NOMENCLATURE

Acronyms

ADMM	Alternating direction method of multipliers.
DN	Distribution network.
DSM	Demand-side management.
EV	Elecric vehicle.
ESS	Energy storage system.
FCM	Fuzzy C means.
GA	Genetic algorithm.
GBD	Generalized Bendeers decomposition.
HEMS	Home energy management system.
HVAC	Heat, ventilation and air conditioning.
IoT	Internet of things.
KKT	Karush-Kuhn-Tucker optimality conditions.
LAN	Local area network.
LMP	Locational marginal price.
MILP	Mixed-integer linear programming.
PV	Photovoltaic.
SOC	State of charge.
SVG	Static var generator.
WT	Wind turbine.

Index

c	Index of customer.
g	Index of generator.
i, j	Index of node/bus.
k	Index of cluster center.
s	Index of scenario.
t	Index of time.
v	Index of SVG.
ϕ	Index of phase.

Sets

$\mathcal{C}$	Set of customers.
$\mathcal{G}_j$	Set of generators at bus j.
$\mathcal{L}$	Set of line segments.
$\mathcal{N}$	Set of nodes.
$\mathcal{N}_j$	Set of all buses located strictly downstream of bus j.
$\mathcal{T}$	Set of time.
$\mathcal{V}_j$	Set of SVG at bus j.
$\mathcal{S}$	Set of scenarios.
$\mathcal{S}_K$	Set of reduced scenarios.
$\mathcal{T}^{ex}$	Set of time slots when the node power exceeds the limit.

Parameters

$d_{s,k}$	Euclidean distance between scenario s and center k.
e	EV's energy consumption (kWh per km).
$E^{ESS,max}$	ESS's battery capacity.
$E^{EV,max}$	EV's battery capacity.
$\mathbf{h}_j^{\phi}$	3-phase households at node j.
k	heat flux-to-temperature conversion coefficient.
LMP^t	LMP at time slot t.
m	EV's daily driving distance.
$\mathbf{M}_{i\to j}^{P}$	3-phase resistance of line segment $l_{i\to j}$.
$\mathbf{M}_{i\to j}^{Q}$	3-phase reactance of line segment $l_{i\to j}$.
$\mathbf{P}_{i\to j}^{max}$	3-phase maximum active powers flow of line segment $l_{i\to j}$.
$\mathbf{P}_{swing}^{max}$	3-phase maximum active powers flow from the transmission grid to DN.
$\mathbf{P}_{j,g}^{\phi,t,pre}$	3-phase predicted output values of the g-th renewable energy generator at node j.
$\mathbf{P}_{j,g}^{\phi,t,actual}$	3-phase actual output values of the g-th renewable energy generator at node j.
PF_c	Power factor of customer c.
$\mathbf{Q}_{i\to j}^{max}$	3-phase maximum reactive powers flow of line segment $l_{i\to j}$.
$\mathbf{Q}_{swing}^{max}$	3-phase maximum reactive powers flow from the transmission grid to DN.
$\mathbf{q}_{j,v}^{\phi,t}$	Output of SVG at node j,
$p_c^{PV,t}$	PV output power at time slot t.
$p_c^{fix,t}$	Fixed load power of customer c at time slot t.
$p^{ESS,max}$	Maximum output power of ESS.
$p^{ESS,min}$	Minimum output power of ESS.
$p^{EV,max,ch}$	Maximum charing power of EV.
$p^{EV,max,d}$	Maximum discharing power of EV.
$p^{EV,min,ch}$	Minimum charing power of EV.
$p^{EV,min,d}$	Minimum discharing power of EV.
$p^{HVAC,max}$	Maximum power of HVAC.
$p^{HVAC,min}$	Minimum power of HVAC.
$p_{j,g,s}^{\phi,t}$	Output of renewable energy in scenario s.
$SOC^{ESS,max}$	Maximum SOC of ESS.
$SOC^{ESS,min}$	Minimum SOC of ESS.
$SOC^{ESS,in}$	Initial SOC of ESS.
$SOC^{EV,expect}$	Customer expected SOC of EV.
$SOC^{EV,max}$	Maximum SOC of EV.
$SOC^{EV,min}$	Minimum SOC of EV.
$\mathbf{tag}^{\phi,t}$	Tap position of the interconnecting transformer at time slot t.
t^{back}	EV's arrival time.
t^{depart}	EV's departure time.
$T_c^{set,t}$	Set temperature at time slot t.
$T_c^{out,t}$	Outdoor temperature at time slot t.
T^{max}	Maximum temperature.
T^{min}	Minimum temperature.
$\mathbf{v}_{swing}^{\phi,t}$	3-phase voltage at the swing node.
$\mathbf{v}_i^{max}$	3-phase maximum voltage at node i.
$\mathbf{v}_i^{min}$	3-phase minimum voltage at node i.
α	Temperature sensitivity of customer.
β	Temperature-to-heat flux conversion coefficient.
ΔT_c^t	Difference between outdoor and indoor temperature at time slot t.
γ	conversion coefficient between HVAC power and released heat flux.
η^{ESS}	ESS discharging efficiency.
η^{EV}	EV discharging efficiency.
θ^{EV}	EV's battery degradation cost.
θ^{ESS}	ESS's battery degradation cost.

