitude of investment. Thus, in IMPLAN's economic flows, a dollar investment and a billion dollar investment in a given industry will lead to the same proportional outcomes, even if an investment of such size exceeds the production or workforce capacity of the region in question. Evaluating capacity constraints is outside the scope of this study, as our investment programs are normalized to a million dollar scale.

b. Geographic detail

All job estimates provided in this study are located within Washington. Jobs supported out of state or abroad are excluded from the study's results. Distributional analysis at the county level is possible in IMPLAN, but requires geographic specificity to the projects implemented and where each line item expenditure occurs. This information is outside the scope of this study and a key focal point of future research as investment programs become rooted in location-specific proposals.

c. Direct and indirect savings

Investment programs in this study, in most cases, result in financial savings for consumers and grantees. Those savings increase the spending power of the state economy, and are used on a variety of goods and services to support additional jobs. Our IMPLAN analysis includes direct financial savings for consumers and grantees, but not indirect financial savings.

Direct savings occur immediately as a direct result of the investment program — for example, the *Low Carbon Buses and Trucks Program* provides funds for transit agencies to offer free fare days to encourage ridership. These funds do not necessarily generate new economic activity within the transit sector, but they do create financial savings for transit riders who otherwise would have paid for their trip that day. IMPLAN can direct these financial savings to typical household expenditures, which leads to additional captured job numbers in our study.

Indirect savings are those which occur due to the cost efficiency that programs achieve over time. For example, the *Low Carbon Buses and Trucks Program* also provides funds for local transit agencies to expand service, which will lead to decreased personal vehicle use and savings on fuel and maintenance costs. Some households will spend these indirect savings on other goods and services. Quantifying these cost savings is important for comprehensively analyzing the benefits of investment, and is an important aspect of future work, but is outside the scope of this study.

d. Net vs. gross impacts

This study strictly looks at the gross number of jobs that are supported by investment programs, not whether these jobs are net positive jobs. When modeling these programs in IMPLAN, the model assumes that each investment is a new additional influx of spending into the Washington State economy. In reality, these funds must originate from somewhere. If the source of revenue of these programs comes from within the state, those revenues would have otherwise been circulated in some way that supports jobs as well. Depending on where revenue comes from, some of the jobs identified in this study may represent a transfer of jobs from one sector of the economy to another, rather than an overall gain in employment.

Such analysis would require counterfactual scenarios of how investment funds would have been used if left to their original sources. Absent details on a funding mechanism, we use an average economy-wide benchmark, as well as a comparison to the ten largest industries in the state, in order to inform the relative effectiveness of the *Resilient Recovery Program* compared to typical spending patterns in the state.

B. *Community Health and Climate Benefit Analysis*

To evaluate the community health and climate benefits of the *Resilient Recovery Portfolio*, we constructed a custom health and climate benefit calculator for each project based on available pollution databases and project-specific literature. Of eighteen total projects, ten had sufficient data to derive statewide health benefits from the investment, and fourteen had sufficient data to derive climate benefits. Our conceptual modeling approach follows five steps:

Using the EPA's National Emissions Inventory ("NEI"), we extracted annual levels of local pollutants ($PM_{2.5}$, SO_2, NO_x, VOCs, and NH_3)

emitted across thirty-six different activity sources at the state and county level in Washington.[96]

Using reduced-complexity models, we calculated pollutant-specific, geographically sensitive annual health damages, in dollar terms, associated with each pollutant from each activity source in Washington.[97]

Using Washington greenhouse gas inventory data, we aggregated and mapped the health damages from each activity source to specific types of fossil fuel usage and/or greenhouse gas inventory emissions (i.e., light-duty vehicle gasoline, heavy-duty vehicle diesel, home natural gas heating, etc.).

Using project-specific literature and quantification tools, we derived the expected reduction in fossil fuel use and/or greenhouse gases per million dollars spent on each project, which were then converted to potential health benefits, in dollar terms, using the public health estimates by emissions source outlined above.[98]

Using a modest $52 per metric ton CO_2e estimate of the social cost of carbon, we converted greenhouse gas reductions to a dollar estimate of avoided climate damages per million dollars invested.

More details about each step of this modelling approach can be found in section VII of the initial *Building Back Better: Investing in a Resilient Recovery for Washington State.*[99]

C. *Deep Decarbonization Benefit-Cost Analysis*

A handful of energy-system scenarios for the state and region have been released over the last few years examining greenhouse gas emission reductions.[100] To provide a full energy system perspective of achieving the state's legislated carbon reduction aims, we apply the screening methodology in this report for community health benefits to two recent deep decarbonization studies: Pacific Northwest Pathways to 2050 by

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[96] *2017 National Emissions Inventory (NEI) Data*, U.S. ENVTL. PROT. AGENCY (Apr. 2020), https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data.
[97] For more details on the RCMs used in this study, *see* CTR. FOR AIR, CLIMATE, & ENERGY SOLUTIONS, https://www.caces.us/ (last visited Dec. 22, 2020).
[98] Some programs, such as the Wildfire Prevention and Preparedness Program, required alternate methods to appropriately derive health benefits. *See* KURMAN-FABER ET AL., INITIAL REPORT, *supra* note 90, at 37-48.
[99] KURMAN-FABER ET AL., INITIAL REPORT *supra* note 90.
[100] These have covered a mix of states, sectors, and ambition levels and, aside from the two used for this report, include: Governor's Office Deep Decarbonization study for WA (2016, with less ambitious greenhouse gas reduction targets based on now updated legislation), E3's electricity sector and electricity sector reliability studies from 2018 and 2019, Climate Solutions electricity sector only study from 2018, the 7th Northwest Power Plan, and the NW Natural Gas Company 2019 study covering all sectors but optimizing only for the electricity sector.

Energy and Environmental Economics (E3) and the Clean Energy Transition Institute's Meeting the Challenge report for net energy system costs.[101,102] We compare the emissions trajectories for a 95 percent reduction relative to 1990 emissions by mid-century, including 45 percent by 2030, to a business-as-usual emissions scenario, which is derived from the state's Carbon Tax Assessment Model.[103]

We compare the business-as-usual scenario to a "deep decarbonization" emissions trajectory extracted from the Pacific Northwest Pathways to 2050 study, which was scaled to match the state's updated emissions limits from 2020 (Figure 1).[104] The deep decarbonization trajectory emissions were adjusted under two additional assumptions, namely compliance with 2019 legislation mandating a coal-free power system by 2025 and a carbon-free power system by 2045, and that all energy-sectors collectively attain the 2020 legislated limits for emissions reduction in 2030 and 2050. This comparison yields a sector and fuel-specific trajectory for deep decarbonization versus expectations with no additional action. Thus, we can calculate our expected greenhouse gas reductions from achieving long-term decarbonization targets, by sector, as the difference in emissions trajectories between our business-as-usual scenario and our "deep decarbonization" scenario. We then converted these expected emissions reductions to health and climate benefits using the methodologies outlined in the previous section.

