

# From sand to agents, in 30 models.

Every AI answer rests on a stack of real machines. Walk the line left to right: energy, the ideas behind computing, the computer itself, the data center, and finally a machine that learns. Buy the ones worth buying, build the rest together.

| #                                                  | MODEL                      | HOW       | WHAT TO GET OR MAKE                            | COST   | BUILD | WHAT IT TEACHES                            |
|----------------------------------------------------|----------------------------|-----------|------------------------------------------------|--------|-------|--------------------------------------------|
| <b>01 Power</b> · Where the energy comes from      |                            |           |                                                |        |       |                                            |
| 01                                                 | Steam engine               | BUY       | Wilesco live-steam engine                      | \$\$\$ | ●○○   | Heat becomes motion                        |
| 02                                                 | Combustion engine          | BUY       | Haynes / Machine Works clear engine kit        | \$\$   | ●●○   | Fuel becomes work                          |
| 03                                                 | Electric motor / generator | DIY       | Magnet, copper wire, nail, battery             | \$     | ●○○   | Motion and electricity, one device         |
| 04                                                 | Coal power plant           | DIY       | Cardboard diorama: boiler, turbine, stack      | \$     | ●●○   | Much power still comes from burning fuel   |
| 05                                                 | Hydroelectric dam          | DIY       | Water wheel spinning a small DC motor          | \$     | ●●○   | Falling water becomes electricity          |
| 06                                                 | Wind turbine               | BUY       | Turbine kit with swappable blades              | \$\$   | ●○○   | Renewable power and blade design           |
| 07                                                 | Solar cell                 | BUY       | Mini PV panel and motor kit                    | \$     | ●○○   | Light becomes current, in silicon          |
| 08                                                 | Nuclear reactor            | DIY       | 3D-printed cutaway: core, rods, coolant        | \$     | ●●○   | Tech firms have signed nuclear power deals |
| 09                                                 | Lithium-ion battery        | DIY       | 3D-printed or paper cell cutaway               | \$     | ●○○   | Storing energy for every device            |
| 10                                                 | Power grid                 | DIY       | Tower, transformer, substation diorama         | \$     | ●●○   | How power reaches the data center          |
| <b>02 Foundations</b> · How machines came to think |                            |           |                                                |        |       |                                            |
| 11                                                 | Jacquard loom / Babbage    | BUY       | Paper-strip music box you punch yourself       | \$     | ●○○   | Holes in cards told machines what to do    |
| 12                                                 | Turing machine             | DIY       | Paper tape, a sliding head, a rule card        | \$     | ●●○   | What computation means                     |
| 13                                                 | Vacuum tube                | BUY       | Real tubes from surplus sellers                | \$     | ●○○   | The switch before the transistor           |
| 14                                                 | Transistor ♦               | BUY + DIY | Giant 3D print + real ones on a breadboard     | \$     | ●○○   | The switch everything is built from        |
| 15                                                 | Logic gates ♦              | BUY       | Turing Tumble, or DIY with switches and LEDs   | \$\$   | ●●○   | Switches combined into decisions           |
| 16                                                 | Sand to wafer              | BUY       | Quartz sand, silicon chunk, real wafer         | \$     | ●○○   | The literal "From Sand"                    |
| 17                                                 | Chip fab / EUV machine     | DIY       | Cleanroom and lithography diorama              | \$     | ●●●   | One of the hardest machines to build       |
| <b>03 The Machine</b> · Inside a computer          |                            |           |                                                |        |       |                                            |
| 18                                                 | CPU                        | BUY + DIY | Decapped chip under a loupe, or 3D-printed die | \$     | ●○○   | The general-purpose brain                  |
| 19                                                 | Memory                     | BUY       | Core64 core-memory kit + a RAM stick           | \$\$\$ | ●●○   | How a bit is stored                        |
| 20                                                 | Hard drive                 | DIY       | Dead drive with an acrylic lid, beside an SSD  | \$     | ●○○   | Spinning platters versus flash             |
| 21                                                 | Motherboard                | DIY       | Salvaged board, labeled with stickers          | \$     | ●○○   | How the parts talk to each other           |
| 22                                                 | Graphics card / GPU ♦      | DIY       | Teardown of a used card                        | \$\$   | ●○○   | The chip that made modern AI possible      |
| 23                                                 | Desktop computer           | DIY       | Clear-case build assembled by learners         | \$\$\$ | ●●●   | All the parts working together             |
| 24                                                 | Keyboard + mouse           | BUY + DIY | Keyboard kit; optical mouse teardown           | \$\$   | ●●○   | Human input becomes signals                |
| 25                                                 | Monitor / pixel            | DIY       | LED matrix driven by a microcontroller         | \$     | ●●○   | Numbers become pictures                    |
| <b>04 Scale</b> · Where AI actually runs           |                            |           |                                                |        |       |                                            |
| 26                                                 | Server rack ♦              | BUY       | 10" mini rack filled with Raspberry Pis        | \$\$\$ | ●●●   | A real, working cluster you can touch      |
| 27                                                 | Data center                | DIY       | Diorama with racks, cooling and power feed     | \$     | ●●○   | Where a chatbot's answer is made           |
| 28                                                 | Undersea fiber cable       | BUY       | Cable cross-section + light-pipe demo          | \$     | ●○○   | How the answer can cross an ocean          |
| <b>05 AI</b> · The payoff                          |                            |           |                                                |        |       |                                            |
| 29                                                 | Neural network ♦           | DIY       | Perceptron: knobs = weights, LEDs = outputs    | \$     | ●●○   | A machine you can train by hand            |
| 30                                                 | Robot arm                  | BUY       | Servo robot-arm kit                            | \$\$   | ●●○   | AI acting in the physical world            |

## ♦ Start with these five

Transistor → logic gates → GPU → server rack → neural network. Those five cover the whole path from one switch to a machine that learns. The other 25 fill in around them, one club session at a time.

## Key

**Cost (estimated):** \$ under \$25 · \$\$ \$25–\$100 · \$\$\$ over \$100

**Build:** ●○○ one session · ●●○ a few sessions · ●●● multi-week project

**Buy** = kit or real object · **DIY** = kids build it

