



User Manual

Arab Power Twin – Digital Twin of Power Plants in the Arab World

Version 1.1.1 · 2026-09-20



ASFAN

Asfan Co. · info@asfanco.com · WhatsApp +962 77 614 0404

Contents

1. Introduction

- 1.1 Who uses the program?
- 1.2 Main modules
- 1.3 System requirements
- 1.4 Technical support

2. Installation and first start

- 2.1 Downloading the installer
- 2.2 Installation steps
- 2.3 Where is the data stored?

3. License activation

- 3.1 The activation screen
- 3.2 Activation error messages

4. Initial setup and sign-in

- 4.1 Creating the super-admin account
- 4.2 Signing in
- 4.3 The general layout

5. Dashboard

6. Plant explorer

- 6.1 List and map
- 6.2 Card view and badges

7. Plant page

8. Digital twin

- 8.1 The screen and the 3D scene
- 8.2 Indicators and controls
- 8.3 Training scenarios
- 8.4 KPIs, alarms and trends

9. Exams (student view)

- 9.1 Available exams
- 9.2 Taking the exam
- 9.3 The result

10. Practice quiz

11. My results and my account

11.1 My results

11.2 My account

12. Administration: users and groups

12.1 User management

12.2 Importing students from a CSV file

12.3 Groups / classes

13. Administration: exams and results

13.1 Exam management

13.2 Results & assessment

13.3 Simulation sessions

14. System: license, settings and data

14.1 License

14.2 Settings

14.3 Data & backup

14.4 Activity log

15. Updates and About

15.1 Updates

15.2 About

16. Setting up a university lab

17. Troubleshooting

17.1 Common problems

17.2 Getting help

18. Appendices

18.1 Supported technologies

18.2 Mouse controls in the 3D scene

18.3 Glossary

1 Introduction

Arab Power Twin is an educational Windows application that provides a **digital twin** of real power plants across the 22 Arab League countries. It combines a database of more than 620 plants (gas, steam, nuclear, photovoltaic, concentrated solar, wind, hydro, diesel, coal, waste) with a simplified physics-based simulation of every technology in a 3D scene, an examination and assessment system for students, and role-based user management.

This manual explains every screen in detail: what it shows, what you can do on it and the steps for each task, from installing and activating the software to managing exams, results and updates.

1.1 Who uses the program?

Role	What they can do
Super admin	The institution administrator or course professor. Created at first start-up; manages everything: users of all roles, groups, exams, all results and sessions, the license, settings, the data folder, backups and the activity log.
Instructor	Adds and imports students, creates groups and exams, views and exports the results and simulation sessions of all students.
Student	Explores plants and the map, runs the digital twin, takes assigned exams and practice quizzes, and sees only their own results.

1.2 Main modules

- **Plant explorer:** a real database with an interactive offline map and filters by country, energy source, technology and status.
- **Plant page:** overview, key facts, technology description and components, estimated generation, location and nearby plants.
- **Digital twin:** a 3D scene of the plant on a realistic site (sky with the true sun position, terrain, sea for coastal plants) with a live simulation of output, efficiency, fuel, emissions and grid frequency, controls and training scenarios.
- **Exams:** a bilingual question bank plus questions generated from real plant data, timed formal exams and self-practice, with instant grading.
- **Results & assessment:** statistics, charts, per-student reports and CSV, JSON and PDF export.
- **Administration:** users, groups, license, settings, a shared data folder for university labs, backup, activity log and automatic updates.

1.3 System requirements

Item	Requirement
Operating system	Windows 10 or 11 (64-bit)
Processor and memory	Dual-core or better, 8 GB RAM (16 GB recommended for labs)
Graphics	Any adapter with WebGL 2 (integrated or discrete). The 3D scene runs more smoothly on discrete GPUs
Disk space	About 700 MB for the program and data
Display	1366×768 minimum, 1920×1080 recommended
Internet	Not required to run. Used only to check for and download updates

1.4 Technical support

The program is developed and distributed by **Asfan Co.** For enquiries, licensing and technical support:

- E-mail: info@asfanco.com
- WhatsApp: [+962 77 614 0404](https://wa.me/962776140404)

Tip: When requesting support, include the program version (shown at the bottom of the sidebar and on the About page), the machine ID and a screenshot of the problem.

2 Installation and first start

2.1 Downloading the installer

The program is distributed as a single installer named `ArabPowerTwin-Setup.exe` through a permanent link provided by the vendor. The link never changes between releases and always delivers the latest version.

Note: Windows or your browser may warn about a newly downloaded executable. Choose "Keep" and then "Run anyway" if the SmartScreen screen appears; the file comes from the vendor.

2.2 Installation steps

1. Double-click `ArabPowerTwin-Setup.exe`.
2. Choose the installer language (Arabic or English).
3. Keep the default installation folder or change it, then click Install. No administrator rights are needed because the program installs for the current Windows user.
4. When finished, a desktop and Start-menu shortcut named Arab Power Twin is created and the program starts automatically.

On the first start you go through three screens in order: **License activation**, then **Initial setup** to create the super-admin account, then **Sign in**. The next chapters explain each one.

2.3 Where is the data stored?

Accounts, exams, results and simulation sessions are stored as files on the computer in `%APPDATA%\arab-power-twin\workspace`; settings and the license are kept in the same folder. The super admin can move the data folder to a shared network folder from the Settings page so that every lab computer works on the same data (see the chapter "Setting up a university lab").

Uninstalling the program does not delete your data; it remains in the folder above for reuse after reinstalling.

3 License activation

3.1 The activation screen

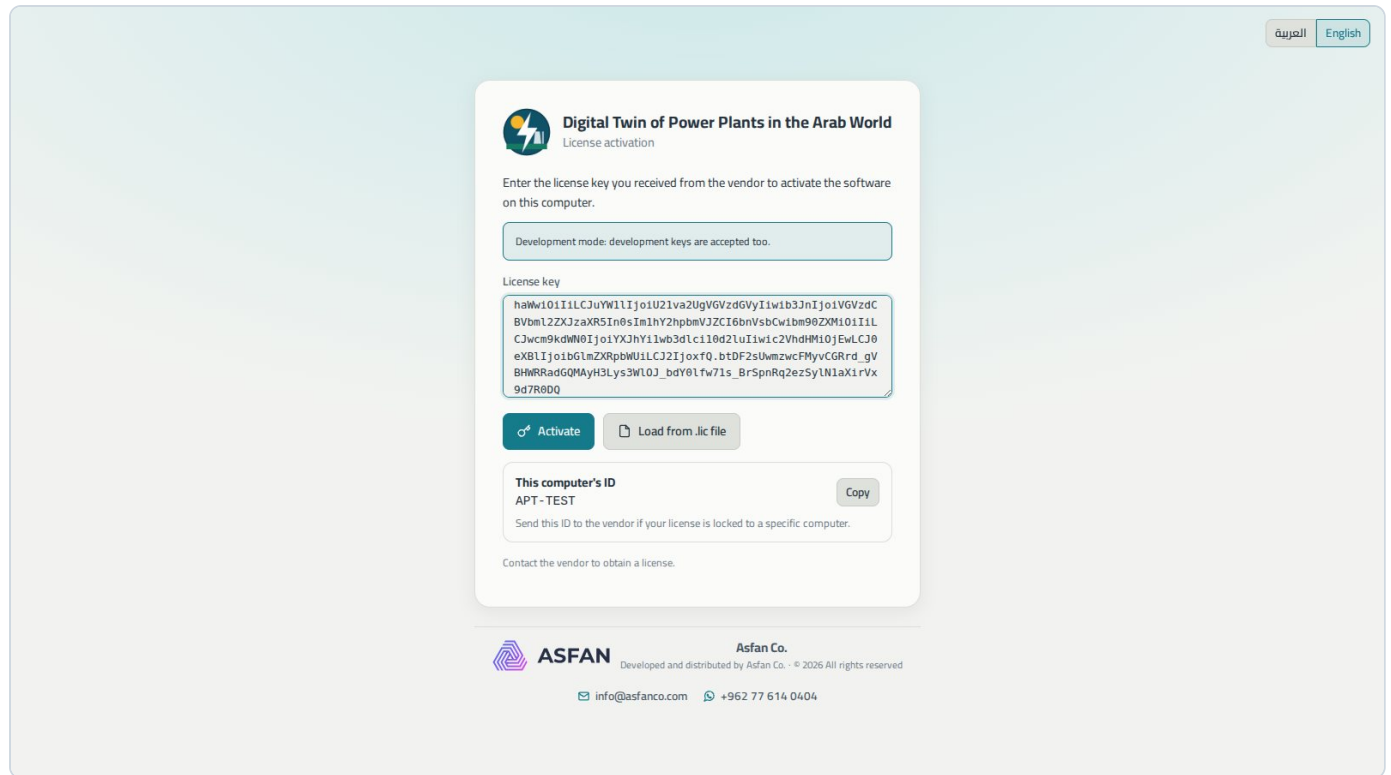


Figure 1: License activation at first start

The program runs with a digitally signed license supplied by the vendor as text starting with `APT1.` or as a `.lic` file. The license is verified on the computer itself; no internet connection is needed.

1. Paste the license key into the box, or click "Load from .lic file" and choose the file you received.
2. Click "Activate". On success a confirmation appears and the program moves to the initial-setup screen.

The bottom of the screen shows **this computer's ID** (format `APT-XXXX-XXXX-XXXX-XXXX`) with a copy button. If your license is locked to one computer, send this ID to the vendor so that a key for this computer can be issued.

What does the license control?

- **Type:** lifetime, or fixed term with an expiry date. Thirty days before a fixed-term license expires the program shows a reminder.
- **Seats:** the maximum number of active accounts of all roles (0 means unlimited).
- **Included modules:** digital twin and/or exams. A module that is not included disappears from the menus.
- **Included technologies:** plants of technologies not included show a lock badge; their data can be browsed, but the digital twin cannot be started and they are excluded from generated questions.

- **Machine lock:** optional; a machine-locked license works only on the matching computer.

3.2 Activation error messages

Message	Meaning and remedy
The key format is invalid	Make sure the whole key was copied without missing lines or spaces, or use the .lic file.
Invalid signature	The key is forged or was issued for another build. Ask the vendor for a new key.
The license has expired	The fixed-term date has passed. Contact the vendor to renew and enter the new key under Administration → License.
This key is locked to another computer	Send this computer's ID to the vendor to obtain a key for it.
System clock rollback detected	The computer date was moved backwards. Set the correct date and time and restart the program.
The key belongs to another product	The key is not for Arab Power Twin.

4 Initial setup and sign-in

4.1 Creating the super-admin account

The screenshot shows the 'Initial setup' screen for the 'Digital Twin of Power Plants in the Arab World'. It includes a form to create a super-admin account. The form fields are: Organisation name (filled with 'King Saud University'), Username (filled with 'admin'), Full name (filled with 'Dr. Haya Waleed'), Password (masked with dots), and Confirm password (masked with dots). A 'Create account and start' button is at the bottom. The footer includes the ASFAN logo, 'Asfan Co.', and contact information: 'info@asfanco.com' and '+962 77 614 0404'. A 'License activated successfully' message is visible in the bottom left corner.

Figure 2: Initial setup: creating the super-admin account

This screen appears once, after activation. The account you create here is the **super admin** with every permission, usually the course professor or the institution's administrator.

1. Enter the **organisation name** (university or company). It appears at the top of the sidebar and in reports.
2. Choose a **username** in Latin letters or digits (at least 3 characters) and the **full name**.
3. Enter a **password** of at least 6 characters and confirm it.
4. Click "Create account and start".

Note: Keep the super-admin password in a safe place. No other account can reset it; if it is lost you must restore a backup or contact support.

4.2 Signing in

العربية English

Digital Twin of Power Plants in the Arab World
King Saud University

Username
student09

Password

→ Sign in

Licensed to: Test University
Data folder: /tmp/apt-test-837rCd
v1.0.0

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Figure 3: The sign-in screen

Enter the username and password and click “Sign in”. Below the form the licensed organisation and the current data folder are shown, and the interface language can be switched with the button at the top of the screen.

- Students whose accounts were created with a temporary password must change it at their first sign-in before using the program.
- If a student forgets the password, an instructor or the super admin resets it from the Users page.
- A suspended account cannot sign in until the administrator reactivates it.

4.3 The general layout

After signing in the screen has three parts:

- **Sidebar:** the sections “Learn” (dashboard, plant explorer, exams, practice quiz, my results), “Administration” for instructors and administrators, and “System” (license, settings, data & backup, activity log, updates, my account, about), then Sign out. Below it the version number and plant count.
- **Top bar:** page title, language switch (العربية/English), theme button (dark/light) and the current-user chip that opens “My account”.
- **Content area:** the selected page; at the bottom of every page the Asfan Co. signature with the support e-mail and WhatsApp number. When an update is available a bar appears above the content with a “Download update” button (see the Updates chapter).