We subsequently derived the system-level costs of decarbonizing beyond baseline emissions from the Clean Energy Transition Institute's Meeting the Challenge of Our Time report.[105] Meeting the Challenge covers Idaho, Montana, Oregon, and Washington, modeling several scenarios of an 86 percent economy-wide reduction in greenhouse gases below 1990 levels. This includes a roughly 45 percent reduction by 2035, approximately five years later than the current legislation for Washington

[101] ENERGY AND ENVTL. ECON., PACIFIC NORTHWEST PATHWAYS TO 2050: ACHIEVING AN 80% REDUCTION IN ECONOMY-WIDE GREENHOUSE GASES BY 2050 (2018), https://www.ethree.com/wp-content/uploads/2018/11/E3_Pacific_Northwest_Pathways_to_2050.pdf.
[102] *Meeting the Challenge of Our Time: Pathways to a Low-Carbon Future for the Northwest*, CLEAN ENERGY TRANSITION INST. (June 2019), https://www.cleanenergytransition.org/meeting-the-challenge.
[103] Specifically, we derive the business-as-usual pathway from the CTAM "Adjusted Emissions" scenario, which reflects policies in place through the 2019 legislative session with no carbon price applied.
[104] ENERGY AND ENVTL. ECON., *supra* note 101 at 31.
[105] CLEAN ENERGY TRANSITION INST., *supra* note 102.

requires.[106] Washington's share of system costs are assumed to scale proportional to share of regional emissions (45.5 percent).[107]

To determine the benefits from avoided air pollution and climate damages, we apply the previously established GHG-NEI-CACES methodology to the difference in emissions between the Deep Decarbonization and business-as-usual ("BAU") scenarios. A three percent social rate of net present value ("NPV") discounting was applied to both the system-level benefits and costs.

Additional methodological and calculation steps for the BAU emission trajectory, deep decarbonization emissions trajectory, benefit multiplier of achieving decarbonization versus BAU, net costs of achieving deep decarbonization, and the NPV benefits and costs of wildfire prevention can be found in section VII of the initial *Building Back Better: Investing in a Resilient Recovery for Washington State.*[108]

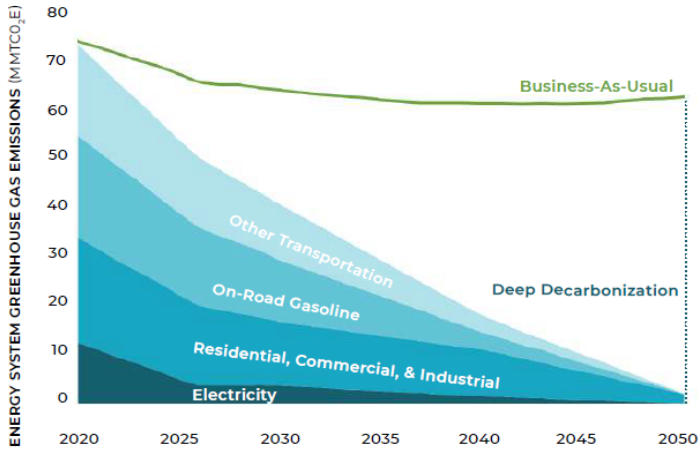

Figure 1: Business-as-Usual and Deep Decarbonization emissions projections for Washington State. KURMAN-FABER ET AL., *supra* note 90 at 31.

[106] To align the two studies in terms of scale of carbon reduction, we assume the net costs from *Meeting the Challenge* through 2035 for a 45 percent reduction versus the net benefits using the *E3 Pathways* analysis through 2030 only. We also scale up the costs in *Meeting the Challenge* proportionally from an 86 percent reduction to a 97.5 percent energy-sector reduction.

[107] Washington State's share of emissions in 2020 annual net costs every fifth year through 2020 for the 4-state region were provided in personal communication by the *Meeting the Challenge* study authors.

[108] KURMAN-FABER ET AL., INITIAL REPORT, *supra* note 90 at 37—47.

V. RESULTS

A. *Economic Impacts of the Resilient Recovery Portfolio*

1. Overall portfolio vs. benchmarks

Every million dollars invested in the *Resilient Recovery Portfolio* supports 10.1 FTE jobs either directly, indirectly, or induced. We report FTE jobs in order to normalize across industries that may have variable part-time or seasonal jobs.

To better understand these findings, we constructed benchmark investments into the Washington economy both broadly and targeted at the state's ten largest industries. We did so by running a million-dollar "investment" which is treated in IMPLAN as a million dollar increase in industry output, across all 546 sectors available in Washington. By weighing these results by industry output size, we found that a diffuse million dollar investment across the state's entire economy would support 7.4 FTE jobs.

As a more specific benchmark, we isolated the ten largest industries in Washington, which together generated 32 percent of the state's economic output in 2018.[109] Together, an output-weighted million dollar investment into these top ten industries supports 4.3 FTE jobs, which is less than half the job creation efficiency of the *Resilient Recovery Portfolio*. None of the ten largest industries generated as many jobs per million dollars as the *Resilient Recovery Portfolio*.

The FTE job-years per million dollars includes direct effects, indirect effects, and induced effects. Direct effects are the result of direct payments to industries to carry out a given program (e.g., paying construction firms to build public transit). Indirect effects are the result of how direct industries then subsequently pay money to other industries to conduct their business (e.g., a construction firm subsequently purchasing heavy-duty equipment for the project). Induced effects are the result of how households spend new income across the economy (e.g., construction workers subsequently spend income on food, services, housing, and other non-work expenses).

The portfolio outcomes are somewhat sensitive to the relative share of funds directed to each program. We constructed multiple portfolios that

[109] Industry size is defined as the sum of the industry's economic output in Washington State. In order of size, these industries are aircraft manufacturing, software publishing, other real estate, non-store retailers, scientific research and development services, internet publishing and broadcasting, petroleum refineries, tenant-occupied housing, hospitals, and wireless telecommunications carriers.

individually prioritize FTE jobs, job wages, health benefits, and climate benefits. Isolating for each of these criteria widens the range of potential job creation from 8.3 FTE to 11.1 FTE jobs per million dollars invested, depending on whether wage levels or gross FTE jobs are prioritized. This partially inverse relationship between wage levels and scale of job creation is an expected outcome of input-output models like IMPLAN and does not necessarily capture fully the comprehensive wage and benefit characteristics of the occupations supported by these investments. However, it does suggest the need for policymakers to avoid designing a recovery strategy that maximizes job creation at the expense of sufficient job quality, or vice versa.

