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| **Use case 1: Input number of households to enter information (Extended)** | |
| **Actors** | User |
| **Description** | To enter the total number of household that the user want to input information |
| **Data** | An integer |
| **Stimuli** | User input the number of households to be added |
| **Response** | The system invoke the function “input household information” exactly the same times |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs a negative number -> System inform with an error * user inputs data that is not a number -> System inform with an error |

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| **Use case 2: Input household information (Extended)** | |
| **Actors** | User |
| **Description** | To enter information of a household |
| **Data** | Household id: hid (String)  House owner’s name: name (String)  Household’s address: address (String)  Payment status: payment\_status (to record the number of months that the household have not pay the bill: an integer from 0-2) (default = 0)  Area: area (Integer)  Monthly’s consumption: monthly\_consumption (default = 0) |
| **Stimuli** | User input a household’s basic information |
| **Response** | - The system fetch household’s information and export it to the text file “household.txt”  - Automatically create a Meter object with an attribute hid is the household id |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs hid as a negative number or NaN -> System inform with error * user inputs cid as a negative number or NaN -> System inform with error |

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| **Use case 3: Update household information (Extended)** | |
| **Actors** | User |
| **Description** | To update a household’s information with a specific household id (This function does not update payment status) |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the meter to be updated |
| **Response** | The engine invoke the function to update the household with the household id specified |
| **Pre-conditions** | The hid must exist in the household\_ids[] list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 4: Delete household (Extended)** | |
| **Actors** | User |
| **Description** | To delete a household’s object with a specific household id |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the meter to be deleted |
| **Response** | The engine remove the household from the households list, household\_id from the household\_ids[] list, and also the meter with that hid |
| **Pre-conditions** | The hid must exist in the household\_ids[] list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 5: Update meter information (Extended)** | |
| **Actors** | User |
| **Description** | To update a meter’s information with a specific household id |
| **Data** | A string representing the household id, an integer represents the year, an integer (1→12) represents the month, an integer represents the measurement |
| **Stimuli** | System find the meter with the hid provided then update the information of that meter |
| **Response** | The engine invoke the function to update the meter with the household id specified, and update the monthly consumption of the household with that household id |
| **Pre-conditions** | - The measurement of the future must exceed the measurement of the past |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 6: Update payment status (Extended)** | |
| **Actors** | User |
| **Description** | To update payment status of a specific household |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the meter to be updated |
| **Response** | The engine update the payment status of the household with the household id specified |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 7: Input types of price (Extended)** | |
| **Actors** | User |
| **Description** | To input types of price |
| **Data** | An integer is the number of types of price, and input the prices for each type |
| **Stimuli** | Ask user to input value of prices for each type |
| **Response** | The engine update types of prices and store in a prices array, which consist many tuples (type, value), and also store the data into file “prices.txt” |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 8: Auto-increase payment status (Extended)** | |
| **Actors** | User |
| **Description** | To auto increase payment status of all households (+1) when move to next month payment deadline |
| **Data** | - |
| **Stimuli** | User activate the function to increase all payment status by 1 |
| **Response** | All payment status of all households +1  All households that have payment status > 2 → get deleted |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |

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| **Use case 9: Display household information (Extended)** | |
| **Actors** | User |
| **Description** | To display information of a specific household |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the household to be displayed |
| **Response** | The engine display the household info: hid, name, payment status, area, monthly consumption |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 12: Display historical record of a specific household (Extended)** | |
| **Actors** | User |
| **Description** | To display historical record of a specific household |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the household whose payment history to be displayed |
| **Response** | The engine display the household historical record: month, year, payment value |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 13: Calculate consumption and payment (Extended)** | |
| **Actors** | User |
| **Description** | To calculate consumption and payment of a specific household |
| **Data** | A string representing the household id, an integer represent the month, an integer represent the year |
| **Stimuli** | User input the hid of the household whose consumption and payment for a month in a year needs to be calculated |
| **Response** | The engine compress the data provided into a tuple (hid, month, year, electric consumption, payment) and store it into a payment[] list |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 14: Plot electric consumption of a specific household (Extended)** | |
| **Actors** | User |
| **Description** | To plot the consumption of a specific household on a figure |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the household whose consumption needs to be plotted |
| **Response** | The engine plot the figure using matplotlib and the data it has |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 15: Plot electric consumption of an area (Extended)** | |
| **Actors** | User |
| **Description** | To plot the consumption of a specific area on a figure |
| **Data** | An integer representing the area code |
| **Stimuli** | User input the area whose consumption needs to be plotted |
| **Response** | The engine plot the figure using matplotlib and the data it has |
| **Pre-conditions** | The area must exist |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the area that does not exist -> System inform with error |

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| **Use case 16: Plot electric costs of a specific household (Extended)** | |
| **Actors** | User |
| **Description** | To plot the costs of a specific household on a figure |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the household whose costs needs to be plotted |
| **Response** | The engine plot the figure using matplotlib and the data it has |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 17: Plot electric costs of a specific area (Extended)** | |
| **Actors** | User |
| **Description** | To plot the costs of a specific household on a figure |
| **Data** | A string representing the household id |
| **Stimuli** | User input the hid of the household whose costs needs to be plotted |
| **Response** | The engine plot the figure using matplotlib and the data it has |
| **Pre-conditions** | The hid must exist in the household\_ids list |
| **Post-conditions** | - |
| **Additional scenarios** | * user inputs the hid that does not exist -> System inform with error |

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| **Use case 18: List households (Extended)** | |
| **Actors** | User |
| **Description** | To list all household along with its attributes (id, name, address) |
| **Data** | - |
| **Stimuli** | User invoke the engine to list |
| **Response** | The engine list all households existing |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |

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| **Use case 19: List prices (Extended)** | |
| **Actors** | User |
| **Description** | To list all areas and their corresponding electric price |
| **Data** | - |
| **Stimuli** | User invoke the engine to list |
| **Response** | The engine list all prices existing |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |

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| **Use case 18: List paid households (Extended)** | |
| **Actors** | User |
| **Description** | To list all household that paid all bills along with its attributes |
| **Data** | - |
| **Stimuli** | User invoke the engine to list |
| **Response** | The engine list all households with payment\_status = 0 |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |

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| **Use case 18: List not-yet-paid households (Extended)** | |
| **Actors** | User |
| **Description** | To list all household has unpaid bills along with its attributes |
| **Data** | - |
| **Stimuli** | User invoke the engine to list |
| **Response** | The engine list all households with payment\_status > 0 |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |

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| **Use case 18: Print bill (Extended)** | |
| **Actors** | User |
| **Description** | To print a bill for a specific household in a specific month of a specific year |
| **Data** | Household id, month, year |
| **Stimuli** | User ask the engine to print a bill for a household in a month of a year |
| **Response** | The engine print necessary information for a bill (id, name, address, previous-meter-measurement, present-meter-measurement, electric consumption, cost) |
| **Pre-conditions** | - |
| **Post-conditions** | - |
| **Additional scenarios** |  |