5 Dashboard

5.1 Overview

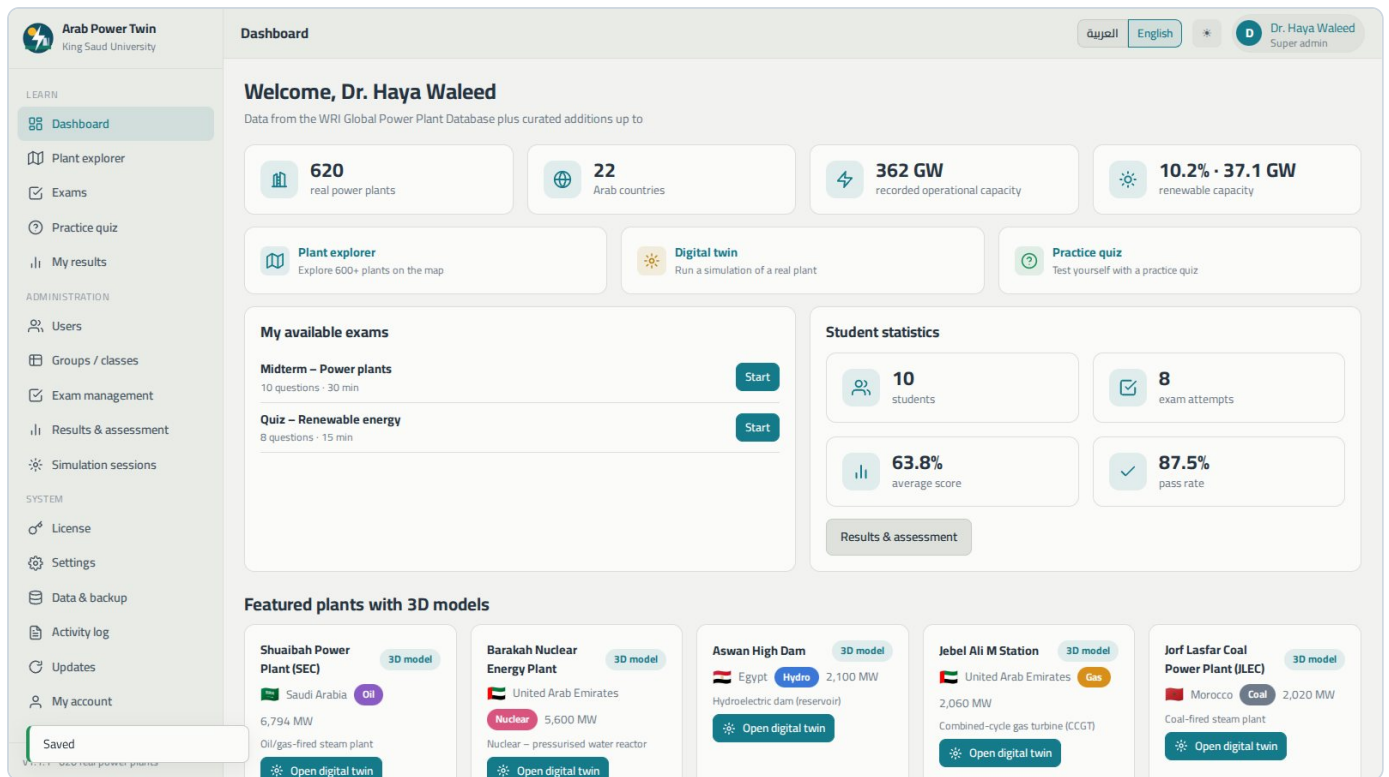


Figure 4: The super-admin dashboard

The home page after signing in. At the top are four statistic cards: real plants in the database, Arab countries, recorded operational capacity in MW, and the renewable share. Below them the “Start here” cards jump to the plant explorer, the digital twin and the practice quiz.

- **My available exams:** students see the exams assigned to them with a “Start” button; instructors and administrators see student statistics instead.
- **Student statistics** (instructors and administrators): number of students, exam attempts, average score and pass rate, with a button to the Results & assessment page.
- **Featured plants with 3D models:** cards for landmark plants (Barakah, Shuaibah, Aswan High Dam, Jebel Ali, Jorf Lasfar, the MBR solar park...) with an “Open digital twin” button.

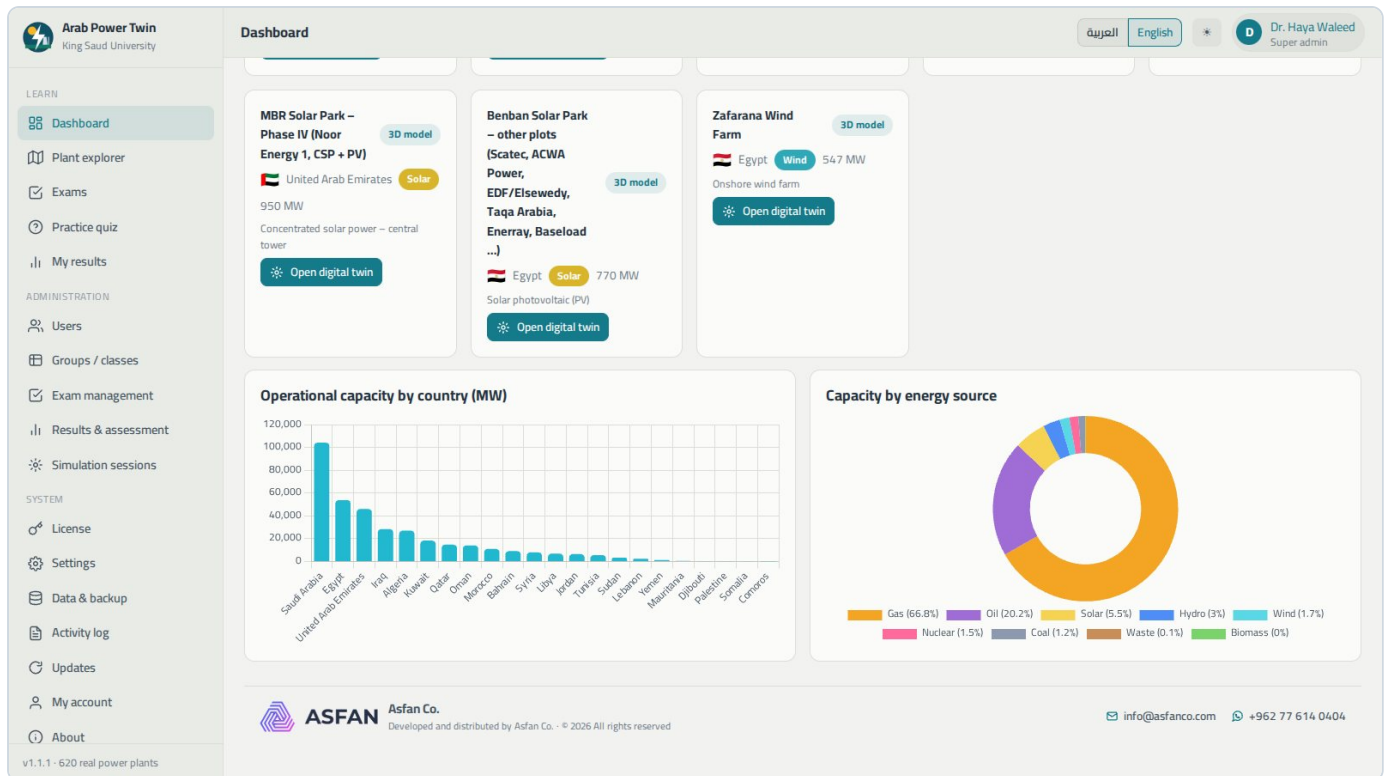


Figure 5: Bottom of the dashboard: featured plants and charts

At the bottom are charts of operational capacity by country and capacity by energy source, and a line stating the data source and its last update date.

6 Plant explorer

6.1 List and map

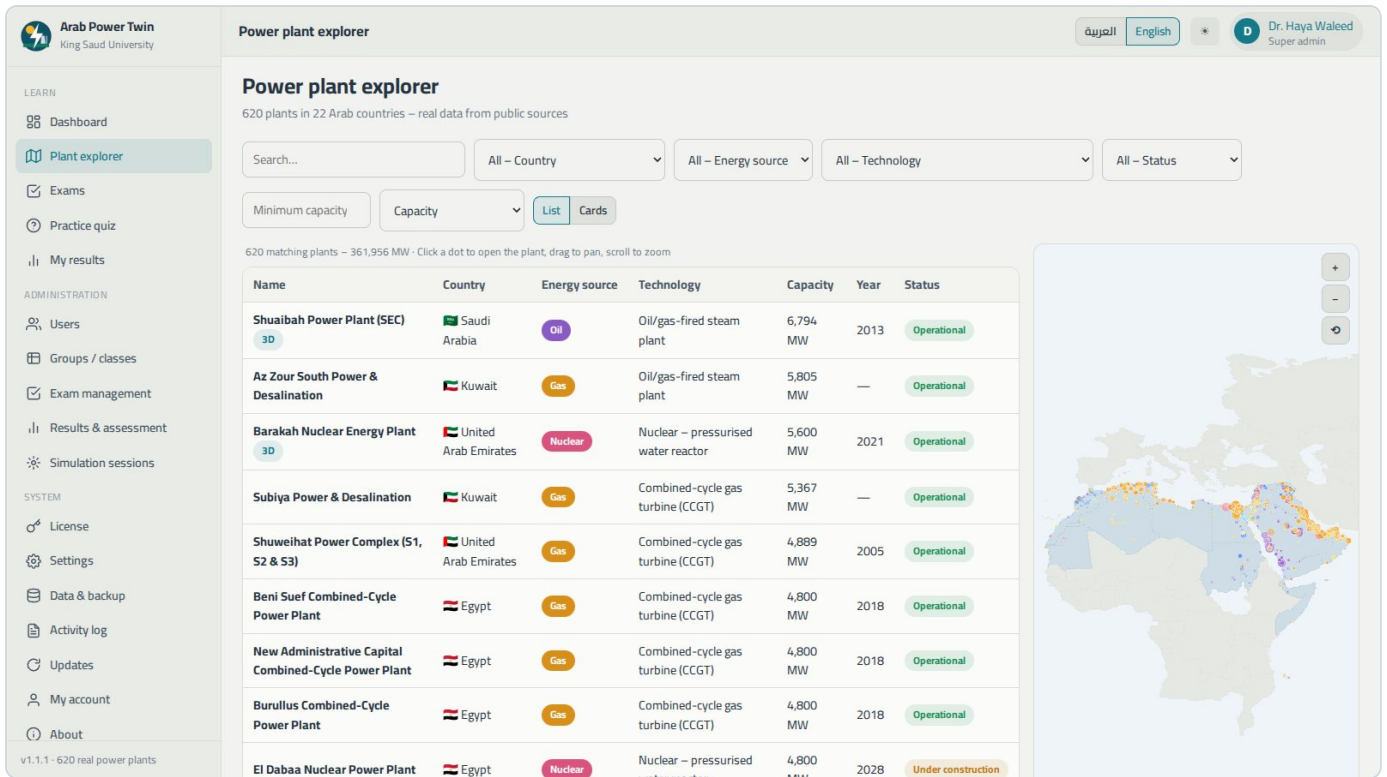


Figure 6: Plant explorer: list with the interactive map

The explorer lists every plant in a table (name, country, energy source, technology, capacity, year, status) next to a map of the Arab world. Every dot on the map is a plant; its colour shows the energy source and its size the capacity.

- **Search:** type part of the plant name in Arabic or English.
- **Filters:** country, energy source (gas, oil, solar, wind, hydro, coal, nuclear, biomass, waste), technology, status (operational, under construction, planned, decommissioned) and minimum capacity.
- **Sort:** by capacity, name or commissioning year.
- **View:** list or cards.
- The “matching plants” line shows how many plants match the filters and their total capacity.

On the map: click a dot to open the plant, drag to pan, use the mouse wheel or the + and – buttons to zoom, and the reset button to return to the full view. Clicking a country filters the list to its plants.

Arab Power Twin

King Saud University

Power plant explorer

620 plants in 22 Arab countries – real data from public sources

Search...

Saudi Arabia (113)

Gas

All – Technology

All – Status

Minimum capacity

Capacity

List

Cards

38 matching plants – 41,509 MW · Click a dot to open the plant, drag to pan, scroll to zoom

Name	Country	Energy source	Technology	Capacity	Year	Status
Ghazlan Power Plant	Saudi Arabia	Gas	Oil/gas-fired steam plant	4,256 MW	2003	Operational
Qurayyah IPP (Hajr)	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	4,098 MW	2014	Operational
Qurayyah Combined-Cycle (SEC)	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	3,846 MW	2014	Operational
Taiba 1 & 2 Combined-Cycle Power Plants	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	3,600 MW	2027	Under construction
Qassim 1 & 2 Combined-Cycle Power Plants	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	3,600 MW	2027	Under construction
Marafiq Jubail IWPP	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	2,941 MW	2010	Operational
Qurayyah Steam	Saudi Arabia	Gas	Oil/gas-fired steam plant	2,500 MW	1992	Operational
Riyadh PP8	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	2,072 MW	2008	Operational
Riyadh PP12	Saudi Arabia	Gas	Combined-cycle gas turbine (CCGT)	2,056 MW	2016	Operational

LEARN

Dashboard

Plant explorer

Exams

Practice quiz

My results

ADMINISTRATION

Users

Groups / classes

Exam management

Results & assessment

Simulation sessions

SYSTEM

License

Settings

Data & backup

Activity log

Updates

My account

About

v1.1.1 - 620 real power plants

Figure 7: Filtering by country and energy source applies to both the list and the map

6.2 Card view and badges

The “Cards” view shows the same plants as tiles with their capacity and status; clicking any card or row opens the plant page.

- The **3D model** badge means the plant has a bespoke 3D model in the digital twin.
- The lock badge means the plant’s technology is not included in your license: its data can be browsed only.

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Page 14 / 48

Arab Power Twin

King Saud University

LEARN

Dashboard

Plant explorer

Exams

Practice quiz

My results

ADMINISTRATION

Users

Groups / classes

Exam management

Results & assessment

Simulation sessions

SYSTEM

License

Settings

Data & backup

Activity log

Updates

My account

About

v1.1.1 - 620 real power plants

Power plant explorer

620 plants in 22 Arab countries – real data from public sources

Search...

