ENERGHX RESEARCH GROUP

PRESENTATION

DIGITAL AUDIT PROTOCOL FOR PLUG AND COOLING LOAD ANALYSIS IN A BUILDING ENVELOPE FOR ENHANCED ENERGY MANAGEMENT OPPORTUNITIES

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Energy audits routinely find savings of 20 to 40 per cent in buildings, mostly in the envelope and cooling systems. Yet none of these energy management opportunities can be ranked, sized or financed until the building's loads are known, and collecting the data to calculate them remains the slowest stage of an audit.

Background of the study



Research Questions

01

Capture

Can appliances be recognised and rooms measured from phone photographs, in place of the tape measure and rating plate?

02

Speed

How much audit time does automation save, and what does it cost in accuracy?

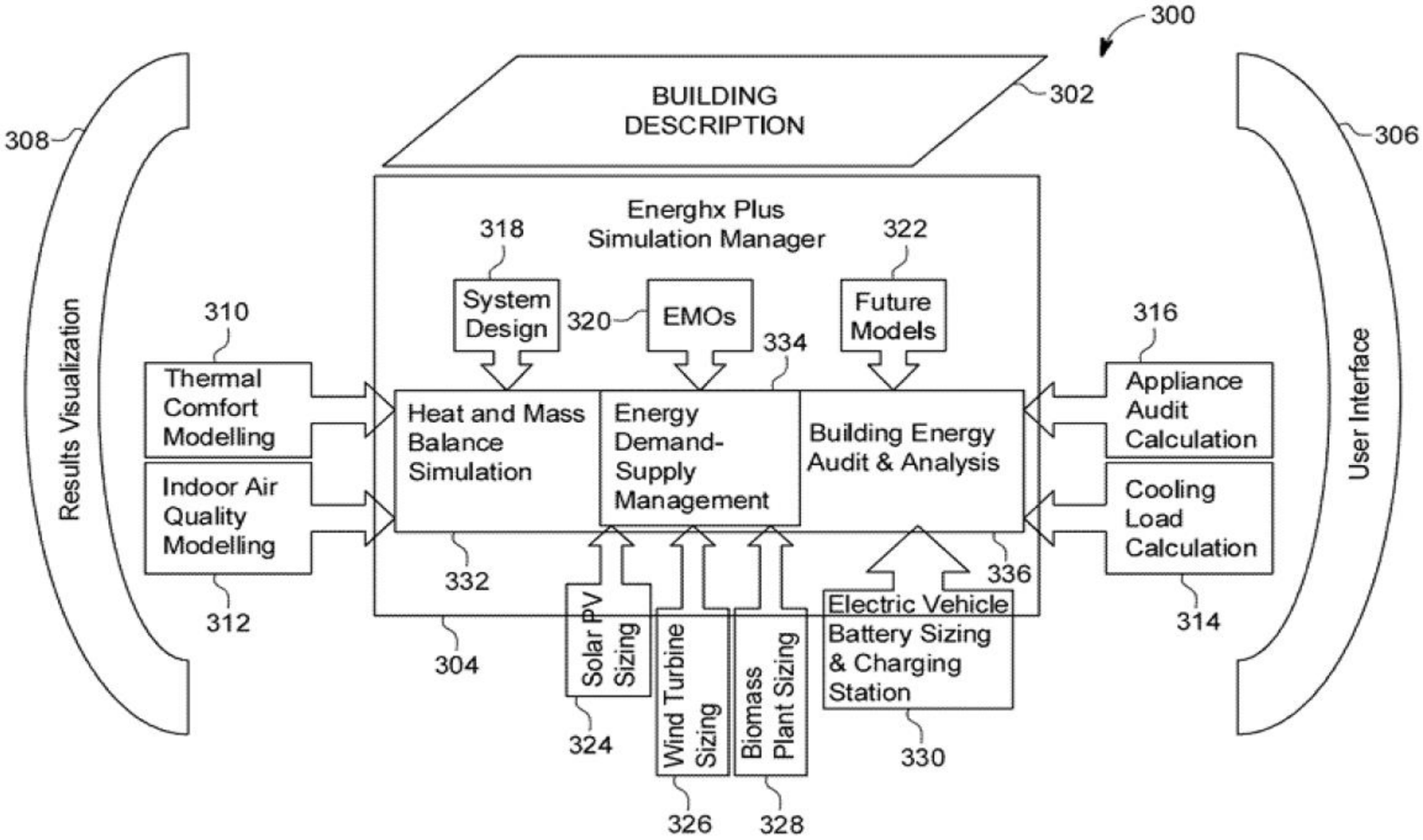
03

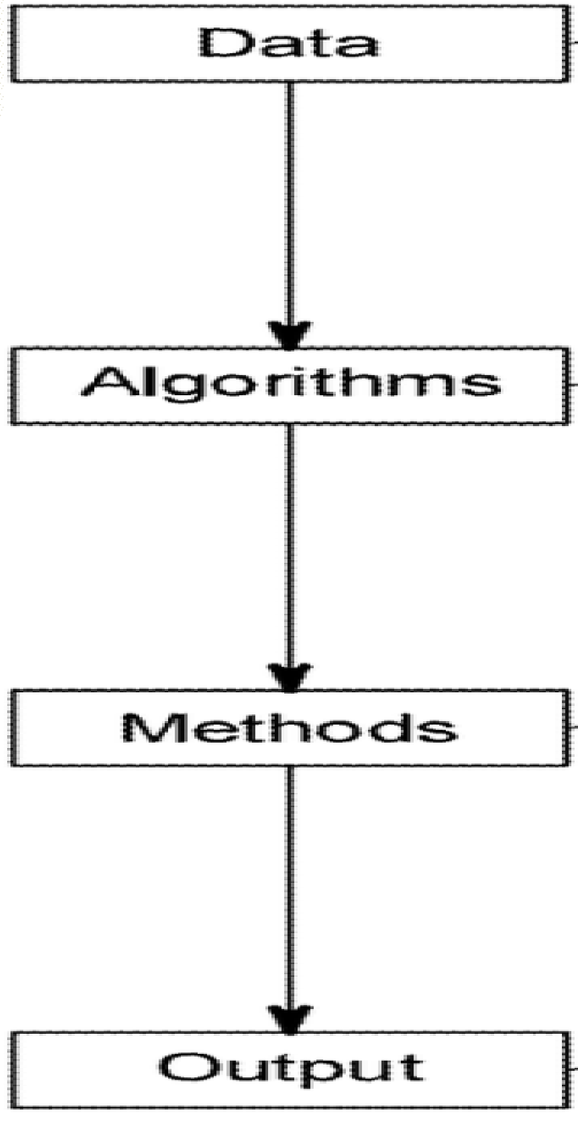
Opportunities

Which energy management opportunities matter most for a typical Lagos home, and what does switching to more efficient appliances change?

EnerghxPLUS Platform

a modular, microservice-based energy-management system





EnerghxPLUS Platform: A Modular Approach

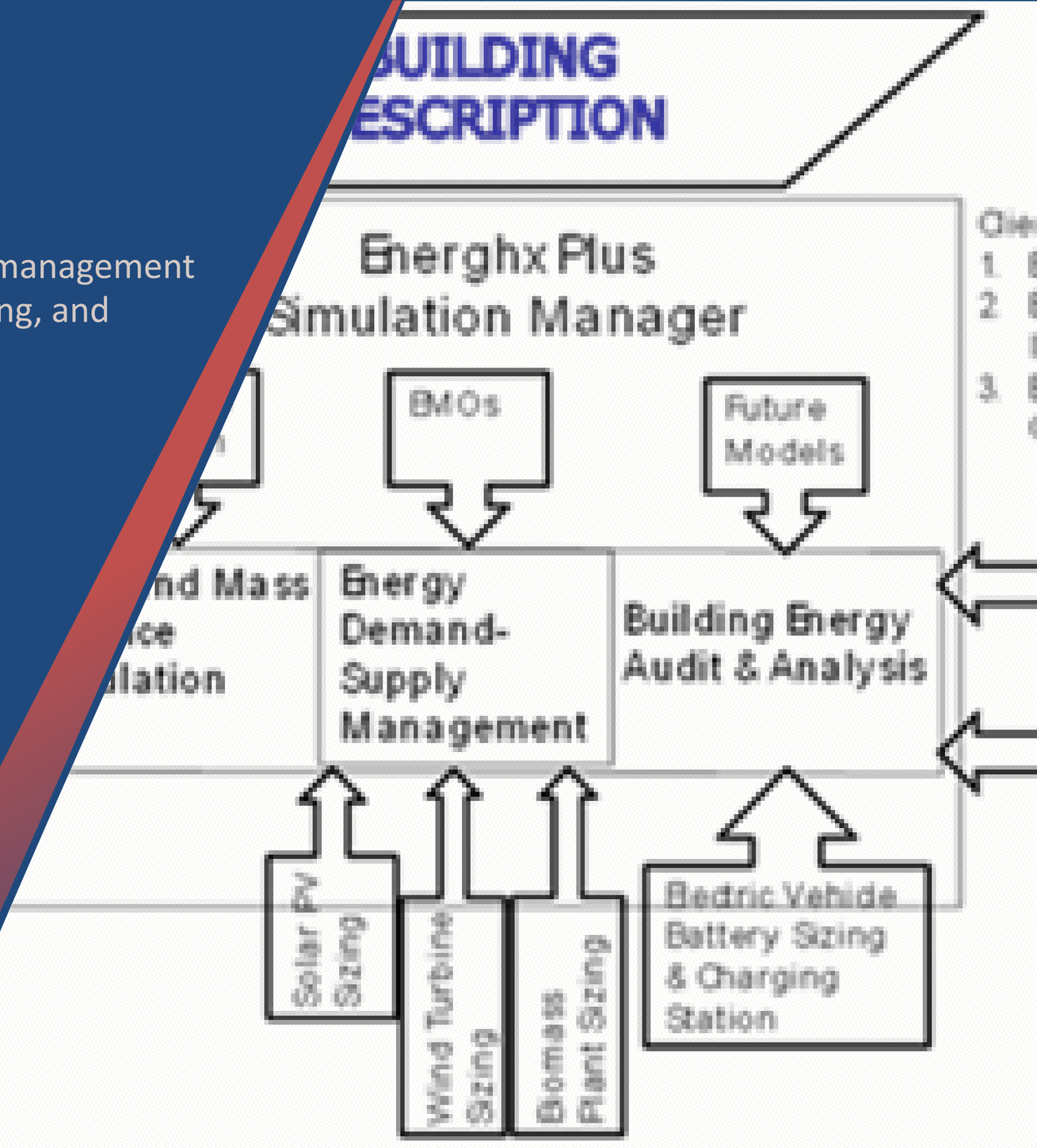
The EnerghxPLUS platform is a modular, cloud-based energy management system designed to unify data ingestion, simulation, forecasting, and decision support across multiple renewable energy domains.