Variables

$H_c^{ex,t}$	Heat flux exchange with outdoor at time slot t.
$H_c^{HVAC,t}$	Heat flux of HVAC at time slot t.

o_k	The k-th cluster center.
$p_c^{ESS,t}$	ESS discharging power at time t.
$p_c^{EV,t,ch}$	EV charging power at time t.
$p_c^{EV,t,d}$	EV discharging power at time t.
$p_c^{HVAC,t}$	HVAC power at time t.
$p_{j,g}^{\phi,t}$	Power of g-th generator at node j.
$\mathbf{p}_j^{\phi,t,max}$	3-phase maximum power of node j at time t.
$\mathbf{p}_{j,c}^{\phi,t}$	3-phase active power of customer c at node j at time slot t.
$\mathbf{P}_{i\to j}^{\phi,t}$	3-phase active powers flow of line segment $l_{i\to j}$.
$\mathbf{P}_{j\to k}^{\phi,t}$	3-phase active powers flow of line segment $l_{j\to k}$.
$\mathbb{P}_k$	probability of occurrence of k-th cluster center.
$\mathbf{Q}_{i\to j}^{\phi,t}$	3-phase reactive powers flow of line segment $l_{i\to j}$.
$\mathbf{Q}_{j\to k}^{\phi,t}$	3-phase reactive powers flow of line segment $l_{j\to k}$.
$\mathbf{q}_{j,c}^{\phi,t}$	3-phase reactive power of customer c at node j at time slot t.
$T_c^{in,t}$	Indoor temperature of customer c at time slot t.
$u_{s,k}$	Membership degree between scenario s and the k-th cluster center.
$\mathbf{v}_j^{\phi,t}$	3-phase voltage at node j at time slot t.
$y_j^{\phi,t}$	Dual variable of j-th node's slack problem.
$\overline{\boldsymbol{\delta}_c^{p,t}}$	Complementary slackness variable of maximum HVAC power constraint.
$\overline{\boldsymbol{\delta}_c^{T,t}}$	Complementary slackness variable of maximum temperature power constraint.
$\underline{\boldsymbol{\delta}_c^{p,t}}$	Complementary slackness variable of minimum HVAC power constraint.
$\underline{\boldsymbol{\delta}_c^{T,t}}$	Complementary slackness variable of minimum temperature power constraint.
$\overline{\boldsymbol{\lambda}_c^{p,t}}$	Lagrange multipliers corresponding to the upper bound constraints on HVAC power.
$\overline{\boldsymbol{\lambda}_c^{T,t}}$	Lagrange multipliers corresponding to the upper bound constraints on indoor temperature.
$\underline{\boldsymbol{\lambda}_c^{p,t}}$	Lagrange multipliers corresponding to the lower bound constraints on HVAC power temperature.
$\underline{\boldsymbol{\lambda}_c^{T,t}}$	Lagrange multipliers corresponding to the lower bound constraints on indoor temperature.
$\epsilon_j^{\phi,t}$	Variable of slack problem of node j at time slot t.
Π_j^*	Optimal value of the slack problem's dual problem of node j.
$\Pi_{j,c}^*$	Optimal value of the slack problem's dual problem of customer c at node j.
$\boldsymbol{\pi}_{j,c}^{ESS,\phi,t}$	Simplex multiplier corresponding to the discharging power of ESS.
$\boldsymbol{\pi}_{j,c}^{EV,\phi,t,ch}$	Simplex multiplier corresponding to the charging power of EV.
$\boldsymbol{\pi}_{j,c}^{EV,\phi,t,d}$	Simplex multiplier corresponding to the discharging power of EV.
$\boldsymbol{\pi}_{j,c}^{HVAC,\phi,t}$	Simplex multiplier corresponding to the power of HVAC.
$\mu^{t,ch}$	Indicator of EV's charging status at time slot t.
$\mu^{t,d}$	Indicator of EV's discharging status at time slot t.