All – Country

All – Energy source

All – Technology

All – Status

Minimum capacity

Capacity

List

Cards

620 matching plants – 361,956 MW · Click a dot to open the plant, drag to pan, scroll to zoom

Shuaibah Power Plant (SEC)

Saudi Arabia

Oil

3D

6,794 MW

Oil/gas-fired steam plant

Az Zour South Power & Desalination

Kuwait

Gas

5,805 MW

Oil/gas-fired steam plant

Barakah Nuclear Energy Plant

United Arab Emirates

Nuclear

5,600 MW

Nuclear – pressurised water reactor

Subiya Power & Desalination

Kuwait

Gas

5,367 MW

Combined-cycle gas turbine (CCGT)

Shuweihat Power Complex (S1, S2 & S3)

United Arab Emirates

Gas

4,889 MW

Combined-cycle gas turbine (CCGT)

Beni Suef Combined-Cycle Power Plant

Egypt

Gas

4,800 MW

Combined-cycle gas turbine (CCGT)

New Administrative Capital Combined-Cycle Power Plant

Egypt

Gas

4,800 MW

Combined-cycle gas turbine (CCGT)

Burullus Combined-Cycle Power Plant

Egypt

Gas

4,800 MW

Combined-cycle gas turbine (CCGT)

El Dabaa Nuclear Power Plant

Egypt

Nuclear

4,800 MW

Nuclear – pressurised water reactor

Rabigh Power Plant (SEC)

Saudi Arabia

Oil

4,348 MW

Oil/gas-fired steam plant

Ghazlan Power Plant

Saudi Arabia

Gas

4,256 MW

Oil/gas-fired steam plant

Qurayyah IPP (Hajr)

Saudi Arabia

Gas

4,098 MW

Combined-cycle gas turbine (CCGT)

Qurayyah Combined-Cycle (SEC)

Saudi Arabia

Gas

4,098 MW

Combined-cycle gas turbine (CCGT)

Jazan Integrated Gasification Combined Cycle (JIGCC)

Saudi Arabia

Gas

4,098 MW

Combined-cycle gas turbine (CCGT)

Riyadh PP9

Saudi Arabia

Gas

4,098 MW

Combined-cycle gas turbine (CCGT)

Map of Arab countries with plant locations marked by colored dots. Includes zoom controls (+, -, reset).

Figure 8: Card view with the 3D-model and lock badges

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Page 15 / 48

7 Plant page

7.1 Page contents

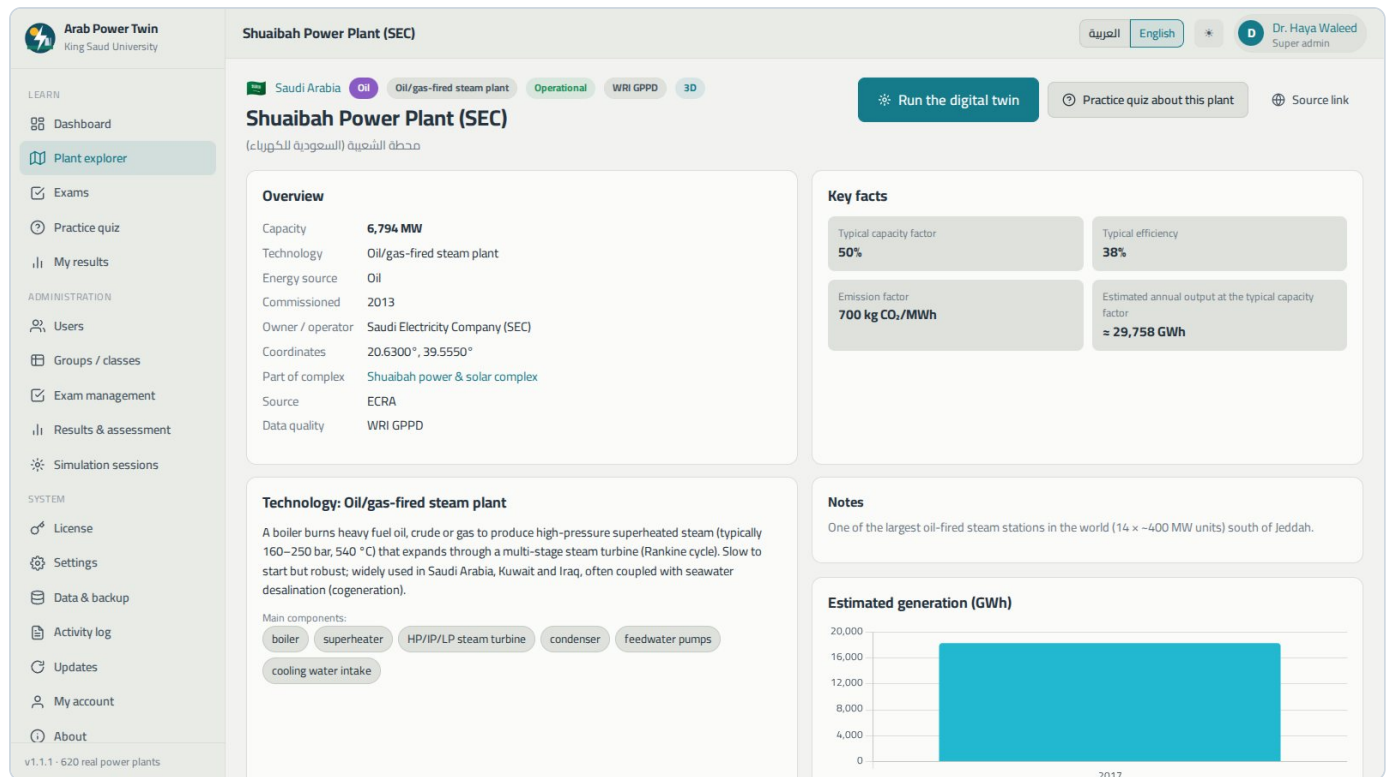


Figure 9: Plant page: overview and key facts

- **Overview:** country, technology, capacity in MW, status, commissioning year, owner or operator, and data quality (verified, WRI GPPD, approximate).
- **Key facts:** typical efficiency, typical capacity factor, emission factor, recorded or estimated annual generation in GWh, and coordinates.
- **Technology:** a simplified explanation of how the technology works and its main components.
- **Notes** about the plant and a link to the original data source.
- **Plants in this complex:** if the plant belongs to a complex (such as Jebel Ali or Ras Laffan) the other members are listed.
- **Nearby plants:** the geographically closest plants with the distance in km.

Arab Power Twin

King Saud University

Learn

- Dashboard
- Plant explorer
- Exams
- Practice quiz
- My results

Administration

- Users
- Groups / classes
- Exam management
- Results & assessment
- Simulation sessions

System

- License
- Settings
- Data & backup
- Activity log
- Updates
- My account
- About

Shuaibah Power Plant (SEC)

المربيةEnglish*

Dr. Haya Waleed
Super admin

GasOilSolarWindHydroCoalNuclearBiomassWaste

Nearby plants

Shuaibah IWPP	0 km · 1,191 MW
Shuaibah 2 Solar PV Plant	2 km · 2,060 MW
Shuaibah 1 Solar PV Plant	6 km · 600 MW
Jeddah South Thermal	76 km · 2,892 MW
South Jeddah Noor Solar PV Plant	77 km · 300 MW
Jeddah 3	96 km · 1,808 MW
Makkah	97 km · 796 MW
Jeddah 2	99 km · 158 MW

Plants in this complex: Shuaibah power & solar complex (10,645 MW)

Name	Technology	Capacity	Year	Status
Shuaibah Power Plant (SEC)	Oil/gas-fired steam plant	6,794 MW	2013	Operational
Shuaibah 2 Solar PV Plant	Solar photovoltaic (PV)	2,060 MW	2025	Operational
Shuaibah IWPP	Oil/gas-fired steam plant	1,191 MW	2009	Operational
Shuaibah 1 Solar PV Plant	Solar photovoltaic (PV)	600 MW	2025	Operational

4 rows

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Figure 10: Bottom of the plant page: technology and nearby plants

At the top of the page are two buttons: **Run the digital twin** opens the 3D simulation, and **Practice quiz about this plant** starts questions generated from this plant's data and technology.

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Page 17 / 48

8 Digital twin

The digital twin is the heart of the program: a 3D scene of the plant built from its actual capacity, number of units, technology and location, driven by a simplified physical simulation in real time or at accelerated speeds. The purpose is educational: understanding how the plant responds to changes in load, weather and faults.

8.1 The screen and the 3D scene

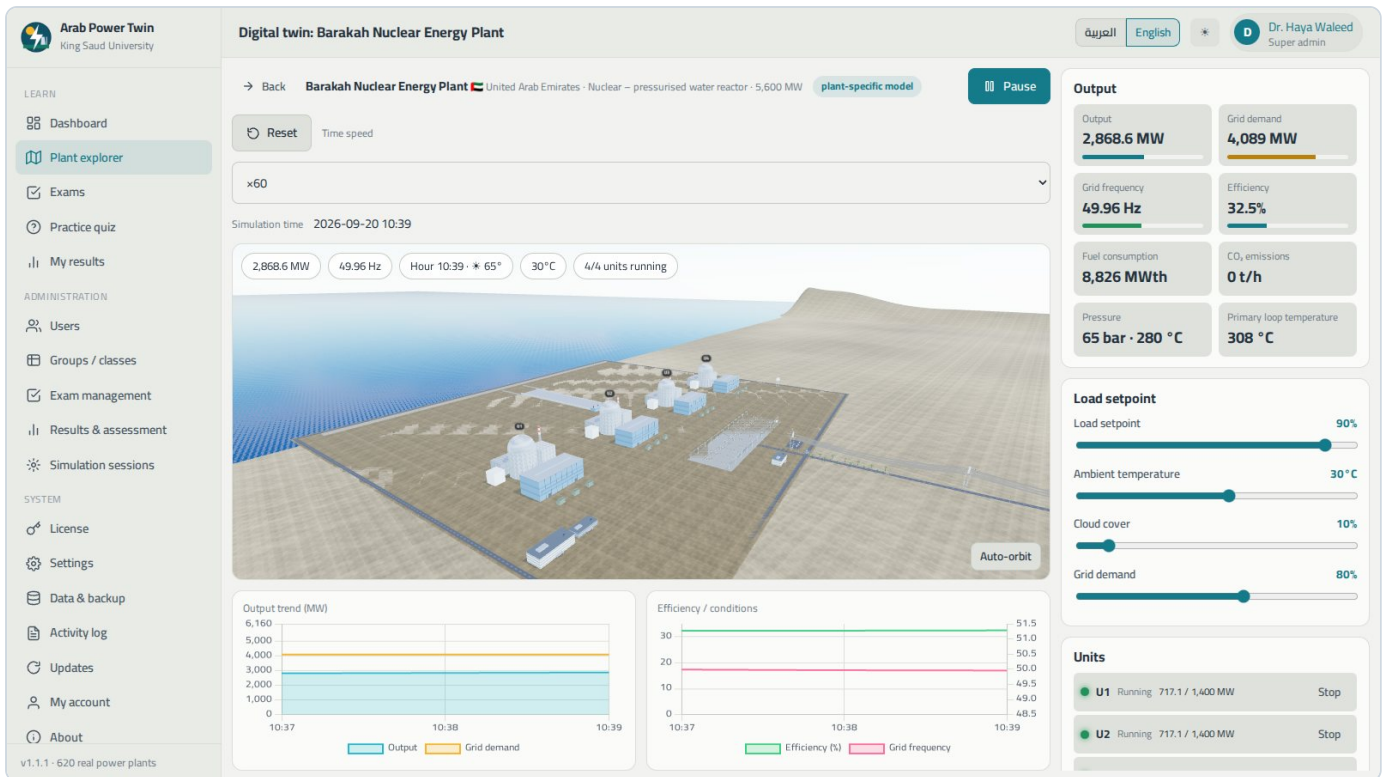


Figure 11: Digital twin of the Barakah nuclear plant

- **Header:** back button, plant name with country, technology and capacity, the badge “plant-specific model” or “generic model for this technology”, pause/run button, a reset button that clears the cumulative indicators, the time-speed selector (real time, ×10, ×60, ×300, ×1800) and the current simulation time.
- **Scene window:** drag with the mouse to orbit, use the wheel to zoom and the right button to pan. “Auto-orbit” turns the camera around the plant. At the top of the window live pills show output, grid frequency, the hour and sun elevation, ambient temperature and the number of running units.
- The scene follows the time of day: lighting and shadows follow the plant’s real sun position, windows and lamps light up at night, chimney plumes, wind-turbine rotors and fans move, and panels and mirrors track the sun.

8.2 Indicators and controls

- **Output:** current output in MW, grid demand, grid frequency, efficiency, and technology-specific indicators: fuel consumption, CO₂ emissions, exhaust temperature and steam pressure for thermal plants; reactor

thermal power and primary-loop temperature for nuclear; irradiance, cell temperature, soiling or thermal storage for solar; wind speed and rotor speed for wind; reservoir level and discharge for hydro.

- **Load setpoint:** the requested load percentage (for hydro: gate opening and inflow).
- **Conditions:** ambient temperature, cloud cover, dust, wind speed and grid demand depending on the technology, plus a “Clean modules / mirrors” checkbox for solar plants.
- **Units:** the list of units with their state (running, starting, stopping, off, tripped) and each unit’s output, with buttons to start, stop and reset a trip.