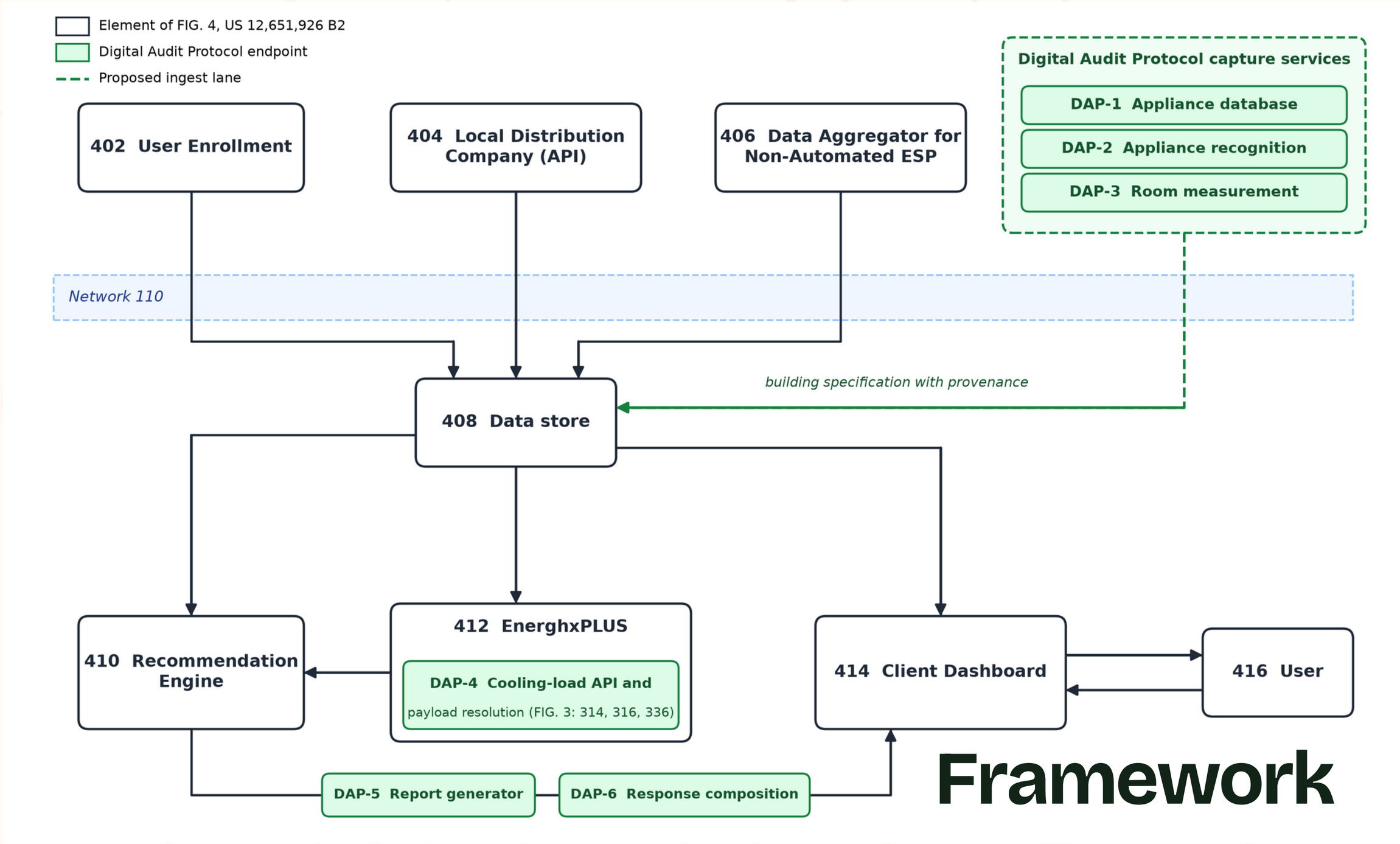
Data Layer
Inputs from user devices, building audits, weather databases, and third-party streams.

