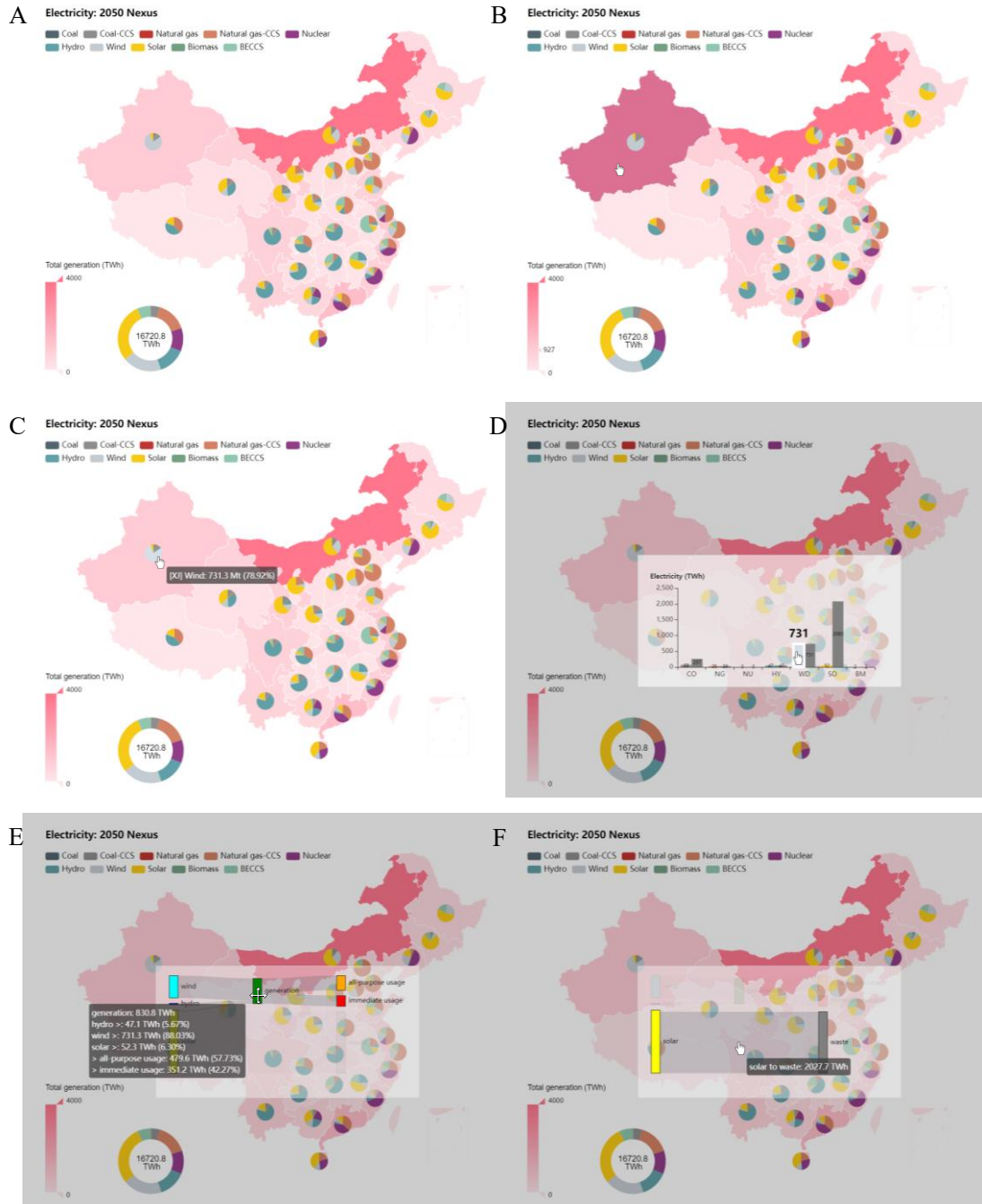


**Figure 1: Electricity and green methanol transmission plot for 2050 nexus scenario.**

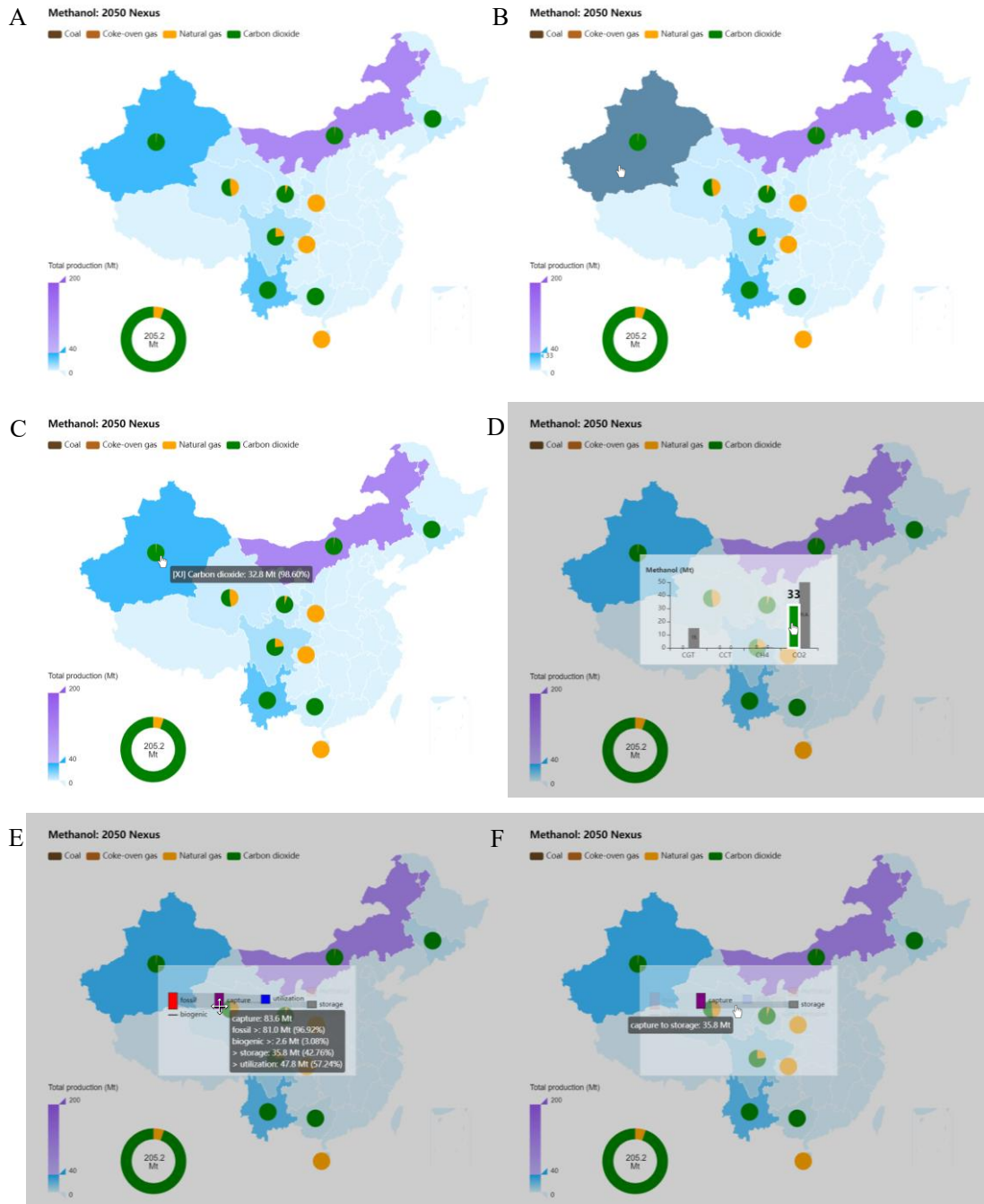
Scenario name, legend and corresponding key statistics, i.e. total transmission amount via grid and green methanol, are shown on the top left corner of figure, as in (A). When mouse pointer hovers over an arrow, the source, destination as well as exact amount of electricity and green methanol transmission represented by that arrow are shown above the arrow. The number in plain text and that in parenthesis with plus sign in front represent electricity and methanol, respectively, as in (B). Similar plots for other scenarios (not shown here) are also generated.