Function

$\mathscr{F}$	The Lagrangian function of the slave problem in the two-layer Stackelberg game of HEMS.
$\mathscr{L}$	The objective function part of the Lagrangian function for the slave problem in the two-layer Stackelberg game of HEMS.
$\mathscr{G}$	The constraints part of the Lagrangian function for the slave problem in the two-layer Stackelberg game of HEMS.
$\mathscr{J}$	The objective function of FCM.

Appendix A. Two-Layer Stackelberg Game of HEMS-Equivalent KKT Optimality Conditions

As mentioned in Section VIII, to facilitate the derivation of the KKT optimality conditions, we reformulate the lower-level problem in matrix form, where the objective function can be rewritten as:

$$\min \mathscr{F}(\mathbf{p}_c^{HVAC,t}) = \sum_{t\in\mathcal{T}} \left[\alpha_c^t\right]_{1\times 24} \cdot \left[\| \left[T_c^{in,t}\right]_{1\times 24}^T - \left[T_c^{set,t}\right]_{1\times 24}^T \|^2\right] \tag{A1}$$

where $\left[\alpha_c^t\right]$, $\left[T_c^{in,t}\right]$, and $\left[T_c^{set,t}\right]$ are 1×24 vectors, representing the customer's temperature sensitivity, indoor temperature, and expected temperature settings, respectively, over a 24-hour period.

The Lagrangian function of the slave problem $\mathscr{L}$ can be expressed as:

$$\begin{aligned}
&\mathop{\mathscr{L}}_{t\in\mathcal{T}}(\mathbf{p}_c^{HVAC,t}, \underline{\boldsymbol{\lambda}_c^{p,t}}, \overline{\boldsymbol{\lambda}_c^{p,t}}, \underline{\boldsymbol{\lambda}_c^{T,t}}, \overline{\boldsymbol{\lambda}_c^{T,t}}) = \mathop{\mathscr{F}}_{t\in\mathcal{T}}(\mathbf{p}_c^{HVAC,t}) \\
&+ \left[\underline{\boldsymbol{\lambda}_c^{p,t}} \cdot (\left[p^{HVAC,min}\right]_{1\times 24}^T - \left[p_c^{HVAC,t}\right]_{1\times 24}^T)\right] \\
&+ \left[\overline{\boldsymbol{\lambda}_c^{p,t}} \cdot (\left[p_c^{HVAC,t}\right]_{1\times 24}^T - \left[p^{HVAC,max}\right]_{1\times 24}^T)\right] \\
&+ \left[\underline{\boldsymbol{\lambda}_c^{T,t}} \cdot (\left[T^{min}\right]_{1\times 24}^T - \left[T_c^{in,t}\right]_{1\times 24}^T)\right] \\
&+ \left[\overline{\boldsymbol{\lambda}_c^{T,t}} \cdot (\left[T_c^{in,t}\right]_{1\times 24}^T - \left[T^{max}\right]_{1\times 24}^T)\right]
\end{aligned} \tag{A2}$$

where $\underline{\boldsymbol{\lambda}_c^{p,t}}$, $\overline{\boldsymbol{\lambda}_c^{p,t}}$, $\underline{\boldsymbol{\lambda}_c^{T,t}}$, and $\overline{\boldsymbol{\lambda}_c^{T,t}}$ are 1×24 vectors, denoting the Lagrange multipliers for each of the 24 time slots.

According to the KKT optimality conditions, the necessary conditions for obtaining the optimal solution are:

$$\frac{\partial \mathscr{L}}{\partial(\mathbf{p}_c^{HVAC,t})} = \frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})} + \frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})} = 0 \tag{A3}$$

where $\mathscr{G}$ represents the inequality constraints of the slave problem, which are constraints(58), (59).