Algorithm Layer
Hosts numerical models, simulation algorithms, and digital twins.

Methods Layer
Applies domain-specific calculations (aerodynamic forces, energy balance).

Output Layer
Dashboards, visualizations, or API responses for stakeholders.




Element of FIG. 4, US 12,651,926 B2
Digital Audit Protocol endpoint
Proposed ingest lane
Digital Audit Protocol capture services
DAP-1 Appliance database
DAP-2 Appliance recognition
DAP-3 Room measurement
402 User Enrollment
404 Local Distribution Company (API)
406 Data Aggregator for Non-Automated ESP
Network 110
building specification with provenance
408 Data store
410 Recommendation Engine
412 EnerghxPLUS
DAP-4 Cooling-load API and
payload resolution (FIG. 3: 314, 316, 336)
414 Client Dashboard
416 User
DAP-5 Report generator
DAP-6 Response composition
Framework

Methodology

01

APPLIANCE DATABASE

A **32,099**-item catalogue that supplies the rated input and equipment class of every appliance, with search that tolerates typos.

02

APPLIANCE RECOGNITION

A trained computer-vision model that recognises appliances in photos and video and records how each item entered the inventory.

03

ROOM MEASUREMENT

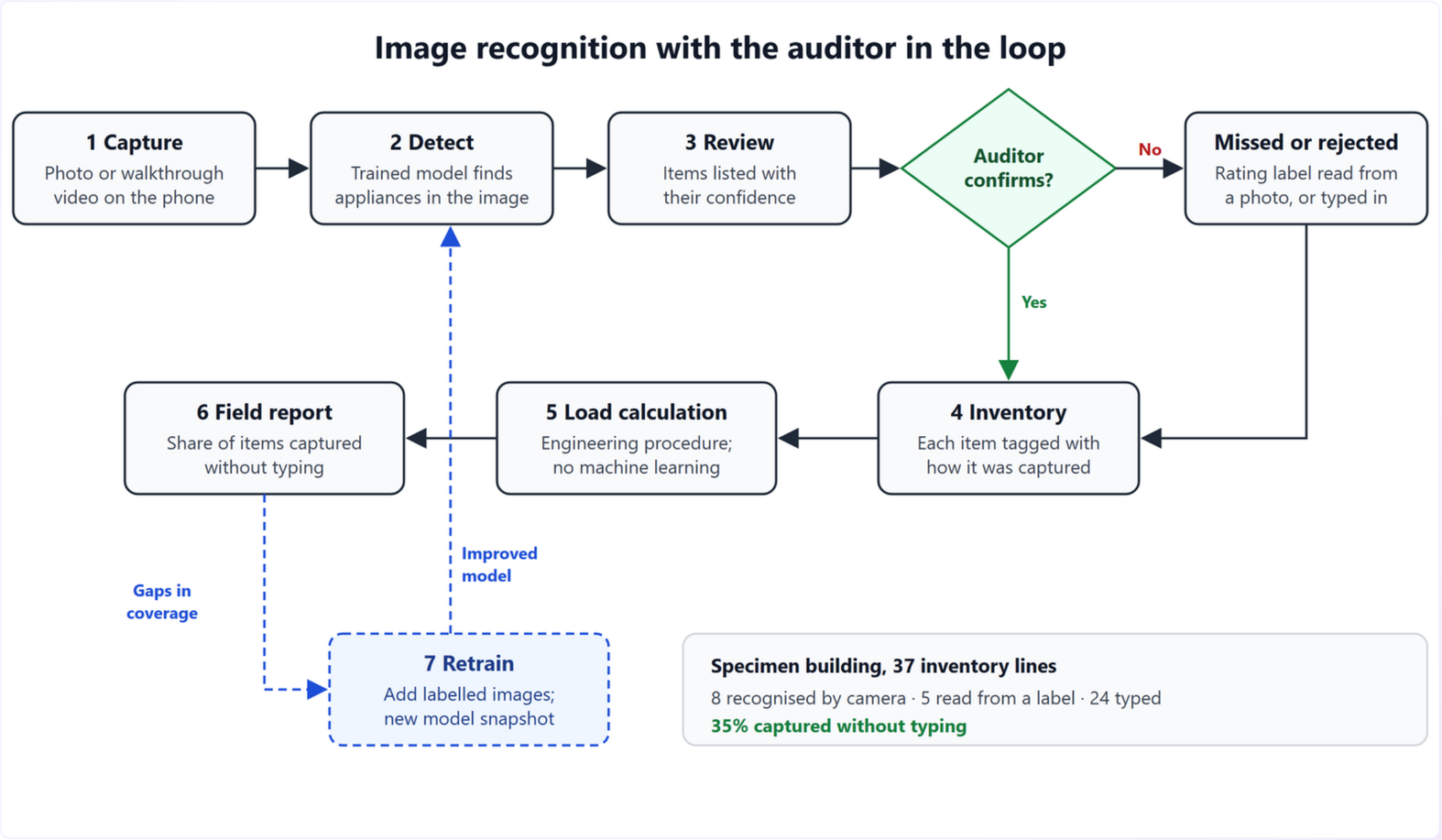
measures each wall, window and roof area from two or three phone photographs, with a reference object of known size (a printed marker, an A4 sheet or a door) taking the place of a tape measure.