8.3 Training scenarios

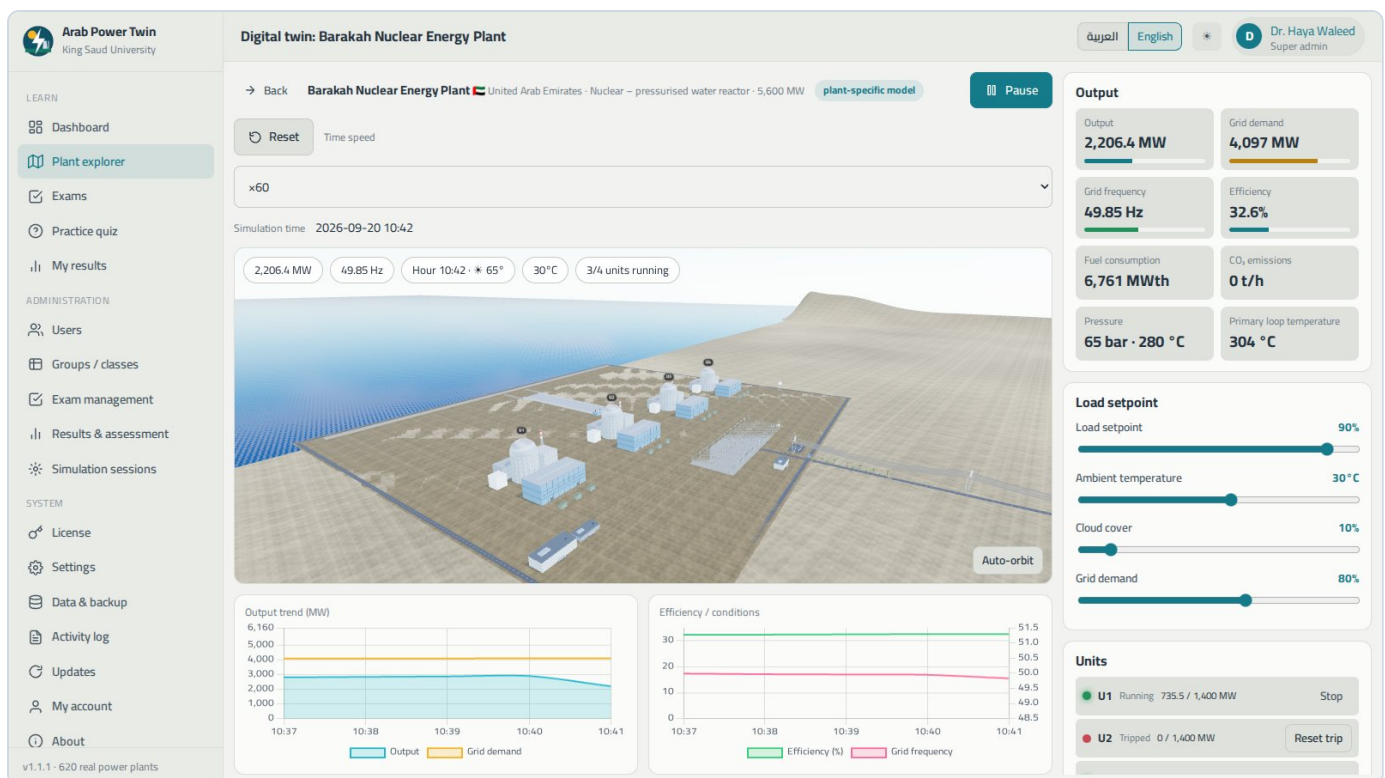


Figure 12: The “Sudden unit trip” scenario: the tripped unit, the alarm and the frequency dip

The scenario chips apply a training event to the plant: **Sudden unit trip**, **Heat wave 48 °C**, **Dust storm**, **Strong wind gust** and **Demand surge**. Watch how the indicators and alarms respond, then click “Clear scenario” to return to normal.

8.4 KPIs, alarms and trends

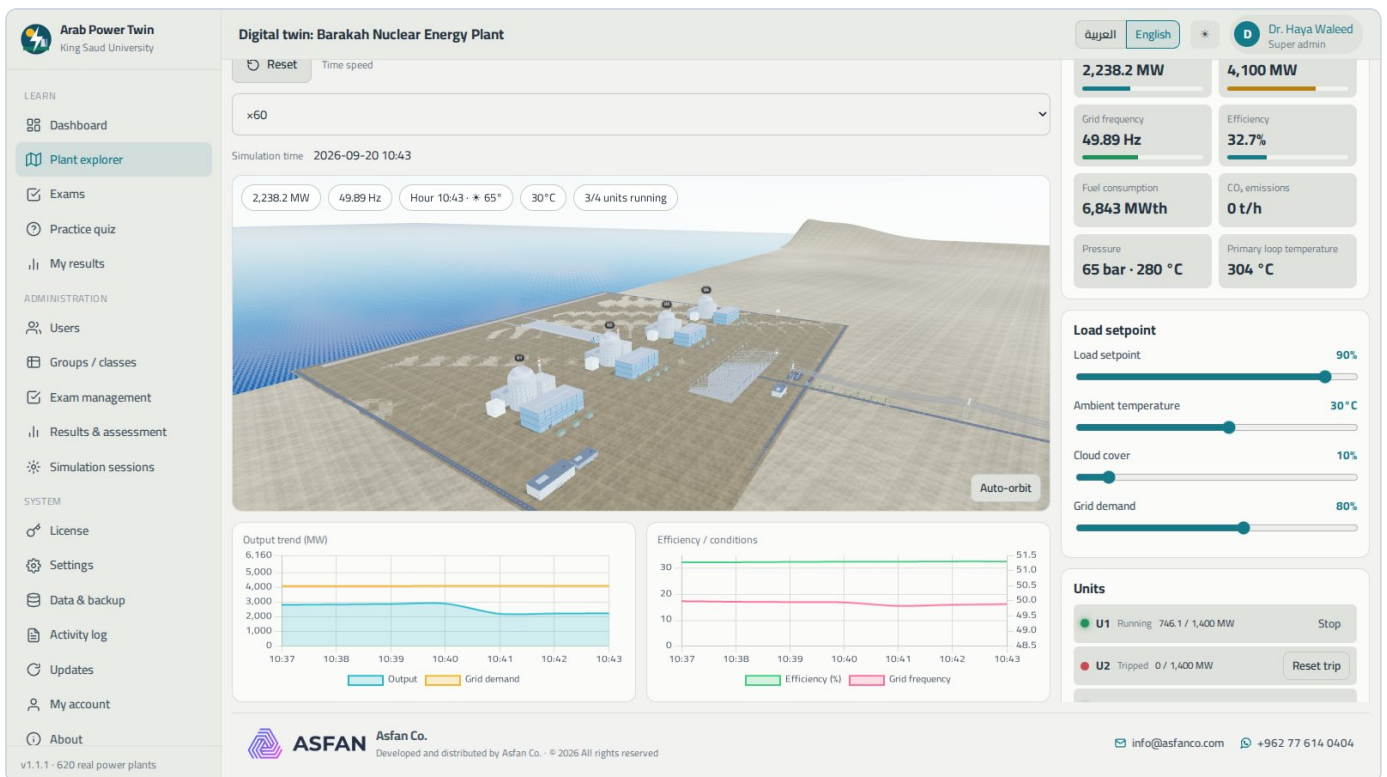


Figure 13: Bottom of the twin page: cumulative KPIs, alarms and the output and efficiency trends

- **Performance indicators:** energy delivered, session capacity factor, availability, number of trips, and cumulative fuel and CO₂.
- **Alarms & events:** frequency deviation, high vibration, high exhaust temperature, soiling, wind above cut-out, full or low reservoir, and start-up, synchronisation and trip messages with their time.
- **Trends:** output versus demand, and efficiency or conditions together with grid frequency.

Ending the session

End session & save report stores a summary of the session (plant, duration, energy, capacity factor, availability, trips, events) in the user's record. Students see their sessions under "My account"; instructors see them under "Simulation sessions". If you leave the page after more than twenty seconds of simulation, the session is saved automatically.

Tip: To assess operating skills, ask students to run a given plant, apply a specific scenario and end the session, then review the results on the Simulation sessions page.

9 Exams (student view)

9.1 Available exams

The screenshot shows the 'Exams' section of the Arab Power Twin interface for 'Student 9'. The page lists two available exams:

- Midterm – Power plants**
 - The exam covers generation technologies and Arab plant data.
 - questions: 10
 - Duration: 30 min
 - Pass mark: 60%
 - Attempts: 0 of 2
 - Start exam button
- Quiz – Renewable energy**
 - questions: 8
 - Duration: 15 min
 - Pass mark: 50%
 - Attempts: 0 - unlimited
 - Start exam button

The footer includes the ASFAN logo, 'Asfan Co.', and contact information: 'info@asfanco.com' and '+962 77 614 0404'. A version note 'v1.1.1 - 620 real power plants' is visible in the bottom left corner.

Figure 14: Exams assigned to the student

The page lists the formal exams assigned to the student's group with their details: number of questions, duration, pass mark and attempts used out of those allowed. **Start exam** begins a new attempt after confirming that the timer starts immediately; **Resume exam** returns to an open attempt that has not been submitted yet.

9.2 Taking the exam

The screenshot displays the 'Midterm – Power plants' exam interface. At the top, the header includes the 'Arab Power Twin' logo and 'King Saud University' on the left, and language options ('العربية', 'English') and a user profile ('Student 9') on the right. A sidebar on the left lists navigation items under 'LEARN' (Dashboard, Plant explorer, Exams, Practice quiz, My results) and 'SYSTEM' (Updates, My account, About, Sign out). The main content area shows the exam title 'Midterm – Power plants' with '0 of 10 answered' and a 'Time left: 29:58' timer. Below this is a row of numbered buttons (1-10) for question navigation, with button 1 highlighted. The current question is 'Question 1 of 10: What happens to grid frequency when demand exceeds generation?'. It features four radio button options: 'A It falls', 'B It rises', 'C It stays constant' (which is selected), and 'D It oscillates randomly'. At the bottom of the question area are 'Previous' and 'Next' buttons, and a 'Submit answers' button with a checkmark. The footer contains the 'ASFAN' logo, 'Asfan Co.' name, a copyright notice 'Developed and distributed by Asfan Co. - © 2026 All rights reserved', and contact information: 'info@asfanco.com' and '+962 77 614 0404'. A version note 'v1.1.1 - 620 real power plants' is visible in the bottom left corner.

Figure 15: The exam screen: timer, question navigation and options

- **Time left** at the top; when it runs out the answers are submitted automatically.
- The **numbered buttons** jump directly between questions; answered questions are highlighted.
- Every student receives a different order of questions and options built from the same specification.
- Answers are **saved automatically**; if the program is closed you can resume where you stopped as long as time remains.
- Questions marked "Generated from real plant data" are built from real plant figures (capacity, country, technology, commissioning year, energy, fuel and emission calculations).

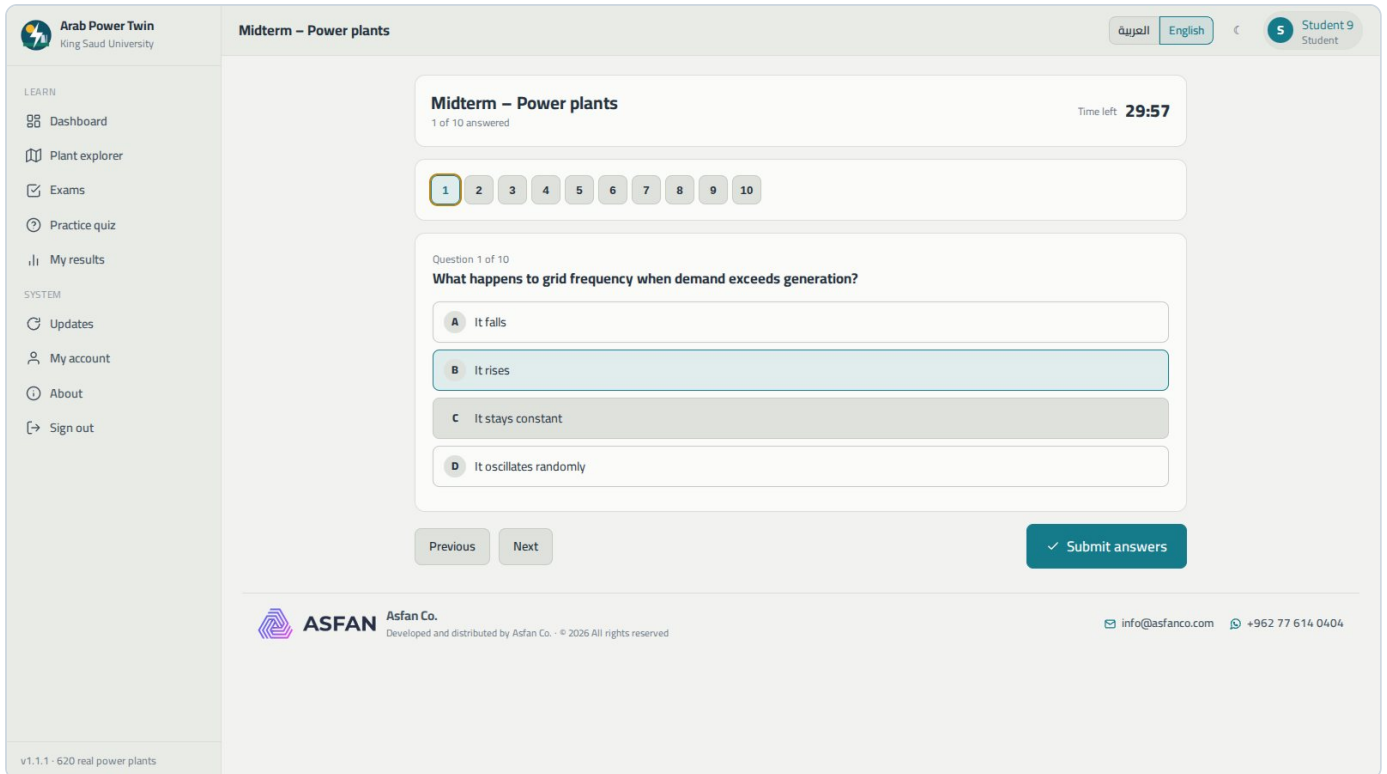


Figure 16: Selecting an answer

When finished click **Submit answers**. If questions remain unanswered the program asks you to confirm.