Additional portfolios that prioritized health benefits and greenhouse gas reductions respectively landed within the range of job creation established by the wage and job-focused portfolios. To construct the *Resilient Recovery Portfolio*, these four priorities were weighted and combined.[110]

While not the focal point of our analysis, IMPLAN provides additional measures on Wage and Benefit levels, output multipliers, and value added to the state economy (Figures 1 and 2). The *Resilient Recovery Portfolio*:

Results in $51,400 in average wages across all jobs supported, which is slightly above the statewide average of $50,200, although lower than the top ten industry average of $67,900 (as of 2018).

Increases state economic output by $1.75 for every dollar invested, which outperforms both the broad economy ($1.73) and the ten largest industries ($1.59).[111]

Provides $0.94 in value added for every dollar invested, which is nearly double that of the ten largest industries ($0.50).[112]

2. Job creation and economic output by industry

The direct impacts of investing in a *Resilient Recovery Portfolio* will be stronger in certain industries, with smaller and more diffuse indirect and

[110] LOW CARBON PROSPERITY INST., *supra* note 82, at 19.

[111] Output is the total measure of all economic activity in a state. In IMPLAN, output is described as the total economic activity required across all industries in the region to satisfy a given level of final-use expenditures. CANDI CLOUSE, OUTPUT MULTIPLIERS, IMPLAN Group (2020).

[112] Value Added is equivalent to gross state product. IMPLAN defines value added as "gross output (sales or receipts and other operating income, plus inventory change) minus intermediate inputs (consumption of goods and services purchased from other industries or imported)." CANDI CLOUSE, UNDERSTANDING VALUE ADDED, IMPLAN GROUP (2020) https://implanhelp.zendesk.com/hc/en-us/articles/360017144753-Understanding-Value-Added-VA-.

induced impact spread broadly across the economy at large. Four of the top ten industries for job creation are new construction or maintenance & repair construction representing over 17 percent of the total job creation. In total, the top ten industries for job creation, measured in FTE jobs, represent nearly 50 percent of all new jobs supported by the portfolio and include industries ranging from shipbuilding to landscape and horticulture, as well as service and state government jobs, including local passenger transit. The next ten are a wider array of industry types, including management consulting, architectural, engineering and related services, retail, restaurants, real estate, and civic organizations.

In terms of the amount of economic output resulting from each million dollars invested in the *Resilient Recovery Portfolio*, the top ten beneficiary industries account for just over one-third of all new economic output. There is substantial overlap with the top ten industries for job creation. For the complete list of top ten industries by job creation and outputs per million dollars of portfolio investment, refer to Tables 3.3 and 3.4 of the initial report.[113]

3. Job creation potential at the program level

The fourteen programs analyzed individually support between 6.4 and 15 FTE jobs per million dollars invested (Figure 1). The *Yakima Basin Ecosystem Resilience Program* (15 FTE jobs), *Sound Transit Expansion* (13.8 FTE jobs), and *Wildfire Prevention and Preparedness Program* (12.2 FTE jobs), are the most compelling job creators and are also shovel-ready for rapid deployment.

All programs in the *Resilient Recovery Portfolio* support more FTE jobs than the state's ten largest industries (4.3 FTE jobs). Out of 14 programs, ten match or outperform the economy-wide benchmark of 7.4 FTE jobs per million dollars invested. Programs that perform lower on FTE job creation tend to be manufacturing heavy (i.e., *Sustainable Industry, Electric Ferries, 100% Clean Power Readiness*), or have large shares of direct inputs flowing to out-of-state purchases (*Clean Vehicle Programs*).

Average annual wages per FTE job supported across these programs ranges from $42,000 (*Urban and Community Forestry*) to $60,700 (*Electric Ferries*) (Figure 2). Nine out of 14 programs provide wages higher than the economy-wide average ($50,200). All programs considered provide lower average wages than investing in the state's top ten industries ($67,900 per FTE job supported).

[113] LOW CARBON PROSPERITY INST., *supra* note 82, at 19.

Figure 2: Jobs and wage projections of the portfolio, state benchmarks and Resilient Recovery programs: KURMAN-FABER ET AL., *supra* note 90 at 22.

4. Broad economic indicators

At a broader economy-wide level, the portfolio investments score well on two key metrics: the total value added per million dollars and share of employee compensation. *Value added* is the sum of all aspects of industry output except for material production costs.[114] *Employee compensation* is the specific portion of value added that is directed to employee labor costs, including wages, benefits, and payroll taxes. This helps measure to what degree investment programs are prioritizing labor-intensive industries as opposed to capital-intensive industries.

All *Resilient Recovery Portfolio* programs are significantly above the value added rates from the ten largest industries, and all but two provide greater value added than the state average benchmark (Figure 3). Out of the fourteen programs, thirteen provide a greater share of money to employee compensation than the ten largest industries, while seven have higher employee compensation rates than the broader economy.

[114] This includes labor income (LI), other property income (OPI), and taxes on production and imports (TOPI). Value added is also interchangeably described as gross domestic product (GDP), which is a standard measure of economic growth, and helps measure to what degree investment programs are prioritizing valuable industries to the in-state economy, as opposed to leakage-prone industries. CLOUSE, *supra* note 111.

Figure 3: Value added and employee compensation rates for the portfolio, state benchmarks, and Resilient Recovery Portfolio programs: KURMAN-FABER ET AL., *supra* note 90 at 23.

Not every program scores strongly on every metric. Due in particular to the portion of funds sent to out-of-state car manufacturers, the *Clean Vehicle Program* performs relatively poorly on both employee compensation share and value added. The *Low Carbon Buses and Trucks* program provides exceptional job creation, wage levels, and employee compensation, but measures poorly on value added to the state economy.[115] Other shovel-ready labor-intensive programs, such as *Sound Transit*, *Wildfire Prevention and Preparedness,* and the *Yakima Basin Ecosystem Restoration Program,* all perform strongly on both employee compensation and value added.

