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| **TCID** | **Requirement ID** | **Test Case Title** | **Precondition** | **Test Steps** | **Expected Result** |
| TC-01 | REQ-01 | Create a New User Account | User is on the registration page | 1. Enter valid registration data (username, email, password,location)2. Click "Register" button | Account is created successfully and confirmation shown |
| TC-02 | REQ-02 | User Login with Valid Credentials | User has a registered account | 1. Navigate to login page2. Enter valid username and password3. Click "Login" | User is logged in and redirected to profile dashboard |
| TC-03 | REQ-03 | Reset Forgotten Password | User is on the login page | 1. Click "Forgot Password?" 2. Enter registered email3. Submit reset request | Password reset email is sent and user can reset password |
| TC-04 | REQ-04 | Enforce Secure Authentication | User tries to login | 1. Enter username and password2. Attempt login with invalid password3. Attempt login with valid password | System rejects invalid login and allows valid login only |
| TC-05 | REQ-05 | Update User Password | User is logged in | 1. Navigate to user profile  2. Enter current password  3. Enter new password and confirm4. Save changes | Password is updated and confirmation message shown |
| TC-06 | REQ-06 | Update Personal Information | User is logged in | 1. Go to user profile  2. Modify personal information fields  3. Save changes | Personal information is updated successfully |
| TC-07 | REQ-07 | View Profile Dashboard | User is logged in | 1. Login  2. Navigate to dashboard page | User’s profile dashboard with all relevant info is displayed |
| TC-08 | REQ-08 | Manage Notification Preferences | User is logged in | 1. Go to notification settings  2. Modify preferences  3. Save changes | Notification preferences updated successfully |

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| TC-09 | REQ-09 | Add a New Solar Panel | User is logged in | 1. Go to solar panels page  2. Click "Add New Panel"  3. Enter valid panel data4. Save | New solar panel is added successfully and appears in list |
| TC-10 | REQ-10 | Modify Existing Solar Panel Data | User has at least one panel | 1. Select a solar panel  2. Edit panel details  3. Save changes | Solar panel data updated and changes reflected immediately |
| TC-11 | REQ-11 | Delete a Solar Panel | User has at least one panel | 1. Select a solar panel2. Click "Delete"3. Confirm deletion | Solar panel is deleted and removed from the list |
| TC-12 | REQ-12 | Automatic Update of Solar Energy Chart | User modifies solar panels | 1. Add, modify, or delete a solar panel2. View energy production chart | Solar energy production chart updates automatically |
| TC-13 | REQ-13 | Add a New Electrical Device | User is logged in | 1. Go to device management2. Click "Add Device"3. Enter device info4. Save | Device is added and shown in the device list |
| TC-14 | REQ-14 | Edit Electrical Device Data | User has devices added | 1. Select device2. Edit device info3. Save | Device data updates successfully |
| TC-15 | REQ-15 | Delete Electrical Device | User has devices added | 1. Select device2. Click "Delete"3. Confirm deletion | Device is deleted and removed from the list |
| TC-16 | REQ-16 | Auto-update Electricity Consumption Chart | User modifies devices | 1. Add, edit, or delete device2. Check consumption chart | Chart updates automatically to reflect changes |

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| TC-17 | REQ-17 | Validate Numerical Inputs | User enters numerical data | 1. Input valid number within range2. Input invalid number out of range3. Input text instead of number | Valid inputs accepted; invalid inputs rejected with error message |
| TC-18 | REQ-18 | View Energy Stats on Dashboard | User is logged in and has both solar panels and devices added | 1.Log in to the system  2.Open the dashboard | System automatically calculates and displays:  -Solar energy production  -Total energy consumption  -A visual comparison between production and consumption |
| TC-19 | REQ-19 | Display Energy Production vs Consumption Chart | User is logged in and has both solar panels and devices added | 1.Log in to the system  2.Open the dashboard | Chart correctly displays production vs consumption |
| TC-20 | REQ-20 | Select Time Filter for Energy Chart | Data available | 1. Choose time filter (daily, weekly, monthly)2. View updated chart | Chart updates according to selected time filter |
| TC-21 | REQ-21 | Generate Daily/Weekly/Monthly Reports | Data available | 1. Select report type (daily, weekly, monthly)2. Generate report | Detailed report for selected period is generated |
| TC-22 | REQ-22 | View Reports | Consumption data present | 1. Navigate to dashboard  2. Select report | report is displayed correctly |
| TC-23 | REQ-23 | Provide Energy Saving Recommendations | Data available | 1. Open dashboard 2.select recommendations section  3. Review tips | Energy saving recommendations are displayed clearly |

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| TC-24 | REQ-24 | Process Requests Quickly | System running normally | 1. Perform multiple requests simultaneously | System responds promptly without delays |
| TC-25 | REQ-25 | Encrypt Sensitive Information | Sensitive data saved | 1. Save password or sensitive info2. Check storage method | Data is securely encrypted |
| TC-26 | REQ-26 | Handle Growing Users and Events | System under load | 1. Simulate high user load2. Monitor system stability | System maintains performance under load |
| TC-27 | REQ-27 | Ensure 24/7 Availability with Minimal Downtime | System operational | 1. Monitor uptime over 24 hours | System remains available with minimal downtime |
| TC-28 | REQ-28 | Allow Continuous Operations without Interruptions | User actively using system | 1. Perform continuous operations2. Monitor for interruptions | No interruptions or data loss during operations |
| TC-29 | REQ-29 | Display Main Dashboard | User logged in | 1. Log in2. Open main dashboard | Main dashboard with key user info is displayed |
| TC-30 | REQ-30 | Display Top Energy Consuming Devices | Devices with consumption data | 1. Open dashboard 2.Nevigate to devices analysis  3.View top consuming devices | Devices are correctly listed in descending order of consumption |

Table 32:execution test cases