9.3 The result

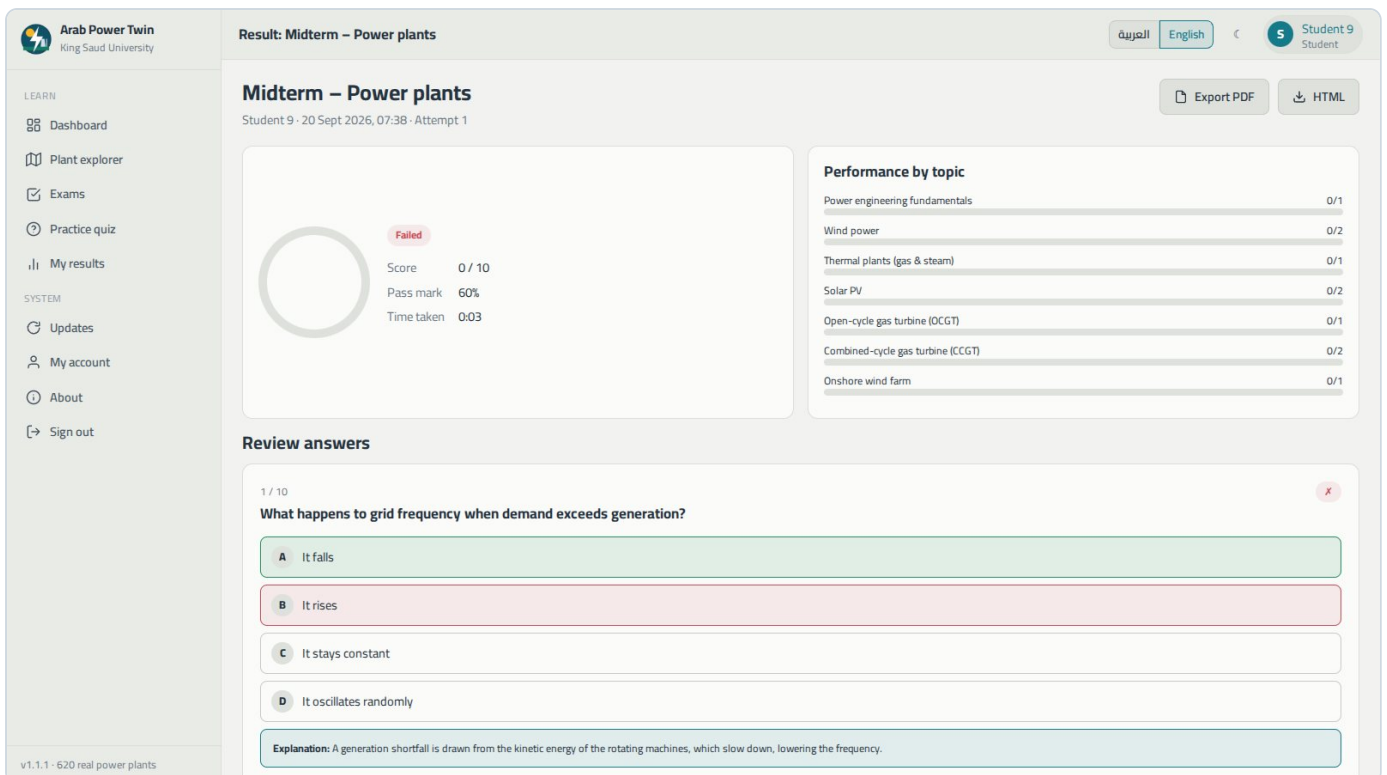


Figure 17: The result page after submission

The result shows the score, the percentage, pass or fail, the time taken and the performance by topic. If the instructor allowed it, a full review appears: your answer, the correct answer and the explanation.

Arab Power Twin
King Saud University

Result: Midterm – Power plants

المربية English Student 9 Student

LEARN

- Dashboard
- Plant explorer
- Exams
- Practice quiz
- My results

SYSTEM

- Updates
- My account
- About
- Sign out

10 / 10

What is the main operational challenge for power plants in desert environments?

- A Excess humidity
- B Dust soiling, which cuts output and requires robotic cleaning
- C Low irradiance
- D Snow

Explanation: Soiling can cost ~1% of output per day without cleaning, so large plants use dry cleaning robots at night.

Which of these plants in Saudi Arabia has the largest capacity?

- A Yanbu Phase 3 Power and Desalination Plant
- B Ras Tanura cogeneration plant
- C Tabarjal
- D Dumat Al Jandal Wind Farm

Explanation: Dumat Al Jandal Wind Farm: 400 MW; Ras Tanura cogeneration plant: 153 MW; Yanbu Phase 3 Power and Desalination Plant: 2,700 MW; Tabarjal: 103.2 MW

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Figure 18: Answer review with explanations

The **Certificate / PDF report** button prints a result report that can be saved as a PDF file.

10 Practice quiz

10.1 Setting up a practice quiz

The screenshot shows the 'Practice quiz' settings page in the Arab Power Twin application. The interface is divided into a left sidebar, a main content area, and a footer.

Left Sidebar:

- Logo: Arab Power Twin, King Saud University
- LEARN section:
 - Dashboard
 - Plant explorer
 - Exams
 - Practice quiz** (selected)
 - My results
- SYSTEM section:
 - Updates
 - My account
 - About
 - Sign out

Main Content Area:

Practice quiz

Test yourself with questions from the bank and questions generated from real plant data. Results are not part of formal assessment but are kept in your record.

Number of questions: 15 (dropdown menu)

Share of questions generated from plant data: 50% (slider)

Topics:

- Fundamentals
- Thermal plants
- Nuclear
- Solar PV
- CSP
- Wind
- Hydro
- Grid & operations
- Arab plants
- Economics & emissions

Countries (for plant questions):

- Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, Yemen

Technologies:

- Combined-cycle gas turbine (CCGT), Open-cycle gas turbine (OCGT), Oil/gas-fired steam plant, Coal-fired steam plant, Diesel / HFO reciprocating engines, Solar photovoltaic (PV), Concentrated solar power – parabolic trough, Concentrated solar power – central tower, Onshore wind farm, Hydroelectric dam (reservoir), Run-of-river / barrage hydro, Nuclear – pressurised water reactor, Biomass / bagasse cogeneration, Waste-to-energy, Integrated gasification combined cycle (IGCC), Oil-shale fired steam plant

Footer:

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Figure 19: Practice quiz settings

The practice quiz is informal and does not count towards assessment. Choose the number of questions, the question-bank topics, the countries and technologies for plant questions and the share of questions generated from plant data, then click **Start practice**.

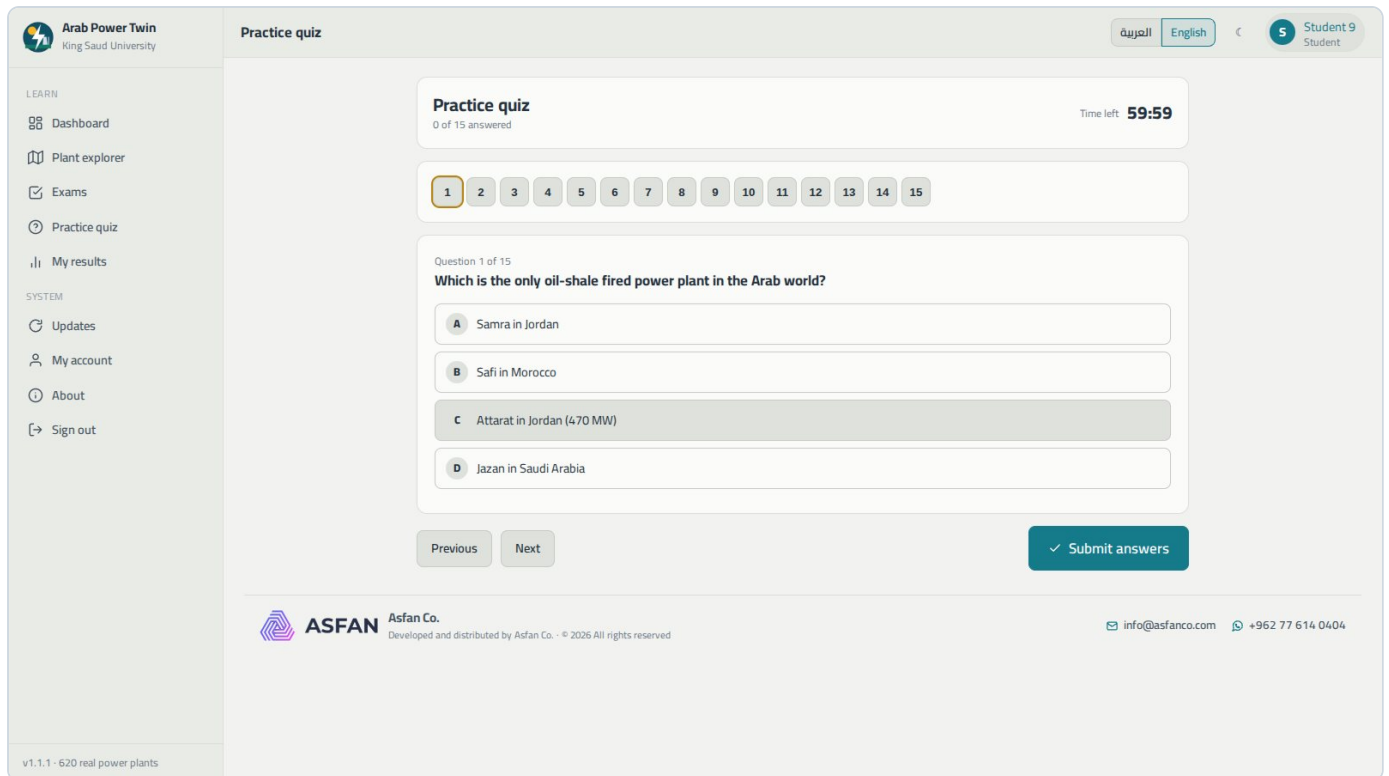


Figure 20: During practice

Grading is immediate after submission, with explanations, and practice can also be started from any plant page to generate questions about that plant.

11 My results and my account

11.1 My results

The screenshot displays the 'My results' section of the Arab Power Twin application. The left sidebar contains navigation links for 'Dashboard', 'Plant explorer', 'Exams', 'Practice quiz', 'My results' (selected), 'Updates', 'My account', 'About', and 'Sign out'. The main content area shows a table of exam attempts. The table has the following data:

Exam	Kind	Date	Attempt	Score	%	Status	Time taken
Midterm - Power plants	Formal	20 Sept 2026, 07:38	1	0 / 10	0%	Failed	0:03

Below the table, there is an 'Export CSV (Excel)' button. The footer of the page includes the ASFAN logo, the text 'Asfan Co. Developed and distributed by Asfan Co. © 2026 All rights reserved', and contact information: 'info@asfanco.com' and '+962 77 614 0404'.

Figure 21: The student's results: formal and practice attempts

A table of all the student's attempts: exam, kind (formal or practice), date, attempt number, score, percentage, status and time taken. Clicking a row opens the result page. **Export CSV** saves the table for Excel.

11.2 My account

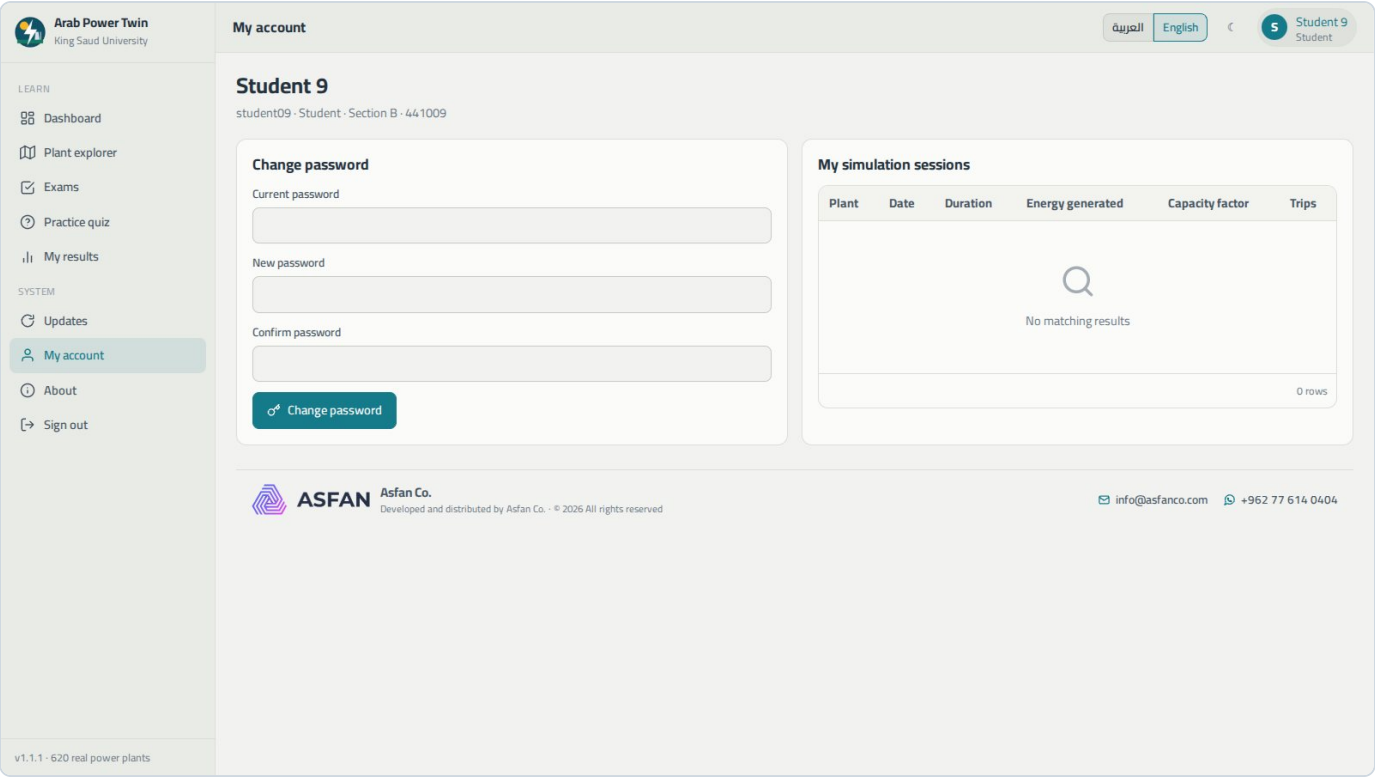


Figure 22: My account: changing the password and simulation sessions

Shows the name, role and group, allows **changing the password** by entering the current and new ones, and lists **my simulation sessions** with their indicators.