B. *Community Health and Climate Benefits*

1. Overall portfolio results

In addition to jobs and broader economic gains, the co-benefits unlocked by these programs are critical to understanding their value. When weighted according to the *Resilient Recovery Portfolio,* we find that these

[115] In the IMPLAN model, a large portion of funds in the Low Carbon Buses and Trucks program are directed to local government passenger transit, which derives significant revenue from budgetary allocations rather than sales of products or services. As such, IMPLAN measures one component of value added from this institution — Other Property Income — as an exceptionally negative value which greatly reduces the total value added from the program.

fourteen programs combined provide $2.4 million in health and climate benefits, including cleaner air resulting in $1.6 million in avoided losses associated with increased mortality for every million dollars invested.[116] This is particularly influenced by the *Wildfire Prevention and Preparedness Program*, which avoids over $12 million in health and climate damages for every million dollars invested.

Beyond significant community health benefits, there are inherent benefits from reducing greenhouse gas emissions reflected through the social cost of carbon. The economic value of avoided damages stemming from climate change incorporates impacts such as reduced agricultural production, damages from extreme weather events, and property loss.

A conservative social cost of carbon estimate from the U.S. Interagency Working Group, adjusted to 2020 dollars, finds that avoided emissions have a societal benefit of $52 per metric ton of carbon dioxide.[117,118] This amounts to approximately one-third of total pollution benefits as calculated in this study, with the other two-thirds coming from cleaner air.

These portfolio-level benefits are despite four projects that lacked sufficient data and specificity to attribute meaningful community health results, even though the projects reduce pollution. Significant additional co-benefits beyond cleaner air, such as reduced traffic fatalities, reduced expenditures on fossil fuel imports, and increased active transportation are not quantified. We therefore expect total co-benefit returns, in dollar terms, to be far higher than our analysis indicates.

[116] The statistical value of life (VSL) is an economic measure of mortality in dollar terms. We use a VSL of $9.4 million in our analysis, mirroring estimates used by the EPA adjusted to inflation.

[117] U.S. INTERAGENCY WORKING GROUP ON SOCIAL COST OF GREENHOUSE GASES, TECHNICAL SUPPORT DOCUMENT: -TECHNICAL UPDATE OF THE SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS -UNDER EXECUTIVE ORDER 12866- (August 2016).

[118] By comparison, other studies project the social cost of carbon as high as $417 per metric ton of carbon dioxide equivalent. This would result in climate benefits from these investments 8 times higher than reported in our model. Katherine Ricke, et al., *Country-Level Social Cost of Carbon*, NATURE CLIMATE CHANGE 8, 895–900 (2018), https://www.nature.com/articles/s41558-018-0282-y.

2. Program level results

The value of avoided air pollution deaths in Washington State from programs in the *Resilient Recovery Portfolio* ranges from $9,000 to $9 million per million dollars invested in each program. Once avoided climate damages are included, total health and climate benefits from these programs jump to between $20,000 and $12.6 million (Table 2). We find that programs in the *Resilient Recovery Portfolio* provide an average of $2.4 million in health and climate benefits for every million dollars invested.

Investment Programs	Avoided GHG emissions, $mtCO_2e$	Climate benefits	Community health benefits	Total co-benefits
Resilient Recovery Portfolio	**12,400**	**$806,000**	**$1,600,000**	**$2,406,000**
High-Speed Rail	180	$9,400	$17,800	$27,200
Light Rail - Sound Transit Expansion Federal Way	130	$6,900	$12,900	$19,800
Low Carbon Buses & Trucks	1,530	$79,200	$121,300	$200,500
Clean Vehicle Programs	710	$36,700	$69,000	$105,700
Transit-Oriented Community Development	490	$25,500	$48,000	$73,500
Home Energy Efficiency & Renewables	2,420	$125,900	$49,000	$174,800
100% Clean Power Readiness				
Grid Resiliency & Optimization*	—	—	—	—
Hydro Expansion and Upgrades	770	$40,000	$9,000	$49,000
Water-Energy Program*	9,190	$477,100	—	$477,100
Wildfire Prevention & Preparedness	70,040	$3,637,500	$9,000,000	$12,637,500
Urban & Community Forestry*	4,760	$247,000	—	$247,000
Yakima Basin Ecosystem Restoration*	—	—	—	—
Low Carbon Agriculture				
Agriculture Water Efficiency*	7,320	$380,300	—	$380,300
Dairy Digesters*	39,920	$2,073,100	—	$2,073,100
Electric Ferries	2,310	$105,300	$677,500	$782,800
Low Carbon Freight Operations				
Multi-Source Facility Projects	130	$6,600	$32,800	$39,500
Sustainable Industrial Manufacturing Zones*	—	—	—	—
Rail-Bed Replacement*	—	—	—	—

**Denotes programs where health benefits were not quantified due to insufficient data*

Table 1: Program-Level Health and Climate Benefits per Million Dollars Invested.

The community health and climate results vary widely depending on how efficiently a dollar spent translates to reduced greenhouse gas and fossil fuel use, as well as the point source of emissions they diminish. In particular, the *Wildfire Prevention and Preparedness* program has the greatest return on investment, avoiding $12.6 million in wildfire damages from substantial amounts of greenhouse gas, $PM_{2.5}$, and VOC emissions prevented for every million dollars invested.

Due to high upfront capital costs, clean transportation programs generate community health benefits between approximately $20,000 (*Sound Transit Expansion*) and $200,000 (*Low Carbon Buses and Trucks*) for every million dollars invested through reduced gasoline and diesel consumption. Though they generate low health and climate benefits relative to the scale of investment, these programs score well on job creation and create other substantial co-benefits such as reduced congestion, reduced traffic fatalities, increased economic development and lower transportation costs. For example, a 2019 study of the Transportation and Climate Initiative by Cambridge Systematics finds that the health benefits of increased physical activity and avoided traffic injuries and fatalities from clean transportation investment were over 21 times greater, in dollar terms, than the health benefits from cleaner air.[119]

The *Electric Ferries* program has higher health benefits than all other sustainable industry programs, estimated at $782,000 per one million dollars invested, because of high $PM_{2.5}$ and NO_x damages associated with Washington's diesel-powered ferry system.[120]

Four *Resilient Recovery* investment programs do not have sufficient data to make community health estimates but have quantifiable climate benefits from emissions reductions. The *Dairy Digesters* program, which would help to reduce methane emissions from agricultural practices, creates nearly $2.1 million in climate benefits for every million dollars invested in the program, second to the *Wildfire Prevention and Preparedness* program.[121] The remaining three programs create between

[119] The Transportation and Climate Initiative (TCI) is a regional program under consideration on the East Coast to reduce transportation emissions and fund public transit and clean vehicles. TRANSPORTATION & CLIMATE INITIATIVE, *Draft Memorandum of Understanding & 2019 Cap-and-Invest Modeling Results* (Dec. 2019), https://www.transportationandclimate.org/sites/default/files/TCI%20Public%20Webinar%20Slides_20191217.pdf.