For the convenience of the following derivation, we will express $\frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})}$ and $\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})}$ in the form of 1×24 matrices as shown below.

$$\frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})} = \sum_{t\in\mathcal{T}} \left[\frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})}\right]_{1\times 24} \quad \text{(A4)}$$

$$\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})} = \sum_{t\in\mathcal{T}} \left[\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})}\right]_{1\times 24} \quad \text{(A5)}$$

The expression for $\left[\frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})}\right]$ is shown below:

$$\left[\frac{\partial \mathscr{F}}{\partial(\mathbf{p}_c^{HVAC,t})}\right] = 2\left[\alpha_c^t\right]_{1\times 24} \odot \left[\left\|\left[T_c^{in,t}\right]_{1\times 24} - \left[T_c^{set,t}\right]_{1\times 24}\right\|\right] \odot \left[\frac{\partial T_c^{in,t}}{\partial(p_c^{HVAC,t})}\right]_{1\times 24} \quad \text{(A6)}$$

To facilitate subsequent derivations, we express the partial derivative operations in the following matrix form:

$$\frac{\partial}{\partial(\mathbf{p}_c^{HVAC,t})} = \left[\frac{\partial}{\partial(p_c^{HVAC,1})} \cdots \frac{\partial}{\partial(p_c^{HVAC,t})} \cdots \frac{\partial}{\partial(p_c^{HVAC,24})}\right]_{1\times 24} \quad \text{(A7)}$$

The vector $\mathbf{T}_{j,c}^{in,t}$ can be expanded as:

$$\mathbf{T}_c^{in,t} = \begin{bmatrix} T_c^{in,1} + k[\beta(T_c^{out,1} - T_c^{in,1}) - \gamma p_c^{HVAC,1}] \\ \cdots \\ T_c^{in,t} + k[\beta(T_c^{out,t} - T_c^{in,t}) - \gamma p_c^{HVAC,t}] \\ \cdots \\ T_c^{in,24} + k[\beta(T_c^{out,24} - T_c^{in,24}) - \gamma p_c^{HVAC,24}] \end{bmatrix}^T_{24\times 1} \quad \text{(A8)}$$

Due to the temporal coupling of heat transfer effects, the indoor temperature at a given time slot is related to the HVAC power consumption of all previous time slots, which can be expressed as a functional relationship.

$$T_c^{in,t} = f(p_c^{HVAC,1}, p_c^{HVAC,2}, ..., p_c^{HVAC,t-1}) \quad \text{(A9)}$$

Then, the partial derivative of the indoor temperature $\mathbf{T}_c^{in,t}$ with respect to the decision variable $\mathbf{p}_c^{HVAC,t}$ can be obtained for each time slot as:

$$\mathbf{T}_c^{in,t} \otimes \frac{\partial}{\partial(\mathbf{p}_{j,c}^{HVAC,t})} = -\begin{bmatrix} \gamma & \cdots & (1-k\beta)\gamma \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \gamma \end{bmatrix}^T_{24\times 24} \quad \text{(A10)}$$

$$\mathcal{CO} = \sum_{t\in\mathcal{T}} \mathbf{T}_c^{in,t} \otimes \frac{\partial}{\partial(\mathbf{p}_{j,c}^{HVAC,t})} = - \begin{bmatrix} \sum_{t\in\mathcal{T}}(\gamma & \cdots & (1-k\beta)\gamma) \\ \sum_{t\in\mathcal{T}}(\vdots & \ddots & \vdots) \\ \sum_{t\in\mathcal{T}}(0 & \cdots & \gamma) \end{bmatrix}^T$$
$$= -\begin{bmatrix} \sum_{t=1}(\gamma + (24-1)(1-k\beta)\gamma) \\ \cdots \\ \sum_{t}(\gamma + (24-t)(1-k\beta)\gamma) \\ \cdots \\ \sum_{t=24}(\gamma + (24-24)(1-k\beta)\gamma) \end{bmatrix}^T = \left[\frac{\partial T_c^{in,t}}{\partial(p_c^{HVAC,t})}\right]_{1\times 24} \quad \text{(A11)}$$

where the matrix in A10 has diagonal elements of γ, lower triangular elements of 0, and upper triangular elements of $(1-k\beta)\gamma$. The coefficient of the partial derivative of indoor temperature with respect to HVAC power at each time slot t is the sum of the elements in the t-th row of the matrix, denoted as $\mathcal{CO}$.