**Figure 2: Electricity generation technologies plot for 2050 nexus scenario.**

Scenario name and legend are shown on the top left corner of figure while the national technology mix and total amount of electricity generation are shown on the bottom left corner, as in (A). When mouse pointer hovers over a province, its background is highlighted with provincial generation amount shown on the color bar at the bottom left corner of figure, as in (B). When mouse pointer hovers over a slice of the pie chart on a province, abbreviated province name, technology name, generation amount of that technology and its percentage for that province are shown in the tooltip, as in (C). When any pie chart or province background is clicked, a bar chart showing generation amount (left colored bar) and capacities (right gray bar) of each technology for that province is popped up. When mouse pointer hovers over any bar, the exact number of that bar is shown with its border highlighted in white, as in (D). When any bar is clicked, a Sankey chart showing the flow of

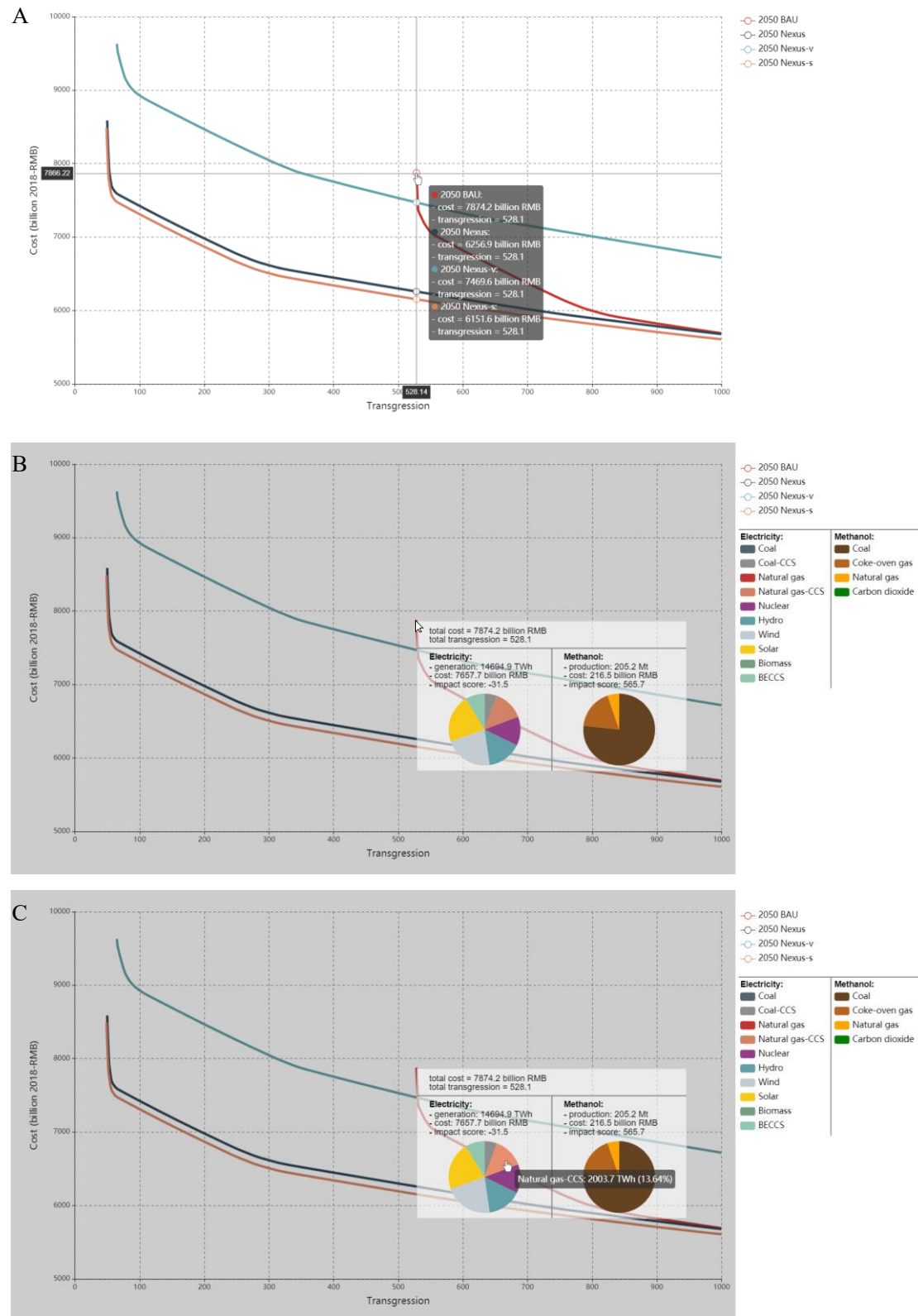
*intermittent renewable resources (hydro, wind and solar) is popped up. When mouse pointer hovers over any node, the exact value of that node, as well as the inflows to that node with percentage (denoted by node name followed by a ">" sign) and the outflows from that node with percentage (denoted by a ">" sign followed by node name), is shown in the tooltip, as in (E). When mouse pointer hovers over any edge, the exact value of that flow is shown in the tooltip, as in (F). When the gray background of (D), (E) or (F) is clicked, the bar or Sankey chart is cleared and the figure is reverted back to (A). Also, mouse drag and zoom are enabled in (A) for the convenience of visualization, and when mouse pointer hovers over or clicks on the doughnut chart for national technology mix, similar effects to those for provincial pie charts are presented. Similar plots for other scenarios (not shown here) are also generated.*