[120] PUGET SOUND MARITIME AIR FORUM, 2016 PUGET SOUND MARITIME AIR EMISSIONS INVENTORY (2018), https://pugetsoundmaritimeairforum.org/2016-puget-sound-maritime-air-emissions-inventory/.

[121] Due to data limitations, our analysis treats methane according to the Intergovernmental Panel on Climate Change's (IPCC) fourth assessment report (AR4), which finds that

$247,000 to $477,000 in climate benefits each.

C. *Deep Decarbonization Benefit-Cost Results*

Washington State residents and leaders repeatedly express ambition to tackle a deep reduction in carbon pollution. With the passage of House Bill 2311 during the 2020 legislative session, the state's emissions limits were updated to mandate a 45 percent reduction by 2030 and a 95 percent reduction by 2050, relative to 1990 levels.[122] The investments in the *Resilient Recovery Portfolio* represent programs that can help contribute to the deep infrastructural changes needed to meet these limits, as well as the requirements outlined in the Clean Energy Transformation Act, passed in 2019, which transitions the state to 100 percent carbon- free electricity by 2045.[123]

By combining existing research on deep decarbonization pathways and costs for Washington State with our clean air modeling methodology outlined above, we find billions of dollars in net benefits. Including net costs, meeting Washington State's climate goals offers health and climate benefits that are nearly 90 percent of energy system costs through 2030 and 175 percent of energy system costs through 2050, equal to net benefits of $46 billion. These benefits extend in scope and scale beyond the specific programs of the *Resilient Recovery Portfolio*, but the net benefits findings are consistent with the impacts of the portfolio which can jump-start the path towards long-term deep decarbonization.

Failing to achieve net-zero carbon emissions by mid-century would be a huge missed opportunity to build a healthier and more resilient state. The potential rewards are myriad, including saved lives, billions of dollars retained in the state's economy, improved energy security and self-reliance, and opportunities for employers and workers to capitalize on growth of new globally relevant industries.

Community health benefits across the energy sectors are projected at $13.1 billion through 2030 and $49.9 billion through 2050. Climate benefits from the energy sectors are projected at $8.9 billion through 2030

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methane has a global warming potential (GWP) 25 times higher than that of carbon dioxide. The IPCC's fifth assessment report (AR5) finds that methane has a GWP 28 to 36 times higher than carbon dioxide over 100 years, meaning releasing one metric ton of methane is equivalent to releasing 28 to 36 metric tons of CO_2.
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 2014, GLOBAL WARMING POTENTIAL VALUES 1 (2014),
https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf.

[122] H.B. 2311, 2020 Leg., Reg. Sess. (Wash. 2020).

[123] WASH. STATE DEP'T OF COMMERCE, Clean Energy Transformation Act (CETA) (2019).

and $56 billion through 2050. We estimate NPV costs for Washington under the Central Case of Meeting the Challenge to be roughly $22 billion through 2035 (when emissions fall to approximately 45 percent below 1990 levels) and $52 billion through 2050. Scaled to a 45 percent reduction by 2030 and a more than 95 percent reduction by 2050, we determine NPV costs of $25 billion through 2030 and $59 billion through 2050 as a direct point of comparison to net health and climate benefits.[124]

We also added in an estimate of avoided forest fire costs and benefits by applying the methodology described above to the Department of Natural Resources (DNR) 20-year Forest Health Strategic Plan[125] and assuming the program costs are sustained through 2050, based on a decadal budget of $554 million dollars. Wildfire prevention adds NPV costs of $0.5 billion through 2030 and $1.1 billion through 2050, compared to a NPV benefit of $1.5 billion through 2030 and $3.4 billion through 2050.[126]

Including a social discounting rate of three percent for future costs and benefits, the avoided emissions and wildfires return a NPV benefit of $46 billion through 2050, equal to 175 percent of the net costs. This includes $106 billion in health and climate benefits minus the net costs. Through 2030, nearly 90 percent of net costs are balanced by $22 billion health and climate benefits (Figure 4).[127,128]

[124] For more information about NPV costs, see table 7.6 and supporting information from the initial report. LOW CARBON PROSPERITY INST., *Building Back Better: Investing in a Resilient Recovery for Washington State* 48 (2020), https://www.lowcarbonprosperity.org/project/building-back-better/ (click on "Read the Full Report").

[125] *20-Year Forest Health Strategic Plan: Central and Eastern Washington*, WASH. STATE DEP'T OF NAT. RESOURCES, https://www.dnr.wa.gov/ForestHealthPlan.

[126] The NPV calculation assumes a 10-year average lag in avoided wildfires and a 5-year average lag in expenditures from the beginning of each decade.

[127] At a fixed social cost of carbon of $52/tCO2e for 2020. Computationally, holding the social cost of carbon constant is the equivalent of applying a social discount rate on future benefits of 3 percent.

[128] The net costs in 2050 are scaled proportional to ambition to a 97.5 percent reduction from the 86 percent reduction in the Meeting the Challenge Central Case.

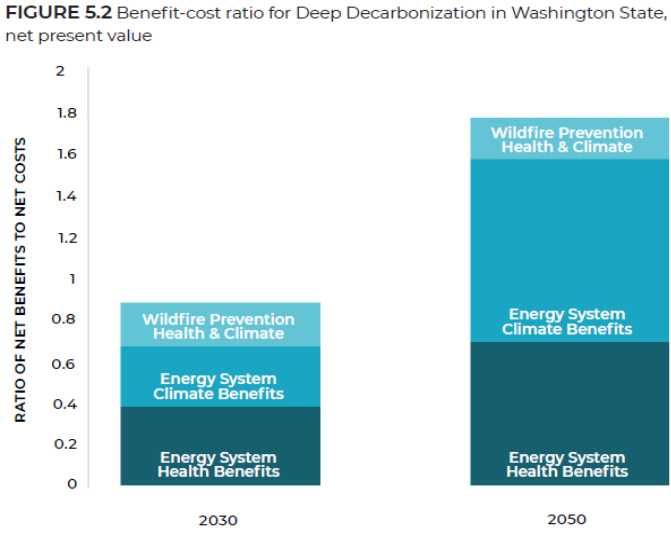

Figure 4: Benefit-cost ratio (net present value) for Deep Decarbonization in Washington State*:* KURMAN-FABER ET AL., *supra* note 90 at 32.

