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WHERE IS REPAIR? | Computer Repair in China

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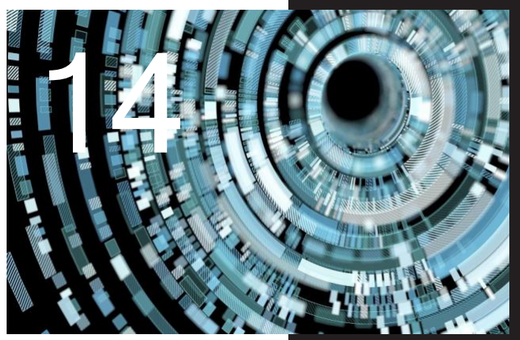
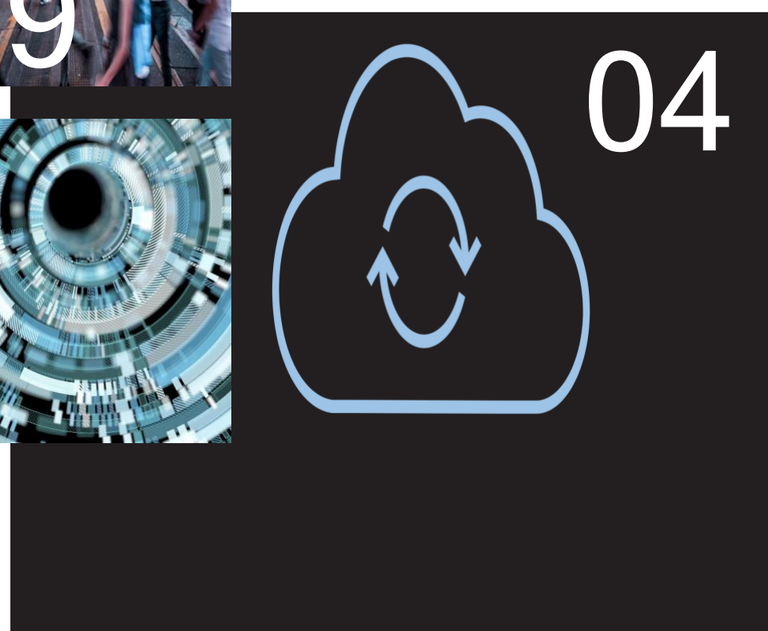


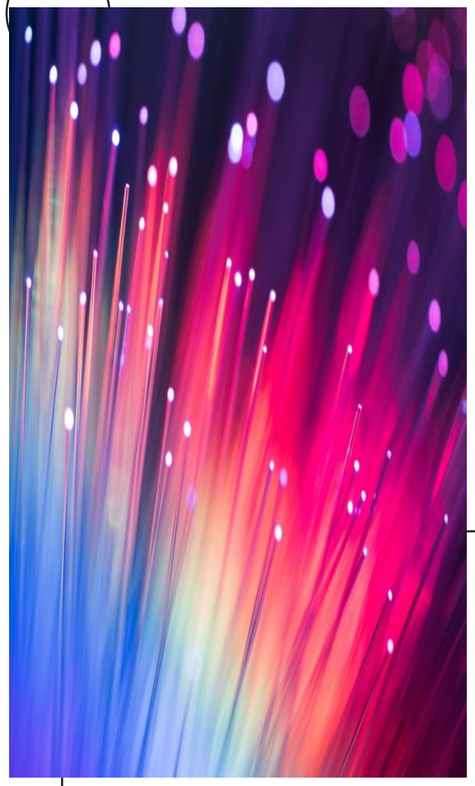


China & the RMC sector

Overview of the Repair and Maintenance of Computer and Communication Equipment in China

Repair and maintenance of electronic devices are increasingly recognized as important sources of broad economic, environmental, and social benefits beyond just the fixing of machines. Repair and maintenance stave off and overcome breakdowns of digital infrastructures. They offer forms of employment, including self-employment, for small and medium sized businesses; they also offer forms of material and energy conservation by lengthening the useful life of devices and, thus, amortizing the embodied energy and materials of those devices over longer periods of time.