12 Administration: users and groups

12.1 User management

User management

Search... All All - Group

Name	Role	Group	Student number	Last login	Status	Actions
Dr. Haya Waleed admin	Super admin	—	—	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results]
Eng. Sami Khaled instructor1	Instructor	—	—	—	Active	[Edit] [Reset] [Results] [Delete]
Student 1 student01	Student	Section A	441001	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 10 student10	Student	Section B	441010	—	Active	[Edit] [Reset] [Results] [Delete]
Student 2 student02	Student	Section A	441002	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 3 student03	Student	Section A	441003	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 4 student04	Student	Section A	441004	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 5 student05	Student	Section A	441005	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 6 student06	Student	Section A	441006	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 7 student07	Student	Section B	441007	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]
Student 8 student08	Student	Section B	441008	20 Sept 2026, 07:36	Active	[Edit] [Reset] [Results] [Delete]

Figure 23: User management

A table of all accounts: name, username, role, group, student number, last sign-in and status. Each row has buttons to edit, reset the password, view results, suspend or activate, and delete.

- Instructors manage student accounts only; the super admin manages every role.
- Suspended accounts cannot sign in; their results are kept.
- The number of active accounts is limited by the license seats; when the limit is reached the message “seat limit reached” appears and an old account can be suspended to free a seat.

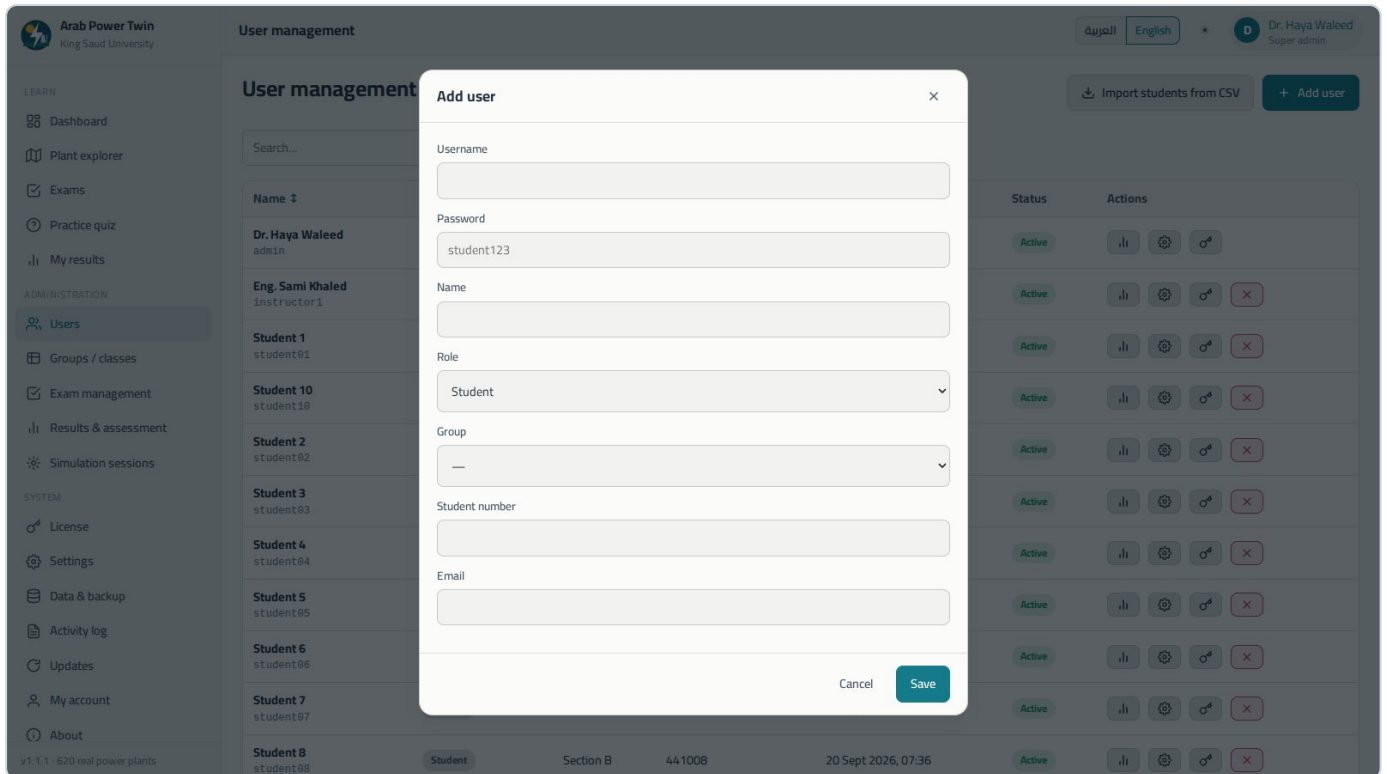


Figure 24: The add-user form

1. Click **Add user**.
2. Enter the username, password and name, choose the role and group, and add the student number and e-mail if available.
3. Click Save. A new student must change the password at the first sign-in.

12.2 Importing students from a CSV file

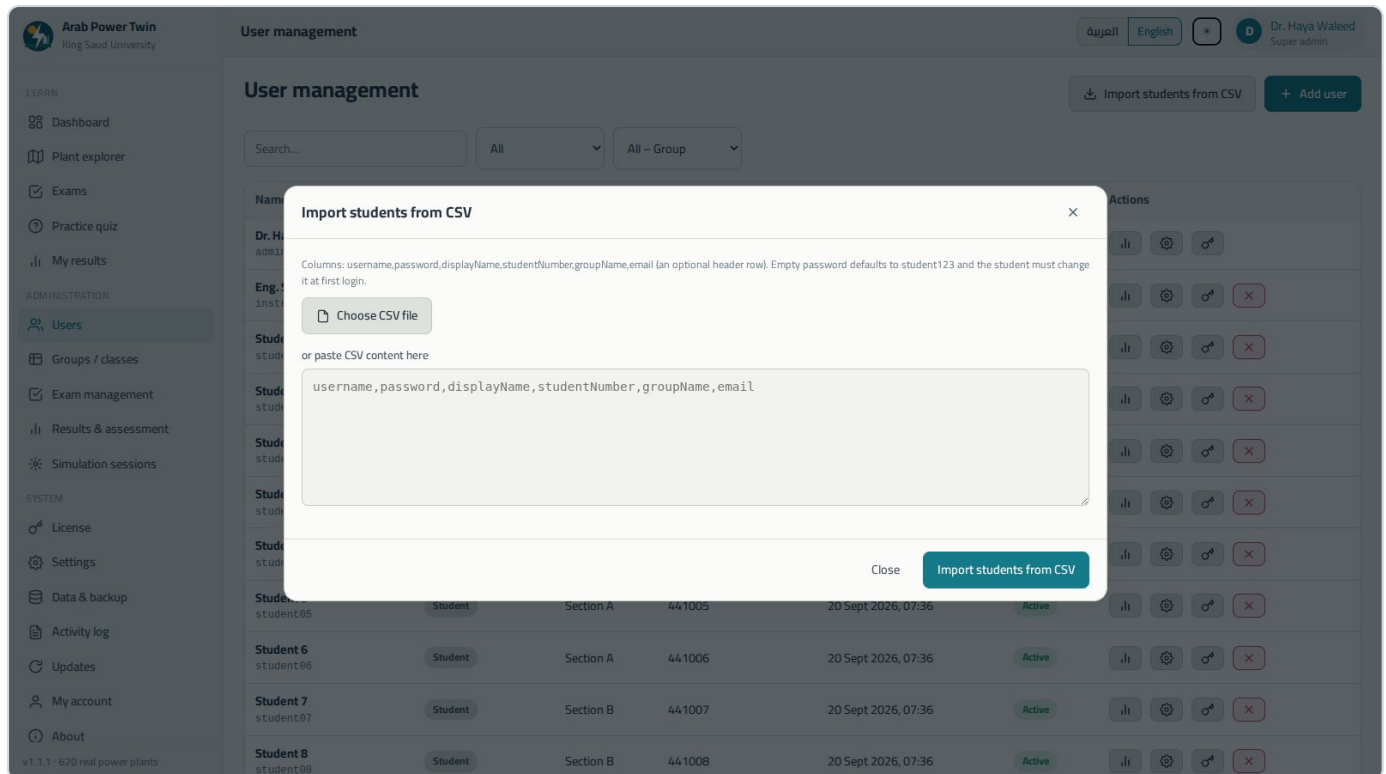


Figure 25: Importing students from CSV

To add a whole class at once prepare a CSV file (from Excel: Save as → CSV UTF-8) with the columns below, then click **Import students from CSV** and choose the file or paste its content:

```
username,password,displayName,studentNumber,groupName,email
ahmad1,,Ahmad Ali,441001,Section A,ahmad@uni.edu
sara2,Sara@2026,Sara Mohammed,441002,Section A,
```

- The first line of headers is optional, and the file may use commas, semicolons or tabs.
- If the password is left empty it becomes `student123` and the student must change it at the first sign-in.
- Groups that do not exist are created automatically from the groupName column.
- After the import a message reports the accounts created and skipped, with the reason for each skip (duplicate username, missing data or seat limit).

12.3 Groups / classes

The screenshot shows the 'Groups / classes' management page in the Arab Power Twin application. The interface includes a sidebar with navigation options, a main content area with a table of groups, and a footer with contact information.

Arab Power Twin
King Saud University

Groups / classes

المربية English *

Dr. Haya Waleed
Super admin

Groups / classes + Add group

Name	Description	Members	Actions
Section A	—	6	
Section B	—	4	

2 rows

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LEARN

- Dashboard
- Plant explorer
- Exams
- Practice quiz
- My results

ADMINISTRATION

- Users
- Groups / classes**
- Exam management
- Results & assessment
- Simulation sessions

SYSTEM

- License
- Settings
- Data & backup
- Activity log
- Updates
- My account
- About

v1.1.1 - 620 real power plants

Figure 26: Groups

A group (class section) gathers students so that exams can be assigned to them and results filtered. Add a group with a name and description, and edit or delete from the row buttons. The member count is shown for each group; a student's group is changed from the Users page.

13 Administration: exams and results

13.1 Exam management

Arab Power Twin
King Saud University

المربية English

Dr. Haya Waleed
Super admin

Exam management

120 questions · 10 Topics

+ New exam

Name	questions	Duration (minutes)	Pass mark	Assigned groups (empty = all students)	Attempts	Status	Actions
Midterm - Power plants Power engineering fundamentals. Thermal plants (gas & steam). Solar PV, Wind power	10	30	60%	All	8 - Average 63.8%	Active	
Quiz - Renewable energy Solar PV, Concentrated solar power, Wind power, Hydropower	8	15	50%	All	0	Active	

2 rows

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Figure 27: Exam management

The list of exams with the number of questions, duration, pass mark, number of attempts, average score and active state. Buttons: edit, activate or deactivate (a deactivated exam is hidden from students) and delete.

Figure 28: The new-exam form

Exam fields

Field	Meaning
Title (Arabic / English)	Shown to students in the interface language.
Description / instructions	Text shown before starting.
Question-bank topics	Choose one or more of the ten topics; the program shows how many bank questions are available for the selection.
Number of questions	Total questions per attempt.
Share of generated questions	The share of questions built from real plant data (0 to 100%). The rest come from the bank.
Plant scope	Countries and technologies used for generated questions (empty = all, within the licensed technologies).
Duration (minutes)	The timer starts when the attempt starts; the exam is submitted automatically when it ends.
Pass mark (%)	The passing threshold.
Max attempts	0 = unlimited.

Field	Meaning
Assigned groups	The sections that see the exam (empty = all students).
Shuffle questions	A different order for every student.
Show correct answers	Lets students review the answers and explanations after submission.

Tip: Correct answers are never sent to the student's computer before submission, and every student receives a different variant of the questions and options.