**Figure 3: Methanol production technologies plot for 2050 nexus scenario.**

Scenario name and legend are shown on the top left corner of figure while the national technology mix and total amount of methanol production are shown on the bottom left corner, as in (A). Regarding the map's color encoding, due to the vast difference in amount of methanol produced by each province, blue is used to represent production amount less than 40 Mt/year while purple is used to represent that above 40 Mt/year, as reflected in the color bar. When mouse pointer hovers over a province, its background is highlighted with provincial production amount shown on the color bar at the bottom left corner of figure, as in (B). When mouse pointer hovers over a slice of the pie chart on a province, abbreviated province name, technology name, production amount of that technology and its percentage for that province are shown in the tooltip, as in (C). When any pie chart or province background is clicked, a bar chart showing production amount (left colored

bar) and capacities (right gray bar) of each technology for that province is popped up. Note that due to the very high capacities of CO<sub>2</sub>-based production, they are not fully shown in the bar charts for most provinces. However, the exact number of any bar, including the one for CO<sub>2</sub>-based production, is always shown with its border highlighted in white when mouse pointer hovers over that bar, as in (D). When any bar is clicked, a Sankey chart showing the flow of carbon dioxides is popped up. When mouse pointer hovers over any node, the exact value of that node, as well as the inflows to that node with percentage (denoted by node name followed by a ">" sign) and the outflows from that node with percentage (denoted by a ">" sign followed by node name), is shown in the tooltip, as in (E). When mouse pointer hovers over any edge, the exact value of that flow is shown in the tooltip, as in (F). When the gray background of (D), (E) or (F) is clicked, the bar or Sankey chart is cleared and the figure is reverted back to (A). Also, mouse drag and zoom are enabled in (A) for the convenience of visualization, and when mouse pointer hovers over or clicks on the doughnut chart for national technology mix, similar effects to those for provincial pie charts are presented. Similar plots for other scenarios (not shown here) are also generated.



**Figure 4: Pareto fronts of nexus optimization.**

The optimal trade-off curves between total cost and total boundaries transgression are shown for the four 2050 scenarios with legends on the top right corner of figure. All cost components are projected to 2050 and expressed in 2018-RMB as explained in Section S1. When mouse pointer hovers over the curves, scenario names together with their corresponding costs and boundaries

*transgression are shown in the tooltip for all four scenarios at the same value of total transgression, as in (A). When a point on any curve is clicked, several key statistics associated with that point including production quantities, costs and impact scores for both electricity and methanol sectors are shown. Two pie charts showing national technology mixes for both sectors are also popped up with legends shown in the right unshaded region of figure, as in (B). When mouse pointer hovers over a slice of any pie chart, technology name, production quantity of that technology and its percentage are shown in the tooltip, as in (C). When the gray background of (B) or (C) is clicked, the pie charts and their legends are cleared, and the figure is reverted back to (A). Also, mouse drag and zoom are enabled in (A) for the convenience of visualization.*