In this report we attempt to quantify the conservation value of repair and maintenance of computing devices in China. We develop a baseline scenario based on trends in urban and rural population as well as computer ownership, projecting historically available data to model between the years 2020--2050.



Where is repair?

Furthermore, we use the model to examine the conservation value of the computer repair sector in China in terms of the number of units of new devices forgone and in terms of tonnes of carbon dioxide equivalent (CO_2e) avoided (see Appendices for full methodology, data, and bibliography).

Unfortunately, publicly available data for China do not disaggregate repair and maintenance activities by sector in terms of employment or economic value such as contribution to GDP. Consequently, unlike in our previous report (Wang and Lepawsky, 2021) this report on China is limited to a description of five modeled scenarios about the potential carbon offsets of the repair and maintenance of computers.

We are unable to describe other relevant factors such as the numbers of people who work in China's electronics repair and maintenance sector specifically or other relevant factors such as their geographical distribution or the value of the sector to the broader economy of China. The five scenarios include a baseline scenario that assumes no lengthening of useful lifetimes of devices and four additional scenarios in which repair and maintenance add 1, 2, 3, and 4 extra years of useful life (see Section 3 and Appendix for detailed discussion of the model and each scenario).

Our results suggest that over the 30 years between 2020-2050 the repair and maintenance scenarios our model indicates

Table 1. Total units of computers saved, 2020-2050

Useful life extended by	Total units of computers saved between 2020-2050
1 year	215,000,000
2 years	499,000,000
3 years	560,000,000
4 years	696,000,000

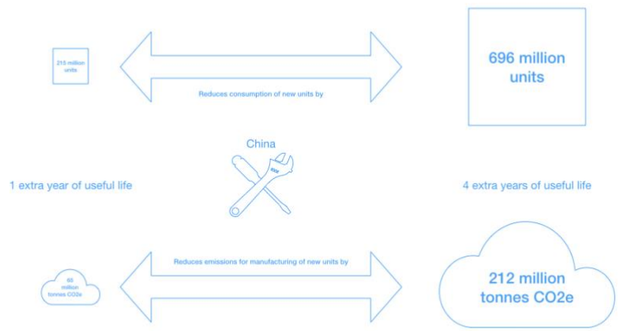


Figure 1. Range of reduction in new devices manufactured and CO2e emitted when between 1 and 4 extra years of useful life are added to devices by maintenance and repair.

can reduce the purchase of new computers by 215,000,000 to 696,000,000 units (Table 1), and can reduce the generation of CO_2e by 65,000,000 to 212,000,000 tonnes (Figure 1). This range of CO_2e is equivalent to taking between 15--50 million passenger vehicles off the road for a year.

Background

The People's Republic of China (PRC) has the world's largest population and the world's third-largest land area. This report pays attention to data from mainland China only.

China can be divided into 34 provincial administration regions: 23 provinces, five autonomous regions, and four direct-controlled municipalities (Beijing, Tianjin, Shanghai, and Chongqing), and the special administrative regions of Hong Kong and Macau (The Central People's Government of the People's Republic of China, n.d.). China is also the world's largest exporter of newly manufactured computers.

Computer Access

in China

Unfortunately, China's statistical yearbooks contain no data about the repair and maintenance of computers (RMC) industry specifically, despite the importance of this sector to the country's economy. However, official data are collected about the general household related repair industry, which includes repairing of computers and office equipment, repairing and maintenance of automobiles and motorcycles, household appliance repair, and other daily products repair (The General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, 2017).

We can see from these data that from 2013 to 2018, the number of enterprises conducting activities related to repair and maintenance in China increased continuously from 74.4 thousand in 2013 to 187 thousand in 2018 (Figure 2). From 2016 to 2018, the operating incomes of those businesses range around 38.6 billion$ (estimated by an exchange rate of 1$=6.5￥). At the same time, around 1 million persons were employed in this industry.

