CLAIMS

1. A method, comprising:

receiving, by a processing device, first data indicating an update to a substrate fabrication system to operate according to one or more process procedures, wherein the update comprises at least one of:

i.) an alteration of a first scheduled operational mode of a support asset of the substrate fabrication system to a shared operational mode;

or

ii.) a modification of a first gas to a second gas to be used by the substrate fabrication system;

inputting, by the processing device, the first data into a digital replica configured to estimate environmental resource usage data indicative of an amount of one or more resources consumed based at least in part on processing the first data;

receiving, by the processing device, estimated environmental resource usage data output from the digital replica corresponding to performing the one or more process procedures by the substrate fabrication system incorporating the update; and

providing, by the processing device, the estimated environmental resource usage data for display on a graphical user interface (GUI).

2. The method of claim 1, wherein the update further comprises replacing a first hardware subsystem device with a second hardware subsystem device having one or more operational specifications different from the first hardware subsystem device.

3. The method of claim 1, wherein the update further comprises altering a first configuration of manufacturing equipment of the substrate fabrication system to a second configuration of manufacturing equipment.

4. The method of claim 1, wherein the digital replica comprises a physics-based model of one or more physical assets of the substrate fabrication system.

5. The method of claim 4, wherein the physics-based model indicates at least one of:

i.) a relationship between a size and a geometry of a substrate process chamber and the estimated environmental resource usage data, and wherein the update further comprises a modification to at least one of the size or the geometry of the substrate processing chamber;

ii.) a relationship between a type of gas used within the substrate fabrication system and the estimated environmental resource usage data, wherein the update comprises the modification of the first gas to the second gas, wherein the first gas and the second gas comprise at least one of a purge gas, a reactive gas, or an etchant gas; or

iii.) a relationship between a heat extraction procedure from the substrate fabrication system and the estimated environmental resource usage data, wherein the update further comprises a modification to at least one of a heat exhaust device, a gas abatement device, a water cooling device, or a gas vent structure.

6. The method of claim 1, wherein determining the estimated environmental resource usage data comprises:

computing estimated environmental resource usage metrics for the substrate fabrication system; and

aggregating the estimated environmental resource usage metrics for the substrate fabrication system to determine the estimated environmental resource usage data.

7. The method of claim 1, further comprising:

determining, using the digital replica, second environmental resource usage data indicating an environment resource consumption corresponding to performing the one or more process procedures; and

determining a value indicating an eco-efficiency impact of the update based on a comparison between the estimated environmental resource usage data and the second environment resource usage data.

8. The method of claim 1, wherein:

the substrate fabrication system comprises a processing chamber, wherein the digital replica indicates:

one or more gases that enter the processing chamber;

one or more reactions occurring on a substrate disposed within the processing chamber; and

one or more relationships between the one or more gases and the one or more reactions occurring on the substrate;

the update corresponds to a modification to a flow of the one or more gases; and

the estimated environmental resource usage data indicates one or more quantities of the one or more gases lost through abatement.

9. The method of claim 1, wherein the estimated environmental resource usage data comprises at least one of an energy consumption, a gas consumption, or a water consumption associated with the substrate fabrication system performing the one or more process procedures.

10. A system comprising:

a memory; and

a processing device, coupled to the memory, to:

receive first data indicating an update to a substrate fabrication system to operate according to one or more process procedures, wherein the update comprises at least one of:

i.) an alteration of a scheduled operational mode of a support asset of the substrate fabrication system to a shared operational mode;

or

ii.) a modification of a first gas to a second gas to be used by the substrate fabrication system;

input the first data into a digital replica configured to estimate environmental resource usage data indicative of an amount of one or more resources consumed based at least in part on processing the first data;

receive estimated environmental resource usage data output from the digital replica corresponding to performing the one or more process procedures by the substrate fabrication system incorporating the update; and

provide the estimated environmental resource usage data for display on a graphical user interface (GUI).

11. The system of claim 10, wherein the update further comprises replacing a first hardware subsystem device with a second hardware subsystem device having one or more operational specifications different from the first hardware subsystem device.

12. The system of claim 10, wherein the update further comprises altering a first configuration of manufacturing equipment of the substrate fabrication system to a second configuration of manufacturing equipment.

13. The system of claim 10, wherein the digital replica comprises a physics-based model of one or more physical assets of the substrate fabrication system.

14. The system of claim 13, wherein the physics-based model indicates at least one of:

i.) a relationship between a size and a geometry of a substrate process chamber and the estimated environmental resource usage data, and wherein the update further comprises a modification to at least one of the size or the geometry of the substrate processing chamber;

ii.) a relationship between a type of gas used within the substrate fabrication system and the estimated environmental resource usage data, wherein the update comprises the modification of the first gas to the second gas, wherein the first gas and the second gas comprise at least one of a purge gas, a reactive gas, or an etchant gas; or

iii) a relationship between a heat extraction procedure from the substrate fabrication system and the estimated environmental resource usage data, wherein the update further comprises a modification to at least one of a heat exhaust device, a gas abatement device, a water cooling device, or a gas vent structure.

15. The system of claim 10, wherein to determine the estimated environmental resource usage data, the processing device is to:

compute estimated environmental resource usage metrics for the substrate fabrication system; and

aggregate the estimated environmental resource usage metrics for the substrate fabrication system to determine the estimated environmental resource usage data.

16. The system of claim 10, wherein the estimated environmental resource usage data comprises at least one of an energy consumption, a gas consumption, a water consumption, or a carbon footprint indicator associated with the substrate fabrication system performing the one or more process procedures.

17. A non-transitory machine-readable storage medium comprising instructions that, when executed by a processing device, cause the processing device to:

receive first data indicating an update to a substrate fabrication system to operate according to one or more process procedures, wherein the update comprises at least one of:

i.) an alteration of a scheduled operational mode of a support asset of the substrate fabrication system to a shared operational mode;

or

ii.) a modification of a first gas to a second gas to be used by the substrate fabrication system;

input the first data into a digital replica configured to estimate environmental resource usage data indicative of an amount of one or more resources consumed based at least in part on processing the first data;

receive estimated environmental resource usage data output from the digital replica corresponding to performing the one or more process procedures by the substrate fabrication system incorporating the update; and

provide the estimated environmental resource usage data for display on a graphical user interface (GUI).

18. The non-transitory machine-readable storage medium of claim 17, wherein the digital replica comprises a physics-based model of one or more physical assets of the substrate fabrication system.

19. The non-transitory machine-readable storage medium of claim 18, wherein the physics-based model indicates at least one of:

i.) a relationship between a size and a geometry of a substrate process chamber and the estimated environmental resource usage data, and wherein the update further comprises a modification to at least one of the size or the geometry of the substrate processing chamber;

ii.) a relationship between a type of gas used within the substrate fabrication system and the estimated environmental resource usage data, wherein the update comprises the modification of the first gas to the second gas, wherein the first gas and the second gas comprise at least one of a purge gas, a reactive gas, or an etchant gas; or

iii.) a relationship between a heat extraction procedure from the substrate fabrication system and the estimated environmental resource usage data, wherein the update further comprises a modification to at least one of a heat exhaust device, a gas abatement device, a water cooling device, or a gas vent structure.

20. The non-transitory machine-readable storage medium of claim 17, wherein the estimated environmental resource usage data comprises at least one of an energy consumption, a gas consumption, a water consumption, or a carbon footprint indicator associated with the substrate fabrication system performing the one or more process procedures.