Similarly, taking the partial derivative of the inequality constraints with respect to the decision variables yields the mathematical expression of $\left[\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})}\right]$:

$$\left[\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})}\right] = -\begin{bmatrix} \underline{\lambda_c^{p,1}} \\ \cdots \\ \underline{\lambda_c^{p,24}} \end{bmatrix}^T_{24\times 1} + \begin{bmatrix} \overline{\lambda_c^{p,1}} \\ \cdots \\ \overline{\lambda_c^{p,24}} \end{bmatrix}^T_{24\times 1} - \mathcal{CO} \odot \begin{bmatrix} \underline{\lambda_c^{T,1}} \\ \cdots \\ \underline{\lambda_c^{T,24}} \end{bmatrix}^T_{24\times 1} + \mathcal{CO} \odot \begin{bmatrix} \overline{\lambda_c^{T,1}} \\ \cdots \\ \overline{\lambda_c^{T,24}} \end{bmatrix}^T_{24\times 1} \quad \text{(A12)}$$

Substituting $\left[\frac{\partial T_c^{in,t}}{\partial(p_c^{HVAC,t})}\right]$ and $\left[\frac{\partial \mathscr{G}}{\partial(\mathbf{p}_c^{HVAC,t})}\right]$ into the Lagrangian equation yields the mathematical expression for the KKT optimality conditions. By incorporating these into the master problem, the two-layer Stackelberg game can be transformed into a single-level optimization problem.

Appendix B. Parameter Settings in Numerical Tests

A. HVAC Parameter Settings

TABLE B1
HVAC PARAMETER SETTINGS

Parameter	Value	Parameter	Value
$k(°C \cdot m^2/kW)$	1	$p^{HVAC,max}(kW)$	2
$\beta(kW/°C \cdot m^2)$	1.2	$T^{min}(°C)$	22
$\gamma(1/m^2)$	6	$T^{max}(°C)$	26
$p^{HVAC,min}(kW)$	0.5		height

As shown in table B1, where k is the heat flux-to-temperature conversion coefficient for changes in heat flux inside the house, with units of m, set to 1 in this paper. β is the temperature-to-heat flux conversion coefficient for the temperature difference between indoors and outdoors, which is related to the size and material of the house, also with units of m, set to 1.2 here. γ is the conversion coefficient between HVAC power and released heat flux, with units of m, the numerical values is 6. The power range for the HVAC system is between 0.5kW and 2kW, while the temperature range is between 22$°C$ and 26$°C$.

B. EV Parameter Settings

Table B2 lists the parameters related to the EV. The power range for both charging and discharging of EV are set between 0 and 6 kW, with efficiency of 90%. The customer's expected EV SOC value is 0.95, EV's battery capacity $E^{EV,max}$ is 60 kWh, with an energy consumption e of 0.25 kWh per km. The battery degradation cost θ^{EV} is 0.01 USD per kW.

C. ESS Parameter Settings

The parameters related to the ESS are listed in table B3. The discharge power range is 0-5 kW, with an efficiency of 90% and a battery capacity $E^{ESS,max}$ of 30 kWh. The battery degradation cost of ESS θ^{ESS} is 0.01 USD per kW.

TABLE B2
EV PARAMETER SETTINGS

Parameter	Value	Parameter	Value
$p^{EV,min,ch}(kW)$	0	$SCO^{EV,min}$	0.0
$p^{EV,max,ch}(kW)$	6	$SCO^{EV,expect}$	0.95
$p^{EV,min,c}(kW)$	0	$E^{EV,max}(kWh)$	60
$p^{EV,max,c}(kW)$	6	$e(kWh/km)$	0.25
$\eta^{EV}(\%)$	90%	$\theta^{EV}(\$/kW^2)$	0.01
$SOC^{EV,max}$	0.95		

TABLE B3
ESS PARAMETER SETTINGS

Parameter	Value	Parameter	Value
$p^{ESS,min}(kW)$	0	$\theta^{ESS}(\$/kW^2)$	0.01
$p^{ESS,max}(kW)$	5	$SOC^{ESS,min}$	0.0
$\eta^{ESS}(\%)$	90%	$SOC^{ESS,max}$	1.0
$E^{ESS,max}(kWh)$	30		