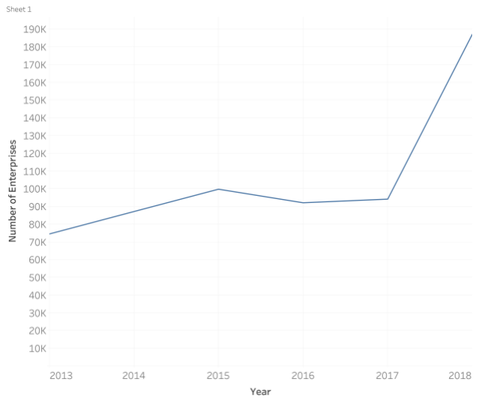


Figure 2. Total number of repair enterprises operating in China from 2013 to 2018.

Trends in Computer Ownership in China

China's household computer ownership increased from 48.9 computers per 100 households in 2013 to 58.7 computers per 100 households in 2017 with a slight decrease to 53.2 computers per 100 households in 2019.

Unfortunately, there are no data about how many computers are consumed in China per year. Consequently, we assume that the computers in China that are not exported are all being consumed locally. With that assumption, China's data on computer production, import, and export were used to calculate the amount of China's domestic computer consumption.

As shown in Figure 3 China's computer consumption decreased from 30 million units in 2012 to 15.9 million units in 2015 and increased quickly from 2015 to 91.57 million units in 2019.

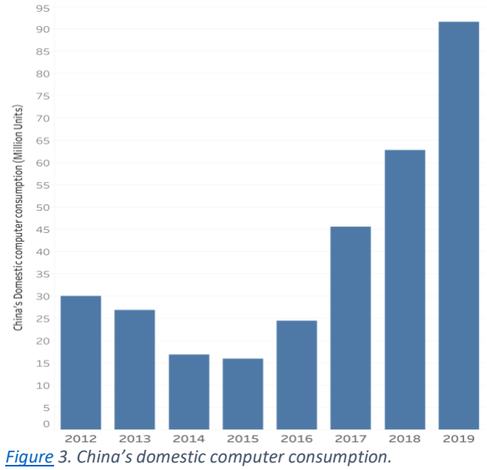
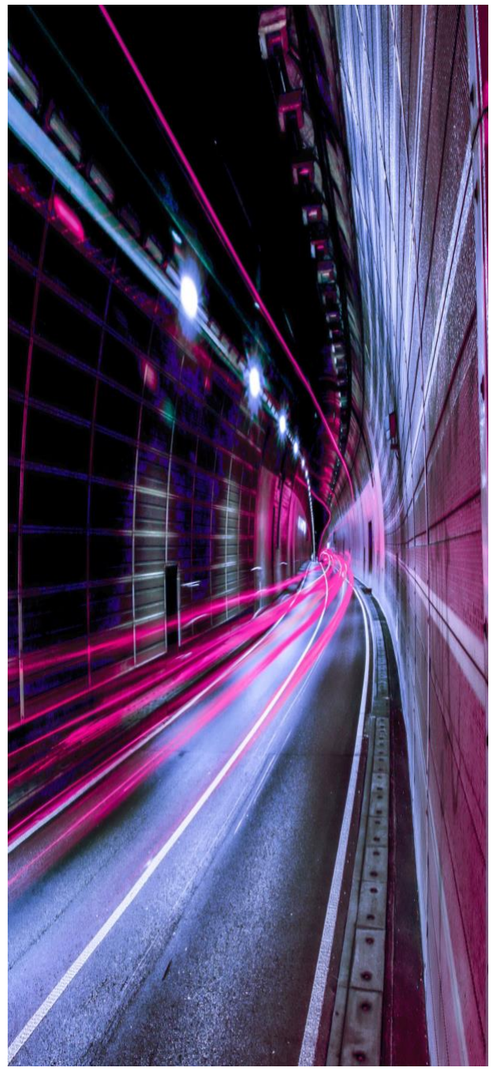


Figure 3. China's domestic computer consumption.



Where is repair?