04

COOLING LOAD API

Turns the platform's cooling-load calculation into a tested service that runs as soon as the building is captured. Hours of manual load calculation become minutes of computation.

A trained model finds appliances in a photo or walkthrough video and lists each with its confidence. The auditor confirms each item before it enters the inventory; anything missed is read from its rating label or typed in. Every item records how it was captured, and loads are always computed by engineering procedure, never by machine learning.



Appliance Recognition Feedback

The field report shows the share of items captured without typing: 35% for the specimen building (8 of 37 by camera, 5 from labels). That share shows where the model falls short, and adding labelled images produces a new, reproducible model that goes back into the detection step.

Methodology

05

Report generator

Produces a technical report for engineers and a field report for the auditor and householder, both from the same computed result, so the two documents can never quote different numbers.

05

Report generator

Each report lists the assumptions behind its figures and says how its inputs were captured, and both export to PDF straight from the phone or browser.

06

Qualitative Methods

Packages the computed analysis into the exact form the platform's dashboard displays, so results reach the end user ready to act on.

06

Qualitative Methods

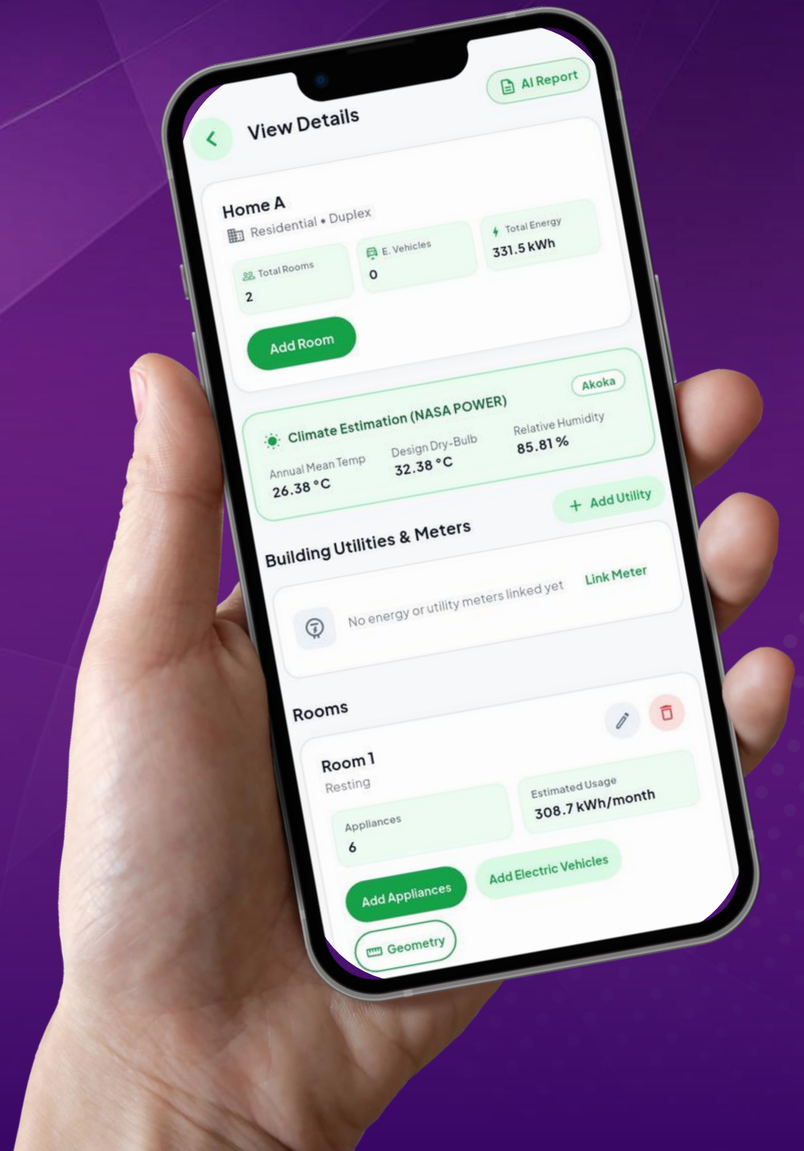
Every assumed or substituted value is announced alongside the result, and any dashboard tile without a computed value is flagged rather than left blank or filled with a guess.