D. SADN Parameter Settings

TABLE B4
SADN PARAMETER SETTINGS

Parameter	Value	Parameter	Value
v_i^{min}	0.95	P_{swing}^{min}	1.5
v_i^{max}	1.05	Q_{swing}^{max}	0.75
$P_{i\to j}^{max,3\phi}$	1.5	$q_{83}^{\phi,t}$	0.2
$Q_{i\to j}^{max,3\phi}$	0.75	$q_{88}^{a,t}$	0.05
$P_{i\to j}^{max,\phi}$	0.75	$q_{90}^{b,t}$	0.05
$Q_{i\to j}^{max,\phi}$	0.375	$q_{92}^{c,t}$	0.05
$tag^{\phi,t}$	4		

Table B4 contains parameters of SADN, all in per-unit values. The base value for voltage is 480 V, and the base value for power is 1 MVA. To ensure the reliability of electricity supply, the node voltage fluctuation must not exceed 5%. Therefore, parameters v_i^{min} and v_i^{max} are set to 0.95 and 1.05, respectively. In the SADN, there are both 3-phase and single-phase transmission lines. The active power limit $P_{i\to j}^{max,3\phi}$ for the 3-phase transmission lines is 1.5, and the reactive power limit $Q_{i\to j}^{max,3\phi}$ is 0.75. For the single-phase transmission lines, the active power limit $P_{i\to j}^{max,\phi}$ is 0.75, and the reactive power limit $Q_{i\to j}^{max,\phi}$ is 0.375. The transformer's active power limit per phase P_{swing}^{min} is 1.5, and the reactive power limit Q_{swing}^{max} is 0.75. The transformer tags are set to 4 for all 3 phases, the voltage value on the low-voltage side is 1.025 according to (11). A 3-phases SVG is aggregated at node 83, capable of supplying 0.2 reactive power per phase. At nodes 88, 90, and 92, the single-phase SVGs can supply 0.05 reactive power to phases a, b, and c, respectively.

E. Node 76 A-Phase Customers Parameter Settings

Table B5 lists the parameters for the six households of node 76 A-phase, as generated in Section **??**. These parameters include the EV return time t^{back}, EV departure time t^{depart}, daily driving distance m, indoor temperature setting T^{set}, and sensitivity to temperature α. Due to the varying electricity usage behavior of the customers on the previous day, the remaining energy in the ESS also differs.

TABLE B5
PARAMETER SETTINGS OF HOUSEHOLD AT NODE 76

	t^{back}	t^{depart}	T^{set}	α	m	$SCO^{EV,t^{back}}$	$SOC^{ESS,in}$
H1	6 p.m.	9 a.m.	$24°C$	0.94	111.75 km	0.484	0.500
H2	7 p.m.	10 a.m.	$24.5°C$	1.08	19.91 km	0.867	0.250
H3	5 p.m.	10 a.m.	$24.7°C$	1.01	126.61 km	0.423	0.333
H4	5 p.m.	9 a.m.	$24.4°C$	1.05	61.52 km	0.694	0.417
H5	5 p.m.	9 a.m.	$24.2°C$	0.98	35.99 km	0.801	0.200
H6	6 p.m.	10 a.m.	$24.6°C$	0.96	168.06 km	0.250	0.583

F. Households Location in SADN

The aggregation of households at each node in SADN is shown in table B6, where phase A aggregates 71 households, phase B aggregates 49 households, and phase C aggregates 60 households.

TABLE B6
HOUSEHOLDS IN SADN

Phase A		Phase B		Phase C	
Node name	Number of households	Node name	Number of households	Node name	Number of households
1	2	2	1	4	2
7	1	12	1	5	1
9	2	22	2	6	2
11	2	35	1	34	2
10	1	38	1	16	2
19	2	39	1	17	1
20	2	43	2	24	2
28	2	47	2	31	1
33	2	48	4	30	2
29	2	49	3	32	1
35	1	56	1	41	1
37	2	58	1	47	2
42	1	59	1	48	4
45	1	64	4	49	2
47	2	65	2	50	2
46	1	76	5	62	2
48	3	77	2	65	3
49	2	86	1	66	4
51	1	80	2	73	2
52	2	87	2	76	5
53	2	90	2	74	2
55	1	95	1	75	2
60	1	96	1	84	1
63	2	99	2	83	1
65	2	106	2	85	2
68	1	107	2	92	2
69	2			100	2
70	1			102	1
71	2			103	2
76	6			104	2
79	2				
82	2				
88	2				
94	2				
98	2				
109	2				
111	1				
112	1				
113	2				
114	1				