13.2 Results & assessment

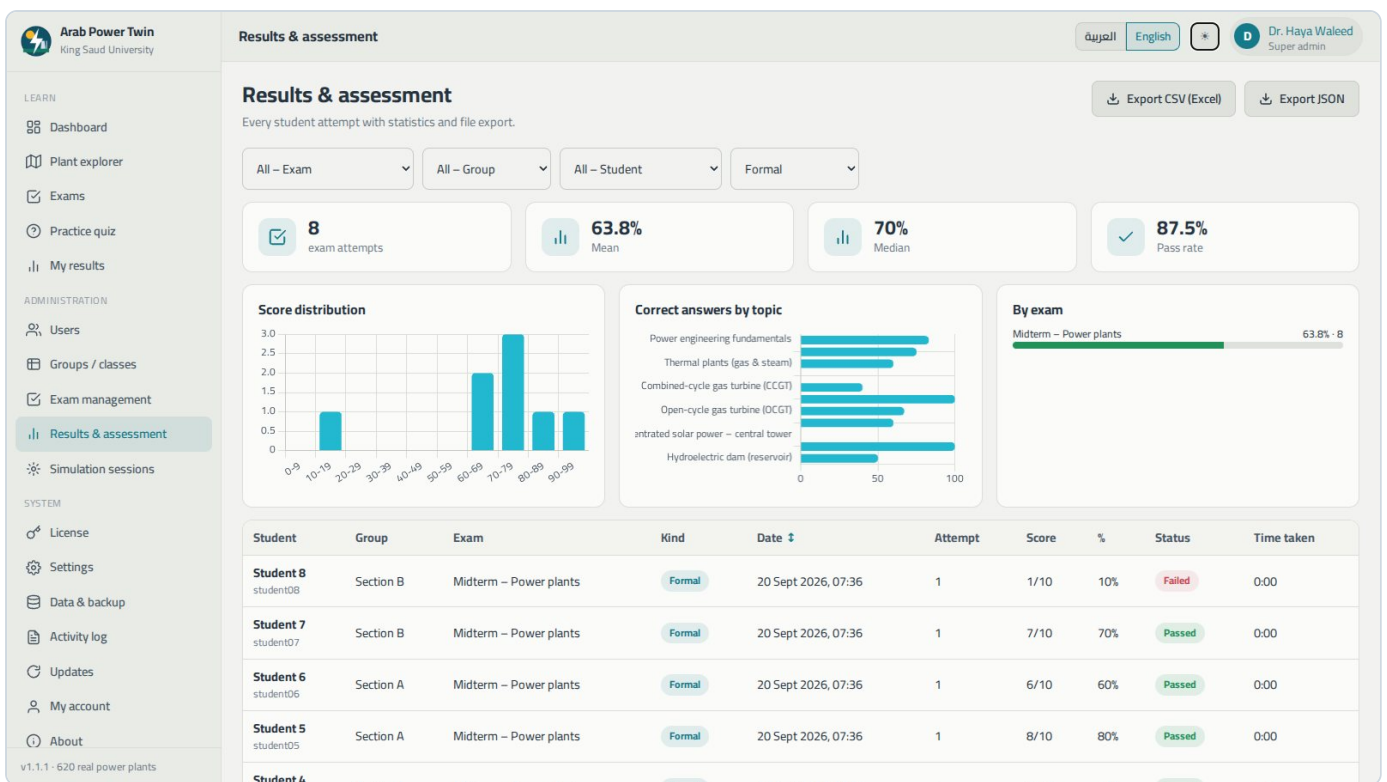


Figure 29: Results & assessment: filters and statistics

This page gathers every student attempt. Filter by exam, group, student or kind (formal/practice) and the indicators update: number of attempts, mean, median and pass rate, with charts of the score distribution, correct answers by topic and the average by exam.

Arab Power Twin
King Saud University

Results & assessment

المربية
English

Dr. Haya Waleed
Super admin

LEARN

Dashboard
Plant explorer
Exams
Practice quiz
My results

ADMINISTRATION

Users
Groups / classes
Exam management
Results & assessment
Simulation sessions

SYSTEM

License
Settings
Data & backup
Activity log
Updates
My account
About

Student 2
student02

Section A

Midterm – Power plants

Formal

20 Sept 2026, 07:36

1

9/10

90%

Passed

0:00

Student 1
student01

Section A

Midterm – Power plants

Formal

20 Sept 2026, 07:36

1

7/10

70%

Passed

0:00

8 rows

Per-student summary

Student	Username	Group	Attempts	Best score	Passed	Last attempt	Actions
Student 1	student01	Section A	1	70%	1	20 Sept 2026, 07:36	Student report
Student 2	student02	Section A	1	90%	1	20 Sept 2026, 07:36	Student report
Student 3	student03	Section A	1	70%	1	20 Sept 2026, 07:36	Student report
Student 4	student04	Section A	1	60%	1	20 Sept 2026, 07:36	Student report
Student 5	student05	Section A	1	80%	1	20 Sept 2026, 07:36	Student report
Student 6	student06	Section A	1	60%	1	20 Sept 2026, 07:36	Student report
Student 7	student07	Section B	1	70%	1	20 Sept 2026, 07:36	Student report
Student 8	student08	Section B	1	10%	0	20 Sept 2026, 07:36	Student report

8 rows

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Figure 30: The attempts table and the per-student summary

- **Attempts table:** student, group, exam, kind, date, attempt number, score, percentage, status and time. Clicking a row opens the attempt details.
- **Per-student summary:** number of attempts, best score and last attempt, and a **Student report** button that prints a PDF report with the student's results and simulation sessions.
- **Export:** CSV (opens in Excel with Arabic support) or JSON of the displayed, filtered table.

13.3 Simulation sessions

 Arab Power Twin
King Saud University

LEARN

- Dashboard
- Plant explorer
- Exams
- Practice quiz
- My results

ADMINISTRATION

- Users
- Groups / classes
- Exam management
- Results & assessment
- Simulation sessions**

SYSTEM

- License
- Settings
- Data & backup
- Activity log
- Updates
- My account
- About

v1.1.1 - 620 real power plants

Simulation sessions

Record of student practice on the digital twin: plant, duration and KPIs.

All – Student

Student	Plant	Date ‡	Duration	Energy generated	Capacity factor	Trips
Dr. Haya Waleed admin	Barakah Nuclear Energy Plant	20 Sept 2026, 07:37	0:30	337.5 MWh	45.5%	1
Student 1 student01	Barakah	20 Sept 2026, 06:36	20:00	1,200 MWh	65%	1
Student 2 student02	Shuaibah	20 Sept 2026, 05:36	25:00	2,400 MWh	70%	0
Student 3 student03	Aswan High Dam	20 Sept 2026, 04:36	30:00	3,600 MWh	75%	1
Student 4 student04	Benban	20 Sept 2026, 03:36	35:00	4,800 MWh	80%	0

5 rows

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Figure 31: The digital-twin session log

For every session: student, plant, date, duration, energy generated, capacity factor, number of trips and session events. The list can be filtered by student, and sessions are included in the student report.

14 System: license, settings and data

14.1 License

The screenshot displays the 'License' page in the Arab Power Twin application. The page is divided into a left sidebar, a main content area, and a footer. The sidebar contains navigation links for 'LEARN' (Dashboard, Plant explorer, Exams, Practice quiz, My results) and 'ADMINISTRATION' (Users, Groups / classes, Exam management, Results & assessment, Simulation sessions). The 'SYSTEM' section is highlighted, showing 'License', 'Settings', 'Data & backup', 'Activity log', 'Updates', 'My account', and 'About'. The main content area is titled 'License' and shows a 'License valid' status. It lists license details: Licensee (Smoke Tester), Organisation (Test University), License type (Lifetime), Expiry date (∞), Seats (10), Issued (2026-09-20), License ID (492e6e45-0363-4915-baf2-9aaa1efce8be), Machine-locked (No), Included modules (Digital twin, Exams & assessment), and Included technologies (All technologies). A yellow box indicates 'Accounts in use: 12 / 10'. Below this, it shows 'This computer's ID' (APT-TEST) with a copy button and 'Source' (memory). On the right, there is a section 'Activate a new key' with a text input for the license key (提示: Paste the key here (starts with APT1.)) and three buttons: 'Activate', 'Load from .lic file', and 'Remove license'. The footer includes the Asfan Co. logo, 'Developed and distributed by Asfan Co. - © 2026 All rights reserved', and contact information: info@asfanco.com and +962 77 614 0404.

Figure 32: The License page

Shows the license state and details: licensee, organisation, type, issue and expiry dates with days left, seats and accounts in use, included modules and technologies, license ID and the machine ID with a copy button.

- **Activate a new key:** when renewing or upgrading, paste the new key or load the .lic file and click Activate; the new license replaces the old one without losing any data.
- **Remove license:** returns the program to the activation screen (super admin only).

14.2 Settings

Figure 33: Settings

Setting	Purpose
Language	The default interface language (Arabic or English).
Theme	Dark or light.
Organisation name	Shown in the sidebar and in reports.
Shared data folder	The folder where accounts and results are stored. Choose a network folder to share data between lab computers, or "Use default folder".
Update server URL	Leave empty for the official releases. An HTTPS link to a folder containing latest.yml and the installer can be used with an internal server.
Check for updates automatically	At start-up and every six hours.

Note: Update settings take effect after restarting the program. When the data folder is changed you are asked to sign in again because the accounts are read from the new folder.

14.3 Data & backup

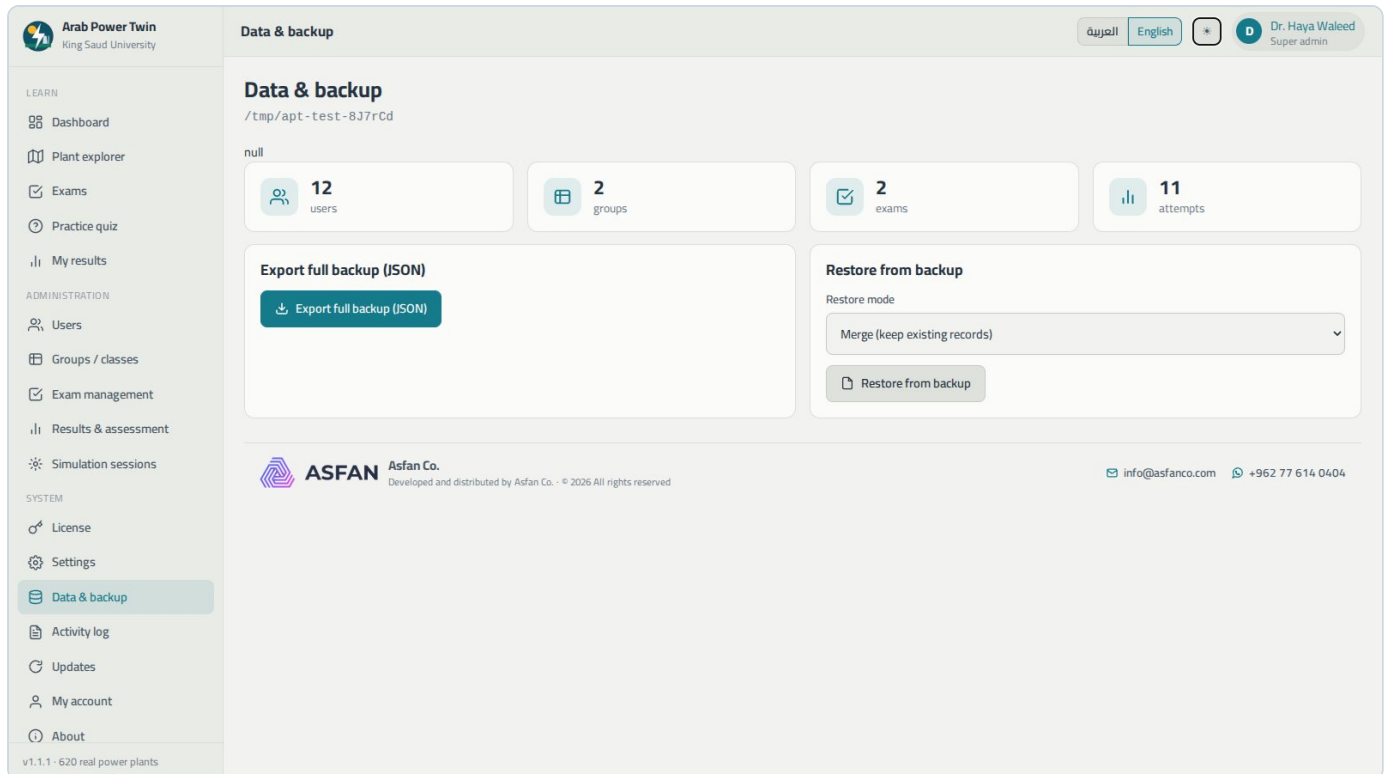


Figure 34: Data & backup

The page shows the data folder path and the record counts (users, groups, exams, attempts, simulation sessions).

- **Export full backup (JSON):** one file containing every record. Save it regularly in a safe place.
- **Restore from backup:** choose the file and the restore mode: **Merge** keeps existing records and adds the new ones; **Overwrite** updates matching records. Used to move data to another computer or after reinstalling.

Tip: Take a backup before the end of every semester and before changing the data folder or reinstalling Windows.

14.4 Activity log

 Arab Power Twin
King Saud University

LEARN

- Dashboard
- Plant explorer
- Exams
- Practice quiz
- My results

ADMINISTRATION

- Users
- Groups / classes
- Exam management
- Results & assessment
- Simulation sessions

SYSTEM

- License
- Settings
- Data & backup
- Activity log
- Updates
- My account
- About

v1.1.1 - 620 real power plants

Activity log

المربيةEnglish*

Dr. Haya Waleed
Super admin

Activity log

Date	Action	By	Details
20 Sept 2026, 07:36	exams.create	admin	{"id":"ex-mu916k4n-e6e548667d","title":"Quiz - Renewable energy"}
20 Sept 2026, 07:36	exams.create	admin	{"id":"ex-mu916k4m-ebd9689b47","title":"Midterm - Power plants"}
20 Sept 2026, 07:36	setup.superadmin	admin	{"username":"admin"}
20 Sept 2026, 07:36	license.activate	—	{"id":"492e6e45-0363-4915-baf2-9aaa1efce8be","licensee":{"email":"","name":"Smoke Tester","org":"Test University"}}

4 rows

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Figure 35: Activity log

The program records sign-ins, user creation and edits, exam creation, edits and deletions, and license activation, with the time, the user who performed the action and its details.