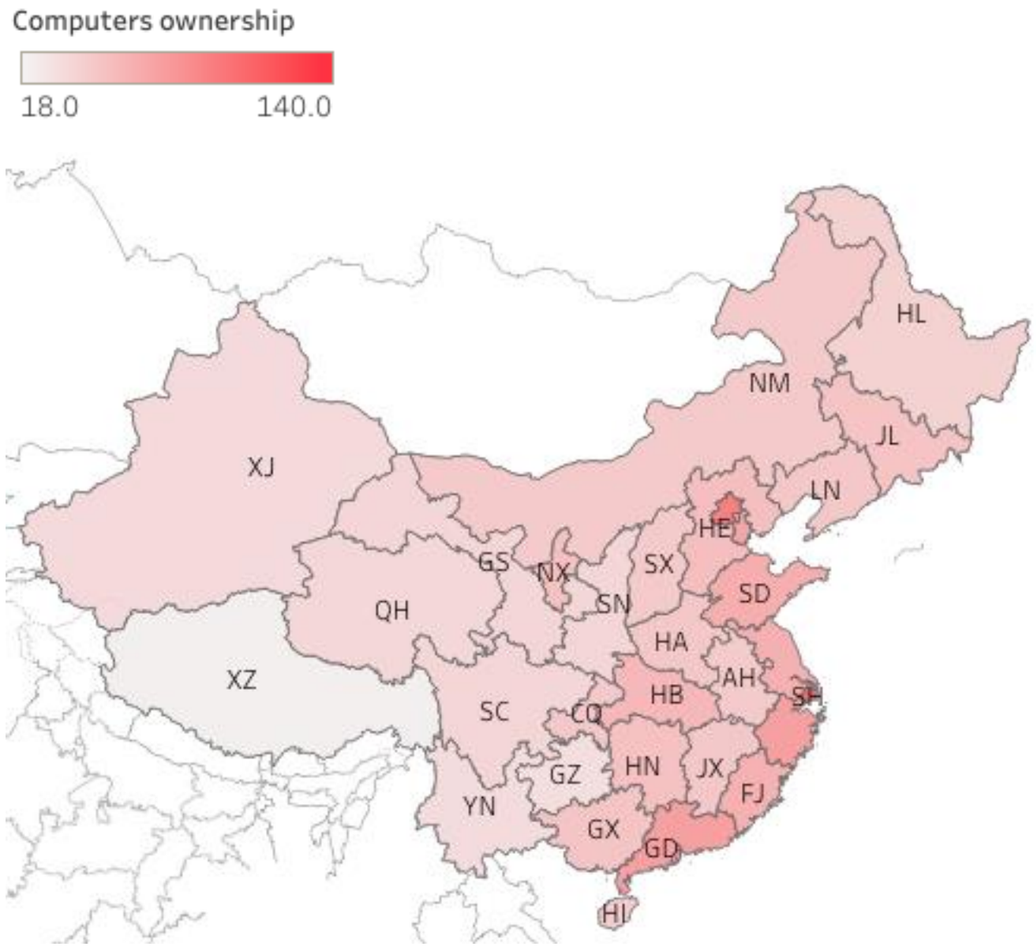


Figure 4. Computer ownership per households by province.

There are significant differences in macroeconomic indicators, like population density or GDP per capita, from province to province. For example, in the 2010s, there were more than 100 million people in Guangdong and Shandong, but only 6 million people in Qinghai province. In 2019, China's provincial GDP per capita ranged from 160 thousand Chinese Yuan in Beijing to only around 30 thousand Chinese Yuan in Gansu province and Heilongjiang Province. This diversity is also reflected in household computer ownership. From 2015 to 2019, the computers owned per 100 households ranged from more than 130 units in Shanghai or Beijing to around 20 units in Tibet, a difference of about 6 times between the two locations (Figure 4).

Rural-Urban Divides

Rural-urban divides

Alongside differences in computer ownership at the provincial level, there are also substantial divides in ownership between rural and urban locations within individual provinces. As shown below, in most cases rural household computer ownership is less than one third of the household computer ownership in urban areas. These rural-urban divides are starker considering that most businesses and government departments are located in the urban areas.