The long-term air quality benefits are mainly projected to come from decreased fuel consumption of on-road gasoline ($2.8 billion through 2030, $16 billion through 2050), marine vessels ($4.1 billion through 2030, $11 billion through 2050), on-road diesel ($2.6 billion through 2030, $9.8 billion through 2050), and wildfires ($3.7 billion through 2030, $8.4 billion through 2050).

Long-term climate benefits are mainly projected to come from on-road gasoline ($1.8 billion through 2030, $14 billion through 2050), on-road diesel ($2.0 billion through 2030, $11 billion through 2050), natural gas in buildings and industry ($1.8 billion through 2030, $9.1 billion through 2050), and jet fuel and aviation ($1 billion through 2030, $8.7 billion through 2050).[129]

VI. DISCUSSION

This report and the *Resilient Recovery Portfolio* seek to address dual challenges exacerbated by the COVID-19 pandemic: economic recovery and community health. The job creation potential and investment returns through the local economy are compelling, firmly outpacing both the largest industries in the state and economy-wide benchmarks. These

[129] Tables showing scenario emissions trajectories and cumulative, net benefits through 2030 and 2050 can be found in the methodology section of the initial report, *see* LOW CARBON PROSPERITY INST., *supra* note 82, at 37-48.

programs also collectively offer a positive return on investment in clean air benefits and avoided climate damages. One grand challenge for policy design and implementation is to ensure that not only are these benefits realized, but that they reach and have real impact for communities most affected and facing the largest barriers such as BIPOC communities. Without targeting impacts to emphasize disadvantaged and historically underserved communities, the investments will inevitably deliver suboptimal returns as Washington State struggles to maximize its potential.

This type of jobs portfolio and investment mindset can kick-start both short-term and long-term job growth, shared economic prosperity, and cleaner air. By developing and investing with this type of approach, Washington can lead a transformative recovery from the current crisis and build a healthier, more resilient future, serving as a template for other states and the country as a whole. However, the methodology developed for this report is not without limitations.[130]

Among the main limitations for both job and community health impacts are the lack of insight on more granular location and timing questions. Job longevity, wage variance within an industry, and additional job quality metrics are beyond the scope of the analysis. The community health analysis is limited to health damages associated with mortality which are the majority of quantifiable health damages from air pollution, but does not capture non-fatal health costs such as increased hospitalization, asthma incidence, or other long-term health issues. Furthermore, our methodology does not consider additional co-benefits beyond cleaner air and climate, such as reduced traffic fatalities, reduced congestion, reduced expenditures on fossil fuel imports, increased active transportation, and accelerated technological deployment, among others. In both health and climate impacts, it is fair to assume the real net benefits of the investments in the *Resilient Recovery Portfolio* exceed what our study indicates but it is not possible to say by how much.

A. *Job Impacts*

The *Resilient Recovery Portfolio* is the weighted composite of four priorities: FTE jobs supported, wage levels, community health benefits, and climate benefits. Four corresponding portfolios were assembled that weight programs according to their rank performance on each priority. The *Resilient Recovery Portfolio* is a balanced composite of these four

[130] More detailed description for each of these components can be found in the initial report, *id*.

portfolios.[131] Combining and weighting these priorities leads to increased funding for the programs that provide the most holistic and balanced benefits and creates a *Resilient Recovery Portfolio* that scores highly on all metrics. Large gains in community health and climate benefits which create a compelling return-on-investment result in only marginal decreases to up-front jobs, employee compensation, and added economic value.

As observed in the construction of these aggregate portfolios, IMPLAN suggests a partial inverse relationship between the scale of FTE job creation and wage levels. Holding other factors constant, an industry with lower wage levels supports more jobs per dollar of output than an industry with higher wage levels. However, the inverse relationship is only partial, due to the additional key factors influencing job creation by industry — namely labor-intensity (the proportion of industry output that is dedicated to paying for labor as opposed to capital costs) and leakage rates (the proportion of industry output that flows out of the state economy creating jobs elsewhere). Maximizing both job creation and job quality requires prioritizing industries that lead to greater labor intensity and lower leakage.

B. *Community Health and Climate Benefits*

Our study uses county-level pollution data where appropriate, but remains generalized at the state level. Important local context may increase or decrease these community health benefits when put in practice. Location and efficacy of the given program largely determines where and how pollution reductions occur, and who are the local or downwind beneficiaries. When these programs transition from hypothetical proof of concept to concrete, location-specific proposals, more granular community health analysis is essential for prioritizing and maximizing benefits on the ground. Subsequent sections of this report will discuss the potential clean air and climate benefits of each program.

True cost-benefit analysis depends on the degree to which these programs leverage funds from federal, private, or other out-of-state sources, should they be implemented. For example, every state dollar invested in California Climate Investments leverages an additional $3.70.[132] Were the *Resilient Recovery Portfolio* programs to leverage this scale of funding from out-of-state sources, the programs would unlock community health and climate benefits of up to $11 million per million dollars invested

[131] For a graphical depiction, see Figure 6.1 in the initial, online report. see LOW CARBON PROSPERITY INST., *supra* note 82, at 35.
[132] This estimate excludes the High-Speed Rail program, and does not differentiate between funds leverage in-state versus out-of-state. CAL. AIR RESOURCES BD., CALIFORNIA CLIMATE INVESTMENTS ANNUAL REPORT: 2020 121 (2020).

by the state, as opposed to our current estimate of $2.4 million. This is particularly important when evaluating stimulus recovery measures, which may leverage significant funds from the federal government.[133]

C. *Additional Components for Consideration*

The *Resilient Recovery Portfolio* offers an investment template for Washington to build back better, delivering compelling results: enhanced well-being for communities and families through clean air and climate benefits linked to above-average job creation, wages, and economic performance. Below we offer an additional piece of analysis that synthesizes previous findings with additional components for the consideration of policymakers and stakeholders.

We present findings throughout this report as comparative "multipliers," which normalize all benefits to a million dollar investment. However, in reality, the various investment areas identified as part of the *Resilient Recovery Portfolio* require different scales of funding. Additionally, not all programs can be deployed immediately — some programs require years of upfront planning and scoping work prior to implementation, others may not require such drawn out steps, while others may be shovel-ready. The speed at which programs can be deployed is an important factor in an effective, rapid recovery plan. Our *Resilient Recovery Portfolio* does seek to emphasize a suite of programs that can generate jobs and other benefits starting in the near-term.