15 Updates and About

15.1 Updates

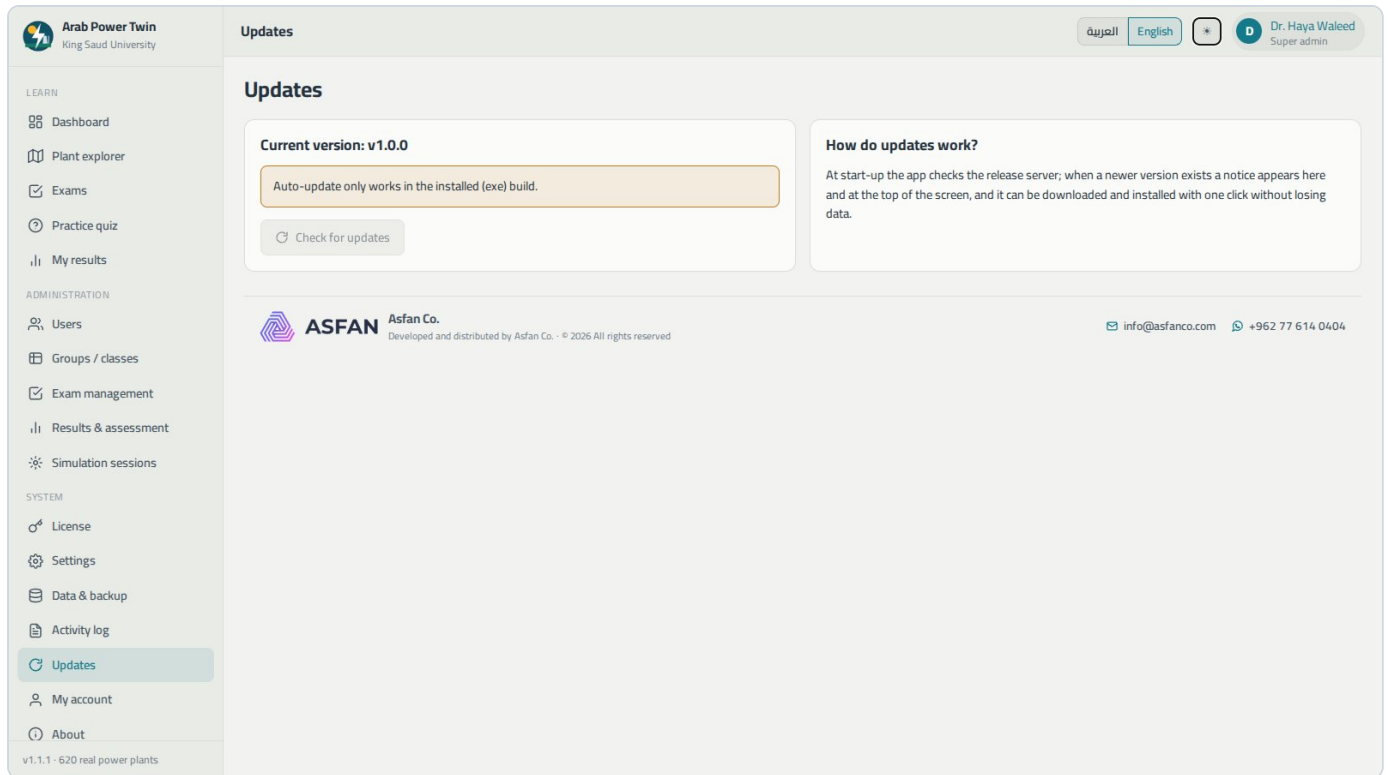


Figure 36: The Updates page

At start-up, and every six hours, the program checks the release server (an internet connection is required). If a newer version exists, a notice appears on this page and a bar at the top of the screen, including on the activation and sign-in screens.

1. Click **Download update**. The download runs in the background with a progress indicator.
2. When it completes click **Restart & install**. The program closes, installs the new version and returns within seconds.
3. If you choose "Later", the update is installed automatically when the program is closed.

Data, accounts and the license are not affected by updates. **Check for updates** runs a manual check, and release notes are shown when available.

15.2 About

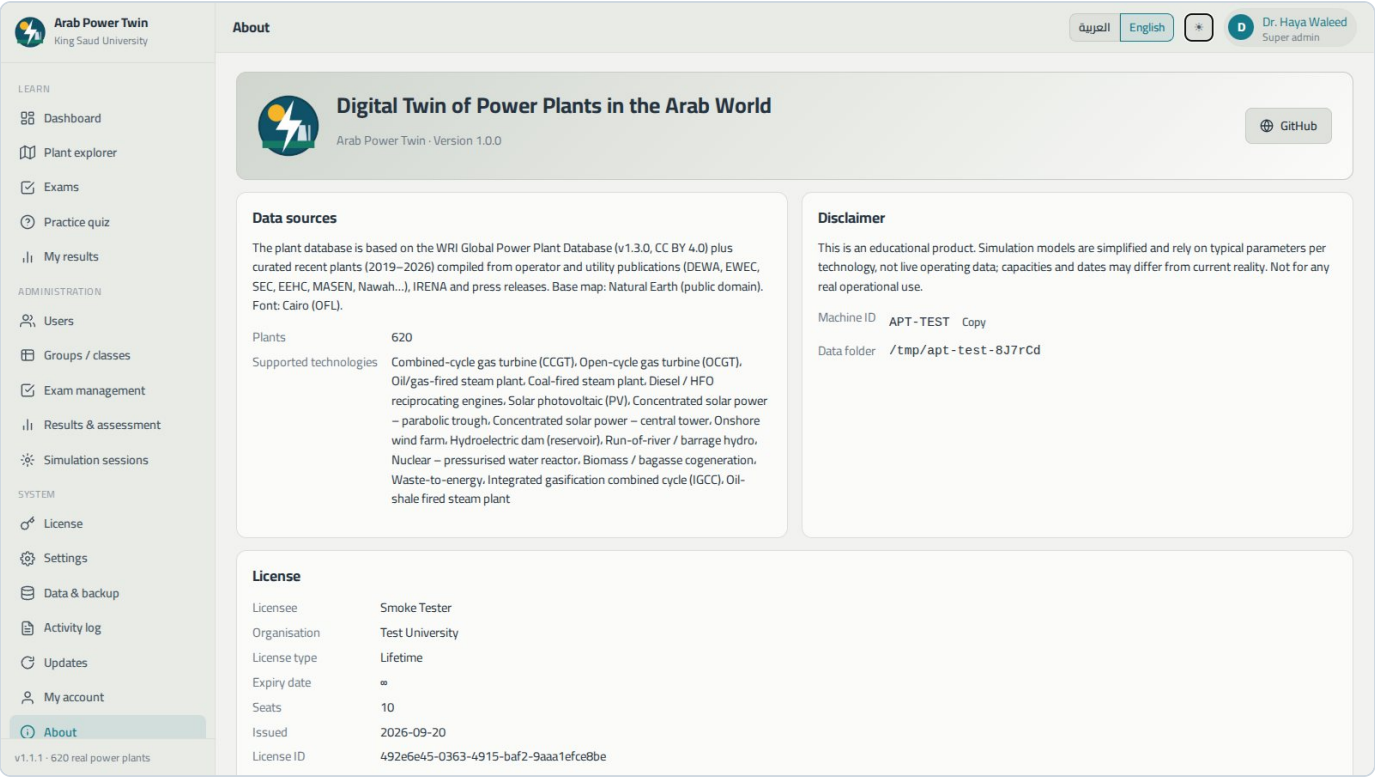


Figure 37: About the program

The page shows the current version, the data sources and their licenses (the WRI Global Power Plant Database, curated additions, the Natural Earth map, the Cairo font), the disclaimer, the machine ID, the data folder and a license summary.

At the bottom is the **Developer** card with Asfan Co. contact details and two buttons that open this manual in Arabic or English. The manual is also available from the “Help” menu at the top of the program window.



Arab Power Twin

King Saud University

LEARN

Dashboard

Plant explorer

Exams

Practice quiz

My results

ADMINISTRATION

Users

Groups / classes

Exam management

Results & assessment

Simulation sessions

SYSTEM

License

Settings

Data & backup

Activity log

Updates

My account

About

الترقية

English

*

D

Dr. Haya Waleed
Super admin

wind farm. Hydroelectric dam (reservoir). Run-of-river / barrage hydro.

Nuclear – pressurised water reactor. Biomass / bagasse cogeneration.

Waste-to-energy. Integrated gasification combined cycle (IGCC). Oil-shale fired steam plant

License

Licensee

Smoke Tester

Organisation

Test University

License type

Lifetime

Expiry date

∞

Seats

10

Issued

2026-09-20

License ID

492e6e45-0363-4915-baf2-9aaa1efce8be

Machine-locked

No

Included modules

Digital twin. Exams & assessment

Included technologies

All technologies

Developer



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Arab Power Twin is developed and distributed by Asfan Co. For enquiries, licensing and technical support contact us by e-mail or WhatsApp.

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User manual

Arabic manual (PDF)

English manual (PDF)



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v1.1.1 - 620 real power plants

Figure 38: The developer card and the user-manual buttons

16 Setting up a university lab

To run the program on several computers in one lab so that the instructor sees every student and their results from any computer:

16.1 Steps

1. Create a shared folder on the university server or the instructor's computer (for example `\\server\ArabPowerTwin`) with read and write permission for the students' Windows accounts.
 2. Install the program on every computer and activate it with the same license key.
 3. On the first computer create the super-admin account, then under Settings → Shared data folder choose the network folder. The current data is moved there.
 4. On the other computers, after activation, change the data folder to the same network folder (from Settings, after creating a temporary account if needed); the administrator and student accounts appear immediately.
 5. Add the students once (manually or from CSV); they can sign in from any computer.
- Every record is stored as a separate file, so several computers can work at the same time safely.
 - License seats are counted per data folder; shared accounts count once.
 - If the shared folder is unreachable the program temporarily works on the local folder and shows a notice on the Data page.

17 Troubleshooting

17.1 Common problems

Problem	Remedy
The 3D scene is black or does not appear	Update the graphics driver and make sure WebGL is not disabled. On weak computers close other programs and reduce the window size.
The simulation is slow	Choose a lower time speed, turn off auto-orbit or use the light theme; very large plants (huge solar and wind farms) are heavier than others.
No update appears	An internet connection is required and the program must be allowed through the firewall. Click "Check for updates" manually.
Cannot add a student: seat limit reached	Suspend old accounts or request a license with more seats.
A plant appears locked	Its technology is not included in the license. Contact the vendor to upgrade.
A student forgot the password	Users → Reset password.
The super-admin password was forgotten	Restore an earlier backup on another computer or contact technical support.
The shared data folder is unreachable	Check the network and permissions; the program works temporarily on the local folder until the connection returns.
"System clock rollback detected"	Set the correct computer date and restart.

17.2 Getting help

Contact Asfan Co. at info@asfanco.com or on WhatsApp [+962 77 614 0404](https://wa.me/962776140404) , stating the program version, the machine ID, the steps that led to the problem and a screenshot if possible.

18.1 Supported technologies

Technology	Short description
Combined-cycle gas turbine (CCGT)	A gas turbine drives a generator and its exhaust raises steam for a second, steam turbine; 55–63% efficiency.
Open-cycle gas turbine (OCGT)	Fast-starting peaking gas turbines with lower efficiency.
Oil/gas-fired steam plant	Large boilers raise steam for steam turbines; historically the most common in the Gulf.
Coal-fired steam plant	As above, fuelled by coal with stockyards and flue-gas treatment.
Diesel / HFO engines	Reciprocating engines for small grids and islands.
Solar photovoltaic	Modules convert irradiance directly into electricity with inverters and transformers.
CSP – parabolic trough	Mirrors focus the sun on a heat-transfer-fluid tube to raise steam, with thermal storage.
CSP – central tower	A field of heliostats tracks the sun and focuses it on a receiver on a tower.
Onshore wind farm	Wind turbines with a power curve that depends on wind speed.
Hydroelectric dam	Dam, reservoir and powerhouse with water turbines; output depends on head and flow.
Run-of-river / barrage hydro	Works on the river flow without a large reservoir.
Nuclear – pressurised water reactor	The reactor heats a primary loop that transfers heat to steam generators.
Biomass	Burning agricultural residues such as sugar-cane bagasse.
Waste-to-energy	Burning municipal waste with advanced flue-gas treatment.
Integrated gasification combined cycle (IGCC)	Fuel gasification followed by a combined cycle.
Oil-shale steam plant	Burning oil shale in special boilers.

18.2 Mouse controls in the 3D scene

Action	Result
Drag with the left button	Orbit the camera around the plant
Mouse wheel	Zoom in and out
Drag with the right button	Pan the camera
"Auto-orbit" button	Automatic tour around the plant

18.3 Glossary

Term	Meaning
Capacity factor	Energy actually generated divided by the energy possible at full capacity all the time.
Availability	The share of time the units are ready to generate.
Grid frequency	50 Hz in most Arab countries and 60 Hz in Saudi Arabia; it drops when generation is short and rises when generation exceeds demand.
Load setpoint	The share of capacity requested from the plant.
Trip	A sudden unit shutdown by protection, vibration or a training scenario.
GWh	Gigawatt-hour = one million kilowatt-hours.