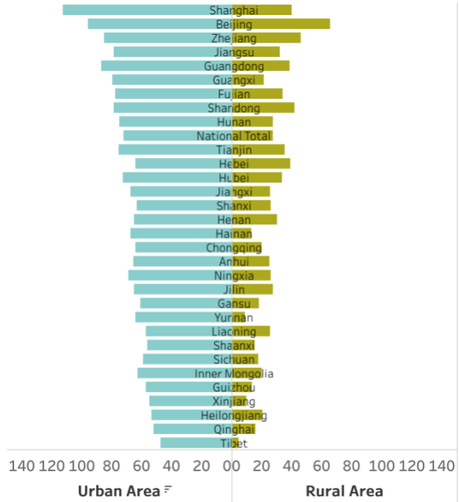


Figure 5. Urban vs rural area, comparison of household computer ownership in 2019.

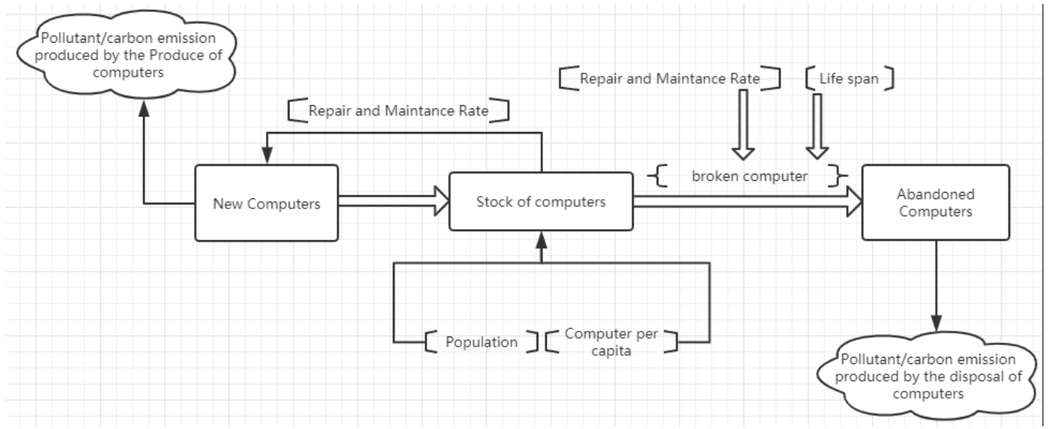


Figure 6. Stock and flow model used in this analysis.

Our estimates of the RMC sector's current and future environmental benefits (measured in the terms of CO_2e) of specific areas are made using a stock and flow model (technical description of the model is available in Wang and Lepawsky 2021; for model assumptions see Appendices).

Results

There are many published forecasts of China's future population (United Nation, 2019; IHME, 2020; Chen et al., 2020). Here we use the results of Chen's research (Chen et al., 2020) with some adjustments (For details about the reasons and process of this adjustment, see Appendices).

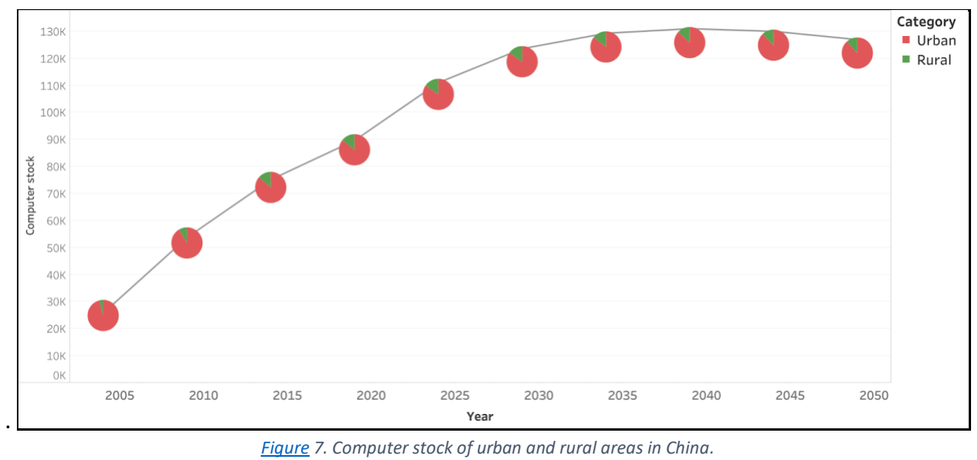


Figure 7. Computer stock of urban and rural areas in China.