To complement our findings, we suggest two additional considerations: **investment scale** and **deployment speed** (Table 3). Investment scale refers to the size of funding required to exhaust available investment opportunities considered in the *Resilient Recovery Portfolio*, and deployment speed refers to the anticipated pace at which projects can be feasibly implemented to facilitate rapid deployment.[134]

[133] The term "leverage" assumes a direct causality between in-state investment and out-of-state assistance. If a specific state proposal directly results in additional federal funds that otherwise would not have occurred, then those federal funds qualify as leveraged and could be omitted from upfront costs for the purpose of state-level cost-benefit.

[134] Additional information is available in Table 6.2 of the initial report, available online: Additional information is available in Table 6.2 of the initial report, *see* LOW CARBON PROSPERITY INST., *supra* note 82, at 35.

Investment Area	Investment Scale	Deployment Speed	FTE Jobs/$M	Health Benefits	Climate Benefits
Clean Transportation	$$$	MIXED	10.7	+++	+++
Water, Power, & Energy Efficiency	$$$	MEDIUM TO FAST	8.7	+++	+++
Forest Conservation & Ecosystem Restoration	$$$	FAST	12.7	+++	+++
Low Carbon Agriculture	$$$	MEDIUM	6.8	NOT QUANTIFIED	+++
Sustainable Industry	$$$	MEDIUM	7.1	+++	+++

INVESTMENT SCALE *Lower opportunity ($) | Medium opportunity ($$) | Higher Opportunity ($$$)*
DEPLOYMENT SPEED *Within 2 years (Fast) | Within 5 year (Medium)* | 5+ years (Slow)
HEALTH AND CLIMATE BENEFITS *Low (+) | Medium (++) | High (+++)*

Table 2: Overview of findings by Investment Area*:* KURMAN-FABER ET AL., *supra* note 90 at 33.

Our evaluation of these two criteria remains qualitative, as concrete program details are required for all programs in Washington State to quantitatively assess both investment scale and deployment speed. Notably, clean transportation has a wide array of deployment speeds depending on the project in question. Large infrastructural projects, such as *High-Speed Rail*, require several additional years of planning and scoping work prior to beginning construction. However, ongoing *Sound Transit Expansion* qualifies as a "fast" potential deployment speed. The Federal Way extension has already entered construction phase, and cash flow is the predominant limiting factor on hastening broader system expansion.

CONCLUSION

At least 65 percent of Washingtonians in every county view protecting the environment as a higher priority than economic growth.[135] The *Resilient Recovery Portfolio* shows that these do not have to be at odds, with well above average performance on jobs and economic value added. Decision makers who wish to build holistic recovery plans can undergo a similar data-driven approach, including the methods and programs highlighted in this report, to balance job creation, community health, climate benefits, and other key priorities such as social justice.

[135] Yale Climate Opinion Maps, 2018. Washington State Response to the question: Which do you think is more important? (a) Protecting the environment, even if it costs jobs or economic growth? (b) Economic growth, even if it leads to environmental problems. *Yale Climate Opinion Maps*, YALE PROGRAM ON CLIMATE CHANGE COMMUNICATION (2018), https://climatecommunication.yale.edu/visualizations-data/ycom-us-2018/?est=prienv&type=value&geo=county.

A data-driven approach on its own cannot remedy the injustices experienced by BIPOC and low-income communities, which have worsened from the compounding COVID-19 economic and public health crises. Engaging and empowering most and first impacted communities at all phases is an essential responsibility of local and state governments. Understanding and addressing the needs of these communities should drive Washington's holistic recovery efforts and future policies.

Future work should build on this report and add critical dimensions of analysis to take the *Resilient Recovery Portfolio* outlined here and convert it into actionable policy. Additional work areas that we see as crucially important include:

(1) Social justice, community engagement, and analysis of the distributional economic and health outcomes of selected recovery measures;

(2) job quality, occupational analysis, career advancement opportunities, diverse and local access, and other components of jobs supported;

(3) expansion of the *Resilient Recovery Portfolio* to additional programs that have the potential to deliver community benefits at the nexus of quality job creation and community health;[136]

(4) deep analysis of the potential contributions and compatibility of stimulus measures with Washington's long-term climate goals, and the net benefits of achieving those goals; and

(5) further work to bridge this portfolio to a workable policy by assessing optimal investment scale, phasing, and project readiness, and identifying possible financing mechanisms including those that leverage other funding.

This work is evolving, with more programs to consider, more states to assess, and additional dimensions to evaluate and engage. With the *Resilient Recovery Portfolio*, we establish a framework for building back to a better Washington, as we envision stretching that framework into a meaningful stimulus for change.

As of September 2020, widespread plumes of wildfire smoke are engulfing communities all across the Pacific Northwest, adding to the upheaval and lethality of a tumultuous and tragic 2020. Frontline communities are indicating that wildfire and air quality along with food systems top the list of their biggest climate concerns.[137] *Wildfire Prevention*

[136] For a non-exhaustive list of additional investment programs worth examining, see table 6.2 of the online report, LOW CARBON PROSPERITY INST., *supra* note 82, at 36.

[137] DEBOLINA BANERJEE ET AL., POWERING THE TRANSITION-COMMUNITY PRIORITIES FOR A RENEWABLE AND EQUITABLE FUTURE, PUGET SOUND SAGE (June 2020), https://www.pugetsoundsage.org/research/clean-healthy-environment/community-energy/.

and Preparedness is highly likely to be extremely cost-effective in generating multiple massive benefits.

Without rapid and concentrated action, these impacts are only going to get worse, impacting all of us and threatening especially the most vulnerable. This analysis demonstrates a framework to realizing job and community health benefits but cannot alone ensure improved environmental and social justice. To meet this grand but essential challenge for policy design and investment decisions, input from and positive outcomes for BIPOC and other vulnerable communities must be prioritized.

Building Back Better requires leveraging all possible policy levers to establish new and durable revenue streams at scale. Whether dealing with federal stimulus dollars, new cap-and-invest policy, or other financing mechanisms, the 2021 Legislative Session offers an opportunity for transformational change and creative solutions. Proven programs such as a well-designed cap-and-invest program could have a vital role in ensuring the state realizes the full potential of these investments and delivers a more resilient, prosperous Washington that lives up to its ambitious air pollution goals.

APPENDIX TABLES

This Appendix provides additional information about the composition of the *Resilient Recovery Portfolio* as a weighting of the various programs, including sub-projects which combine into programs. The overall weighting was based on a methodology developed to rank each program on jobs (factoring in both wages and total job creation), health benefits, and climate benefits. The relative performance and weighting are shown in Table A.1. Program level results across a range of Employment and Pay as well as broader economic impact is shown in Table A.2. More detailed description of both of these datasets, as well as IMPLAN inputs for each program and sub-project can be found in the initial report, available at: https://www.lowcarbonprosperity.org/project/building-back-better/.