THE CAPTURE CLIENT OF THE DIGITAL AUDIT PROTOCOL

ENERGHX
MOBILE APP

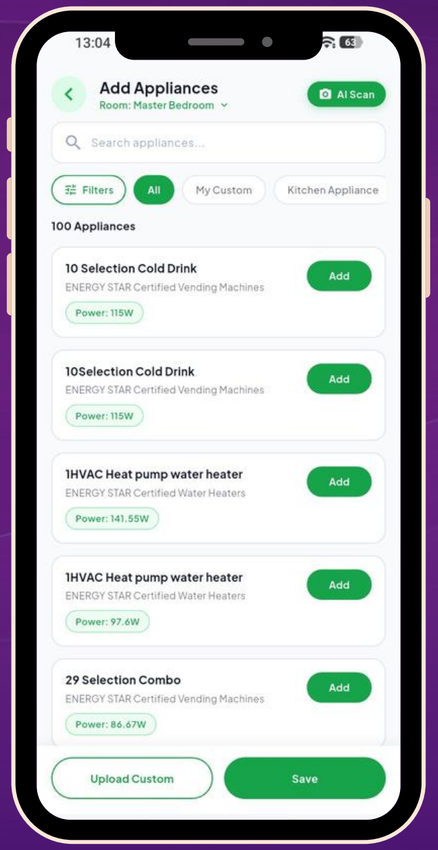
The mobile app is where an audit begins: it holds the camera, the compass and the auditor. Each building is recorded room by room, and its design conditions arrive automatically from the NASA POWER climate record for the nearest location.

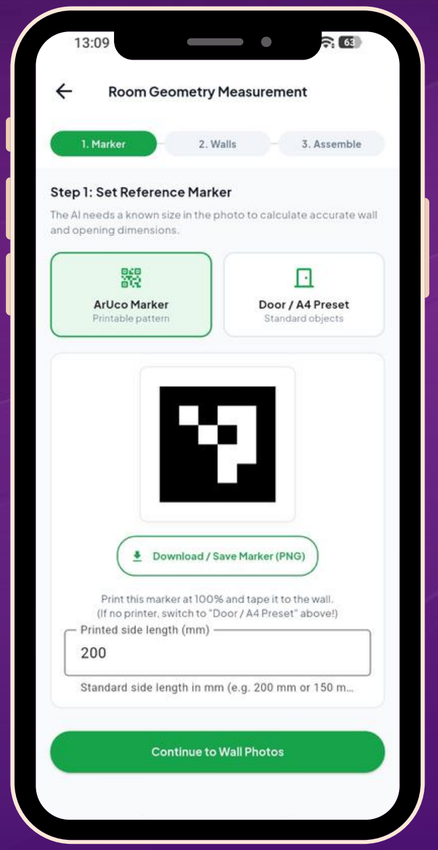
From each room, the auditor measures walls from photographs, adds appliances by catalogue search, camera scan or a photo of the rating label, and produces field and technical reports as PDF. A complete audit can be finished on the phone alone.