We estimate the total stock of computers in China will increase from 449 million units in 2020 to 654 million units in 2041 and then decrease continuously until 2050. Over those years from 2020 to 2050, more than 85% of computers will be consumed in urban areas (Figure 7).

For different provinces, the stock of computers in the urban areas will increase to around 2040s and then decrease slightly. For most provinces, the stock of computers in the rural area will increase and then decrease, the time of the peak is different among provinces. This overall pattern (increase followed by decrease) is likely to be driven by factors such as increase of per capita disposable income and popularity of tablets.

After a historical increase from 2015 to 2020, the amount of new computers consumed in China will decrease and then increase. This pattern likely results from factors such as popularity of tablets (Tech Target China, 2012). This pattern is evidenced across all scenarios modeled in this report.

Abandoned Computers Avoided

The conservation value of China's RMC sector can also be examined from the point of view of reducing the number of discarded (abandoned) computers in the country. Although the number of abandoned computers will continue to rise under all scenarios considered here, the rate of that rise is slowed the longer that devices are kept in working order.

As Figure 8 suggests, the number of abandoned computers avoided through repair can be significant. Extending the useful life of machines by just one year reduces the number of abandoned computers by 10--35 percent. Extending the useful life of computers by four years leads to further reductions of 35--50 percent of abandoned computers compared to the baseline scenario.

The urban area saved more disposable computers than the rural area if the lifespan increased in a similar period. In urban areas of China, from 2020 to 2050, If the lifespan increases by 1 year, 2 years, 3 years, and 4 years, the amount of disposed computers saved will be 174, 328, 462, and 576 million units, respectively. In rural areas of China, in the same period, if the lifespan increases by 1 year, 2 years, 3 years, and 4 years, the amount of disposable computers saved will be 44, 78, 106, and 132 million units, respectively.