Table A.1: Program weighting under different portfolio prioritizations.

TABLE 7.2 Program weighting under different portfolio prioritizations

PROGRAM OR SUB-PROJECT	RESILIENT RECOVERY PORTFOLIO		JOBS PORTFOLIO (50%)		COMMUNITY HEALTH PORTFOLIO (25%)		CLIMATE PORTFOLIO (25%)	
	RANK	SHARE	RANK	SHARE	RANK	SHARE	RANK, CLIMATE	SHARE, CLIMATE
Wildfire Prevention & Preparedness	1	16.9%	2	13.5%	1	25.0%	1	15.9%
Low Carbon Buses & Trucks	2	12.8%	1	15.9%	3	14.3%	8	5.1%
Electric Ferries	3	8.1%	10	3.7%	2	18.9%	7	6.0%
Light Rail — Sound Transit Expansion Federal Way	4	6.7%	3	11.5%	9	2.6%	17	1.2%
Home Energy Efficiency & Renewables	5	6.3%	8	5.1%	5	8.1%	6	7.0%
Urban & Community Forestry	6	6.3%	5	8.3%	Not Ranked	0.5%	5	8.3%
Yakima Basin Ecosystem Restoration	7	6.1%	4	9.7%	Not Ranked	0.50%	9	4.3%
Transit-Oriented Community Development	8	5.2%	7	6.0%	6	6.1%	12	2.7%
Low Carbon Agriculture: Dairy Digesters	9	5.1%	11	3.1%	Not Ranked	0.5%	2	13.5%
Water-Energy Programs	10	4.7%	9	4.3%	Not Ranked	0.5%	4	9.7%
Low Carbon Agriculture: Agricultural Water Efficiency	11	4.3%	12	2.7%	Not Ranked	0.5%	3	11.5%
Clean Vehicle Programs	12	4.3%	15	1.6%	4	10.8%	11	3.1%
Low Carbon Freight Operations: Rail-Bed Replacement	13	4.2%	6	7.0%	Not Ranked	0.5%	13	2.3%
100% Clean Power Readiness: Hydro Expansion & Upgrades	14	2.5%	13	2.3%	10	2.0%	10	3.7%
High-Speed Rail	15	2.3%	14	1.9%	8	3.5%	14	1.9%

Source: KURMAN-FABER ET AL., *supra* note 90 at 44.

Table A.2: Program-level summary of IMPLAN results

INVESTMENT AREA	INVESTMENT CATEGORY	EMPLOYMENT & PAY			
		EMPLOYMENT	FULL-TIME EQUIVALENTS (FTE)	WAGES & SALARY PER FTE	WAGES & BENEFITS PER FTE
CLEAN TRANSPORTATION	High-Speed Rail	8.2	7	$57,297	$59,087
	Light Rail - Sound Transit Expansion Federal Way	14.7	13.8	$50,085	$54,955
	Low Carbon Buses & Trucks	12.3	11.6	$58,023	$67,516
	Clean Vehicle Programs	8.3	7.4	$43,684	$46,328
	Transit-Oriented Community Development	9.8	9	$50,159	$51,439
WATER, POWER, & ENERGY EFFICIENCY	Home Energy Efficiency & Renewables	11.1	10.1	$46,871	$48,776
	100% Clean Power Readiness:Grid Resiliency & Optimization	6.5	5.9	$57,552	$60,968
	100% Clean Power Readiness: Hydro Expansion & Upgrades	7.2	6.6	$61,531	$63,416
	Water-Energy Programs	9.3	8.6	$49,867	$51,746
FOREST CONSERVATION & ECOSYSTEM RESTORATION	Wildfire Prevention & Preparedness	13.1	12.2	$49,893	$55,437
	Urban & Community Forestry	13	11.8	$42,038	$43,812
	Yakima Basin Ecosystem Restoration	15.9	15	$46,763	$48,197
LOW CARBON AGRICULTURE	Low Carbon Agriculture: Agricultural Water Efficiency	7	6.6	$60,152	$62,126
	Low Carbon Agriculture: Dairy Digesters	7.8	7	$57,227	$60,386
SUSTAINABLE INDUSTRY	Electric Ferries	7.4	6.9	$60,704	$58,111
	Low Carbon Freight Operations: Multi-Source Facility Projects	5.7	5.3	$55,592	$58,479
	Low Carbon Freight Operations: Sustainable Industrial Manufacturing Zones	7.8	7.3	$34,084	$35,333
	Low Carbon Freight Operations: Rail-Bed Replacement	9	8.4	$53,448	$56,282

Source: KURMAN-FABER ET AL., *supra* note 90 at 57.

BROADER ECONOMY						
OUTPUT MULTIPLIER	EMPLOYEE COMPENSATION	WAGES & SALARY	WAGES & BENEFITS	PROPRIETOR INCOME	VALUE ADDED, TOTAL	LEAKAGE (DIRECT INVESTMENT FLOWS OUT OF STATE)
1.77	$478,103	$403,105	$415,697	$134,579	$1,018,505	$0
2.06	$826,889	$691,171	$758,381	$247,188	$1,118,789	$48,713
1.88	$902,848	$671,307	$781,130	$63,595	$527,978	$446,860
1.04	$395,755	$323,056	$342,613	$54,823	$682,765	$422,284
1.7	$536,641	$453,387	$464,956	$176,885	$1,145,398	$2
1.85	$567,001	$475,708	$495,037	$136,441	$1,030,031	$0
1.52	$416,065	$340,115	$360,302	$73,026	$786,344	$97,753
1.71	$483,980	$406,809	$419,271	$86,251	$892,452	$4,348
1.76	$513,304	$428,263	$444,403	$88,240	$926,404	$401
1.67	$781,114	$608,197	$675,778	$82,431	$1,143,026	$45,132
1.8	$597,259	$496,128	$517,070	$138,806	$1,108,189	$40,369
2.07	$835,034	$701,743	$723,265	$241,335	$1,194,006	$0
1.73	$475,707	$397,964	$411,024	$53,766	$809,894	$0
1.68	$491,657	$403,413	$425,680	$63,422	$843,028	$0
1.74	$512,798	$420,194	$402,241	$83,968	$933,678	$2,305
1.18	$357,279	$293,938	$309,204	$93,822	$644,079	$379,054
1.5	$302,080	$249,439	$258,579	$273,539	$743,563	$9,465
1.89	$546,657	$449,473	$473,305	$103,761	$889,268	-$87,113

Source: KURMAN-FABER ET AL., *supra* note 90 at 58.