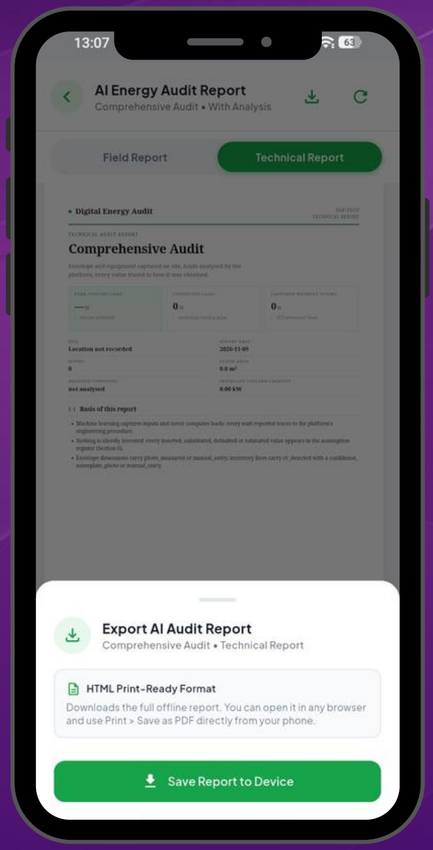


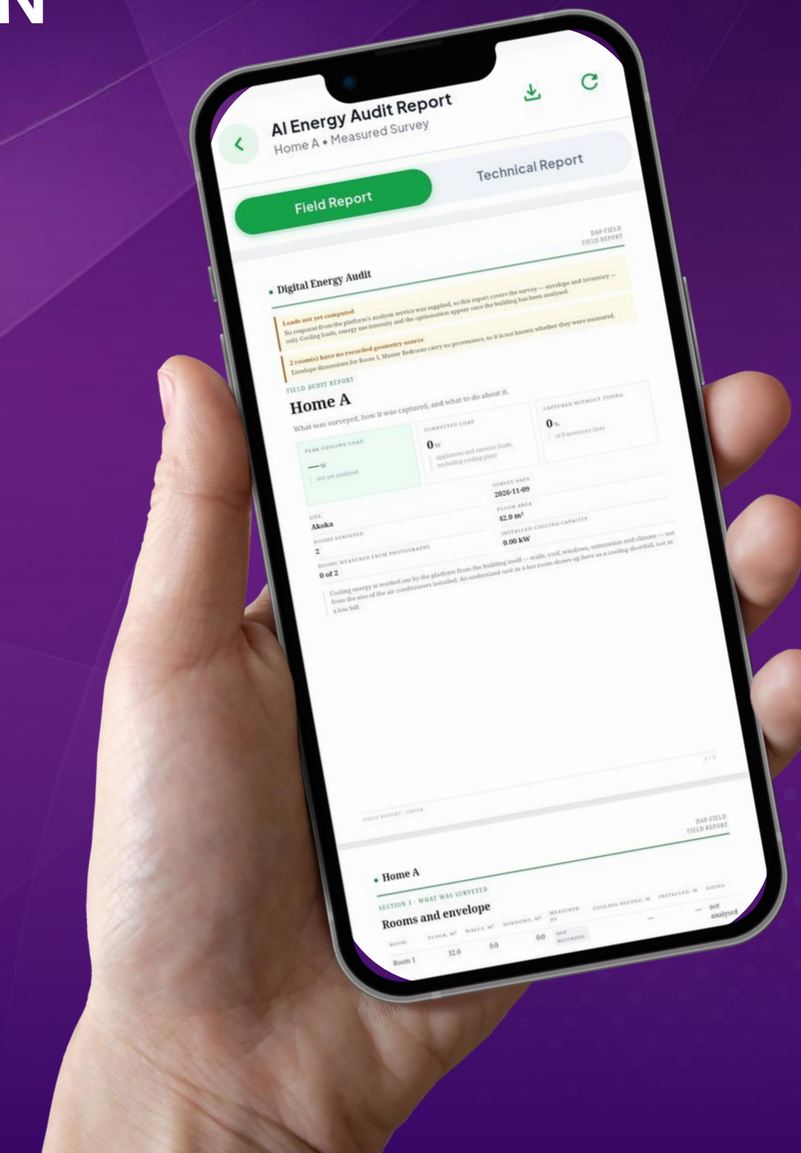
DAP INTEGRATION

VIA EASILY ACCESSIBLE MOBILE APPLICATION



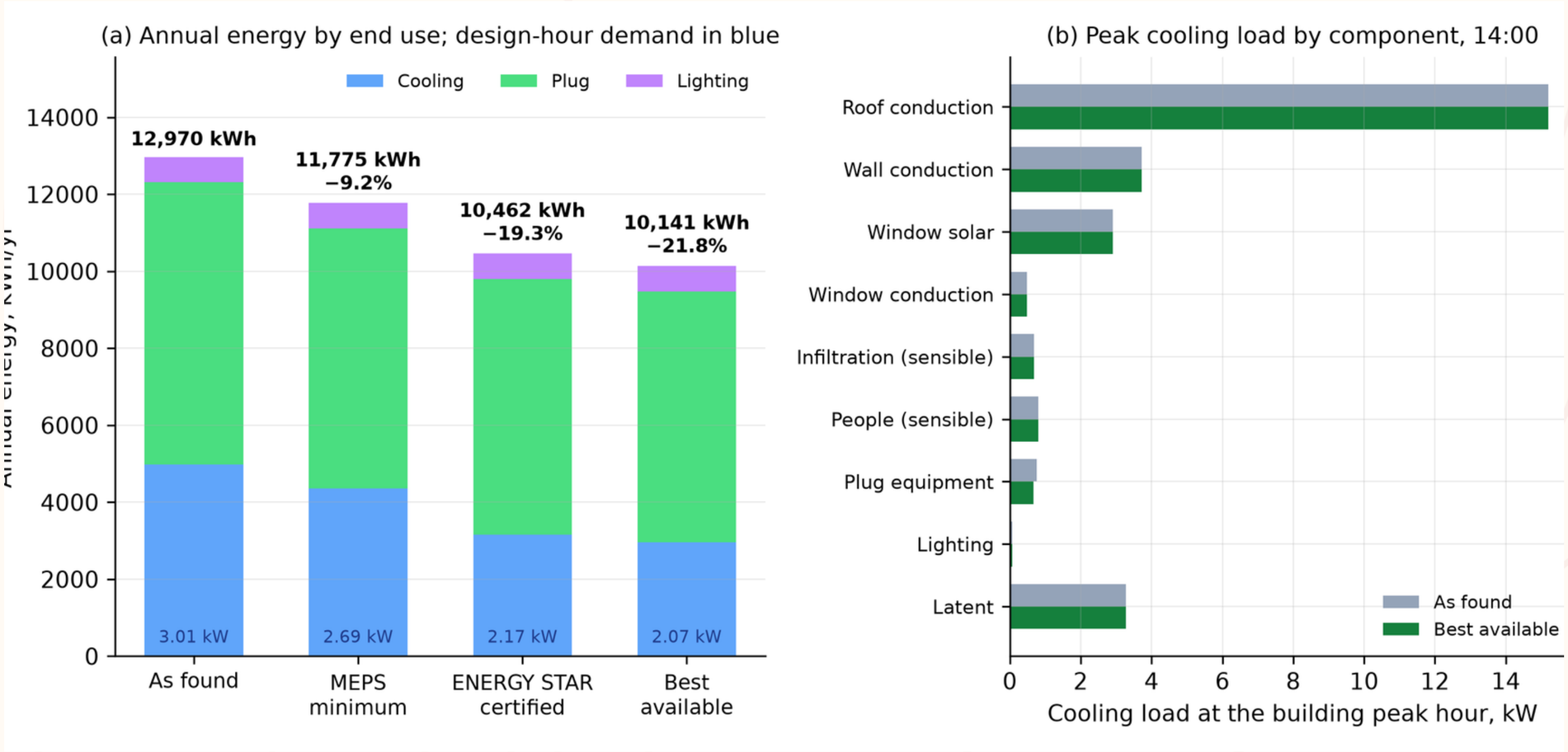




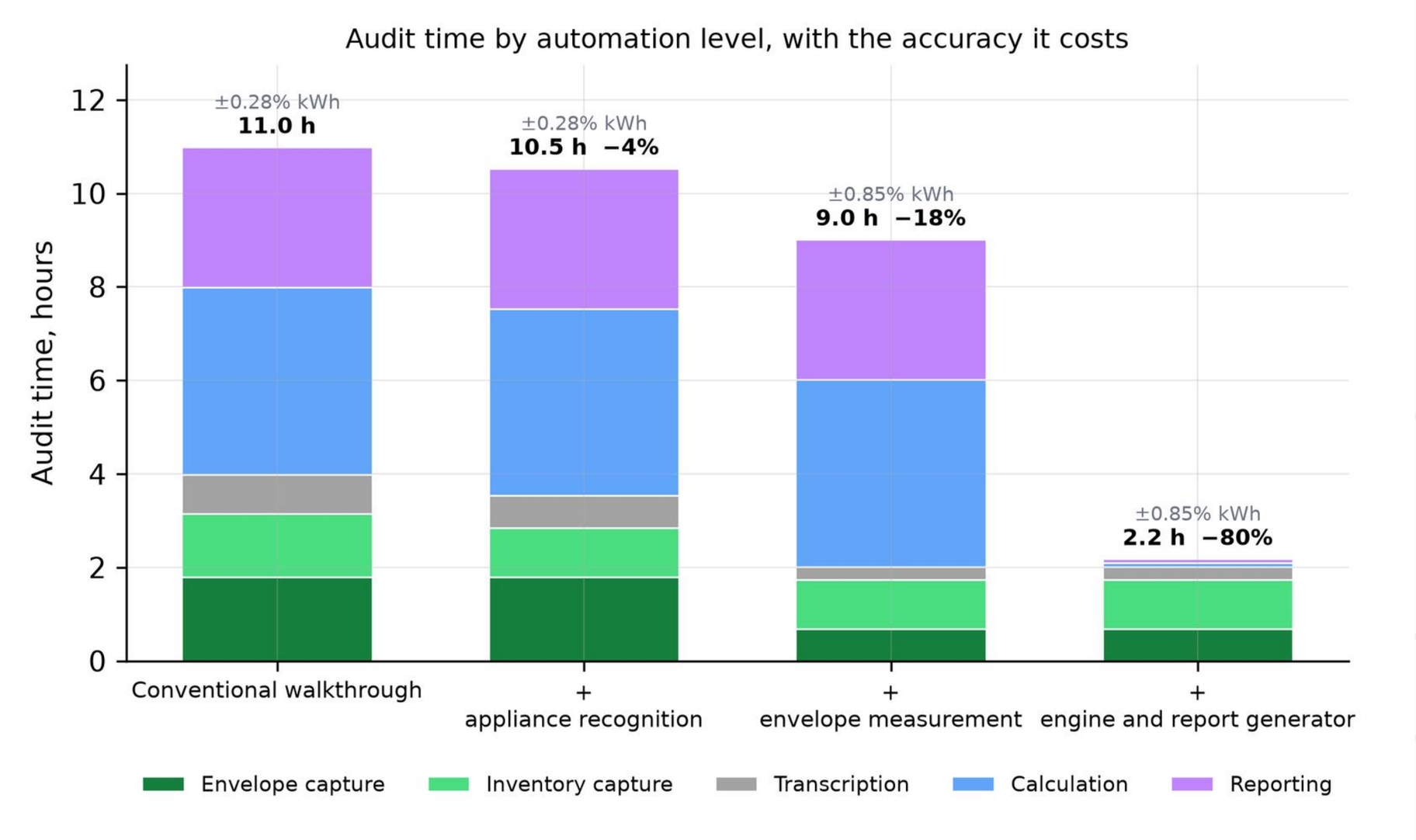


Analysis

Moving the specimen home from its existing appliances to the most efficient available cuts annual energy by 21.8%, mostly through more efficient air conditioners. Yet the peak cooling load barely moves, because roof conduction supplies over half of it: appliances fix the demand, the envelope fixes the load.



Audit Time Improvements



Full automation cuts the audit from 11.0 h to 2.2 h (−80%) with under 1% error in annual energy. The calculation engine and report generator save the most time; appliance recognition saves the least, because usage schedules still need an interview.

Thank



You