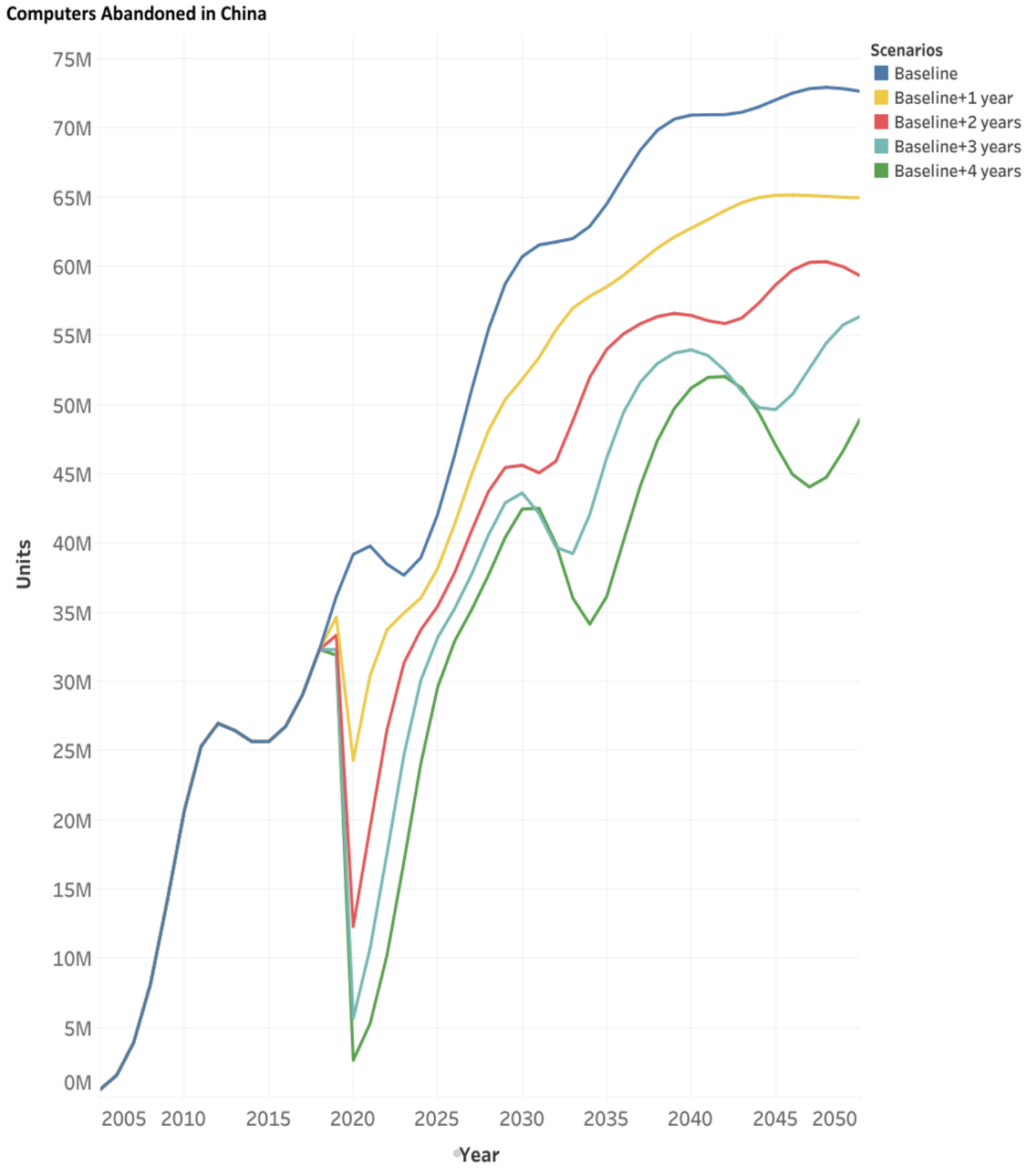
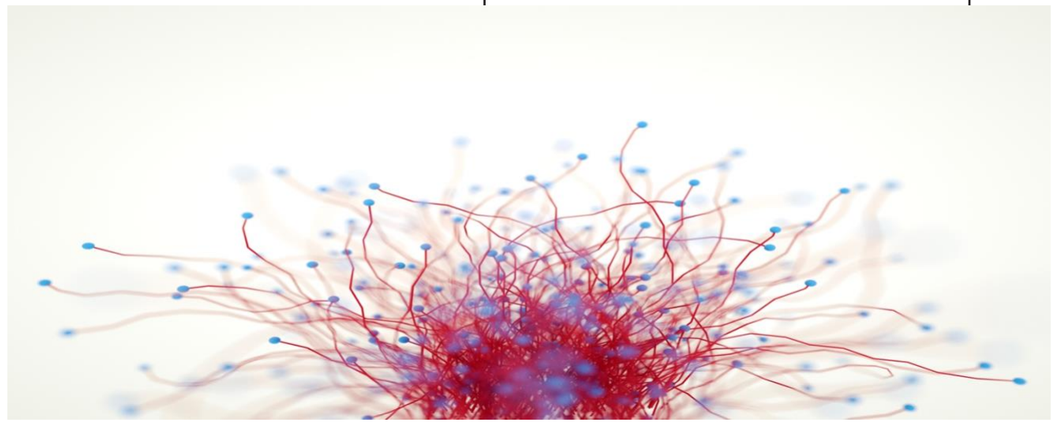


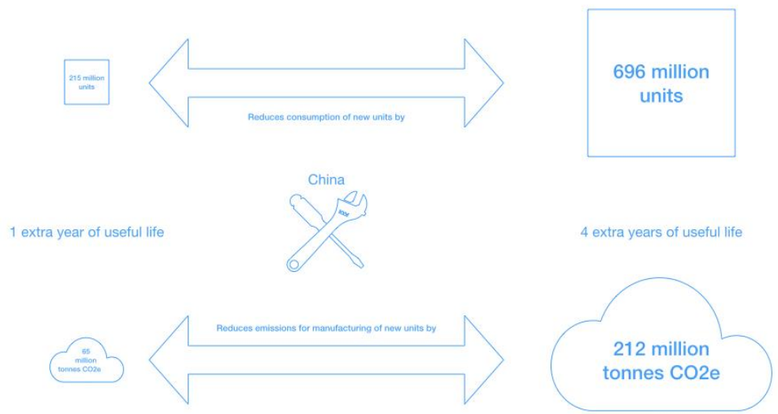
Figure 8. Total units of computers abandoned in China for different scenarios.

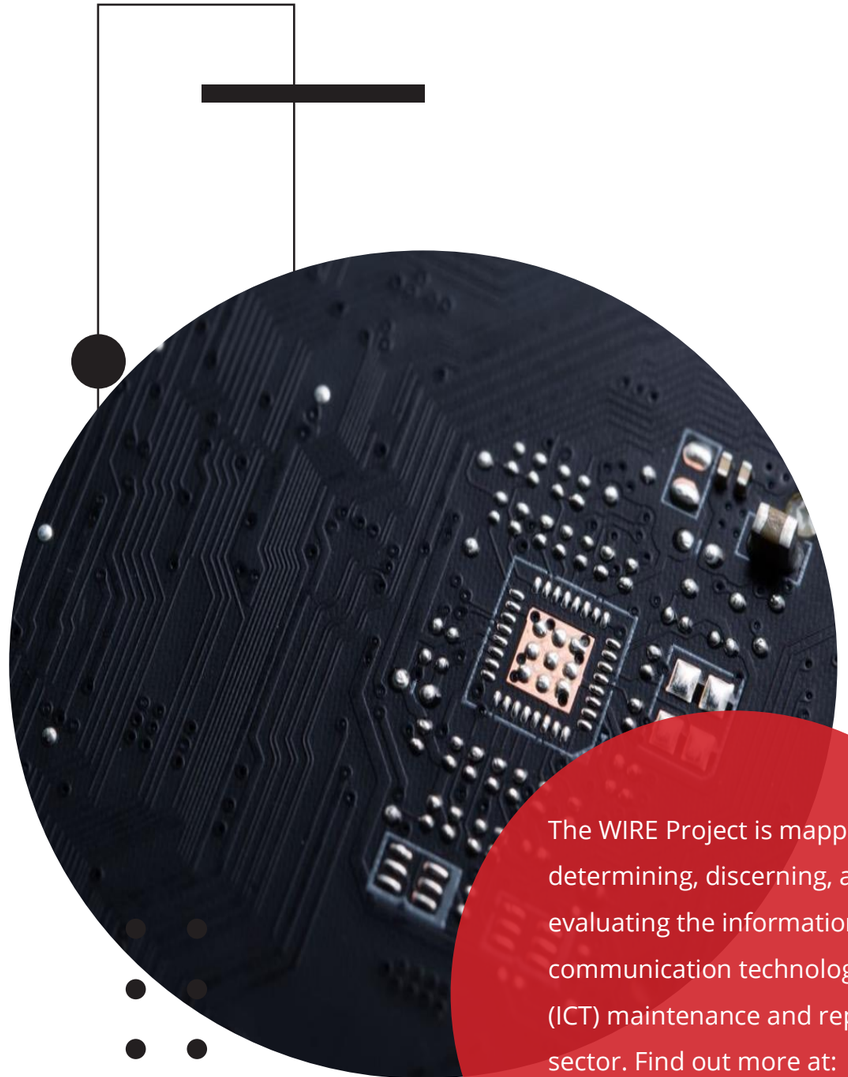


Summary: RMC Sector and Avoided CO_2e

Our modelling suggests China's RMC sector offers significant conservation value when measured in terms of carbon dioxide equivalent (CO_2e). Under the scenarios we examine the RMC sector avoids between 65 million and 212 million tonnes of CO_2e compared to new manufactures of computers. To put those numbers in some perspective these savings represent the equivalent of taking between 15--50 million passenger vehicles off the road for a year.

Useful life extended by	CO_2e avoided (millions of tonnes)
1 year	65
2 years	122
3 years	171
4 years	212





The WIRE Project is mapping, determining, discerning, and evaluating the information and communication technology (ICT) maintenance and repair sector. Find out more at:

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