HOW TO USE THE SMART TECHNOLOGY ECONOMICS LAB

Smart City Dispatch* | *Version 7

1. Choose a starting point

Use the scenario selector or start with Original Project. Read the description directly below the selector and expand What this scenario assumes for live figures. Open the detailed results disclosure for sensitivity and water economics. Adjust these results reveals and marks inputs without moving the page. Sourced case-study facts and illustrative input estimates are distinguished. The Advanced Pilot note includes a feedback email address. Select Start guided tour for seven short steps; dismiss or restart it at any time.

2. Location, tariff and sizing

Choose a state and residential or commercial sector. The State average electricity rate (2025 EIA) is an editable reference, not a contract tariff. Enter your actual rate in $/kWh or use the state benchmark button. Select Scale annual benefits with asset count when estimates should grow with project size. Choose Keep total benefits fixed when annual estimates already describe the entire project. Per-asset expenses always follow quantity. Fixed setup and fixed marketing costs stay fixed.

3. Configure the horizon and cash inputs

Select a horizon from 10, 15, 20, 25 or 50 years. The illustrative 6% rate is nominal. At 6%, $1 million received or saved in ten years is worth about $558,000 today. Money available today could be used sooner for another purpose. Use nominal discount rates and nominal cost growth consistently. Expand colored assumption sections and use the information buttons for units and dependencies.

4. Equipment and financing

Enter hardware, controls, installation, disposal, network and incentive amounts. Include ongoing upkeep, per-visit labor, periodic parts and separate full renewals. Age-related maintenance resets when equipment is renewed. Optional residual values recognize remaining useful capacity at the end of the horizon. Use financing inputs for a separate view of upfront equity, debt service and equity cash flow. The unlevered owner comparison excludes loan service.

5. Streetlights and Chicago

Choose watts times hours or annual kWh per asset. Check service visits, recurring connectivity, wear parts and renewal lives. The Chicago planning example uses an approximately $34 million ComEd incentive reported by DOE, modeled as an upfront payment even though rebates were received during implementation. Utility rebate per asset is zero for that example.

6. Parking

Use Selected operator for the receiving facility or Entire municipal parking network for network-wide incremental paid occupancy. Five customers moving from neighboring lots can add five paid spaces to one operator and zero across the network. Enter net reservation, pricing and compliance receipts without overlap. Enter verifiable avoided staffing or enforcement costs separately. Payments and penalties are transfers in the public analysis. Use annual searches, percent served, baseline minutes, minutes saved, fuel saved per served search and value per person-hour. These assumptions replace the general time and fuel fields while the search model is active. The illustrative preset uses one minute saved, not the roughly five minutes reported by the broader SFpark pilot. Include incremental local economic value only with evidence, excluding gross sales and redistribution.

7. Solar

Use the 8 kW residential, 250 kW commercial or 1 MW municipal preset. Enter installed cost, annual yield, degradation, daytime self-consumption, and export compensation. The State electricity rate (to avoid) applies to eligible self-consumed kWh. Exported kWh earn the separately entered export rate. The same-state comparison uses residential or commercial benchmarks by customer class, with separately editable utility tariffs. Add documented demand-charge reductions only when supported by the tariff and peak reduction. No battery resilience or automatic tax credit is included. Review current IRS eligibility and enter an independently documented incentive if applicable.

8. Building controls, water, roads and fleet

Choose BMS Optimize Existing Controls for commissioning and tuning, or BMS New Integrated Installation for the incremental investment beyond conventional controls. Review the low, typical and high electric-savings sensitivity, existing and proposed heating fuel, verified demand charges, and avoidable upkeep. Do not count breakdown avoidance twice. Water uses avoided volume and marginal cost. Traffic uses travel-time, road-user fuel and safety inputs. Fleet uses separate fuel expenditures, combustion emissions and replacement cycles. Use Original Project to show optional parking, water or fleet controls.

9. Interpret Live Results

Existing and proposed discounted total cost of ownership are directly comparable. Their difference reconciles to owner financial NPV. Net upfront investment reflects eligible incentives. Discounted ROI covers the entire horizon and displays N/A when there is no net upfront investment. Sustained discounted payback can disappear after later replacements. Electricity savings use the first year, while avoided carbon covers the horizon. Enter environmental-credit receipts only if actually payable. A $80/t environmental valuation is a societal estimate, not owner income.

10. Read public value and charts

The solid line shows owner financial advantage. The dashed line shows total net public economic value after real resource costs and with transfers excluded. Gross cumulative public benefits start at zero and are displayed separately. Public NPV can be negative; the benefit-cost ratio compares gross benefits with gross resource costs. Gross cost composition bars share one zero-based scale. Larger annual chart points mark scheduled replacement spending. Hover or focus a year to see its cost breakdown, or open Scheduled

replacement events. Adjust these results buttons reveal and highlight the inputs that drive each output.

11. Save, reopen and export

Save scenario exports editable JSON with a version tag. Open saved restores validated input values including an edited electricity tariff. Download annual CSV for computed results or use Print / Save PDF for a shareable report. The break-even sensitivity estimates the constant nominal additional net savings needed, all else fixed. Scenario estimates are screening inputs and should be replaced with local evidence before investment decisions.

Water economics and break-even

Network monitoring counts distribution monitoring locations. AMI counts customer meters. Choose manual, drive-by AMR, or existing remote collection. The first two have separate editable route budgets; remote reads carry no avoidable collection costs. Avoid counting billing recovery as a public benefit. Customer-side leak detection alone does not establish utility-side water savings.

Municipal Water Network — Acoustic Leak Detection is a distribution-pipe monitoring project, separate from customer-meter AMI. Omaha M.U.D.'s March 2025 report documents 1,000 loggers, $1.075 million for devices plus $40,000 setup, 138 cumulative detected leaks, $570,000 estimated repair savings, and $69,465 estimated avoided-water value. These are cumulative reported results; the report does not give a reliable operating-period denominator or number of emergency repairs avoided. Do not read them as annual results.

The modeled repair case separately counts expected emergency repairs avoided and compares their average emergency cost with the cost of a planned repair. The current Typical starting point uses 22 events per year at $20,000 emergency versus $10,000 planned, for $220,000 modeled annual net repair savings before monitoring and maintenance costs. Low and High are 10 events at $15,000/$10,000, and 25 events at $24,000/$12,000. These are editable screening assumptions, not verified Omaha annual results. M.U.D. described approximately $20,000 emergency main breaks and scheduled work that usually costs about half as much; a separate WaterWorld account described around 50 non-emergency main leaks among 1,200 sensors but did not state an exact observation cutoff. The evidence does not validate a stable annual rate.

The current 1,000-device preset uses the documented $1.115 million initial equipment/setup amount. A separate M.U.D. procurement listed $1.495 million including five years of analyst services, portal maintenance and communications. The difference ($380,000) supports a $76,000/year modeled operations allowance; carrying it beyond the documented five-year term is an editable screening assumption. The current preset schedules one full $1,075-per-device equipment renewal in Year 10. It does not add the retired Year 5 wear-service or Year 12 renewal charges. Routine upkeep is included in the $76,000 annual allowance and must not be counted again.

Current Typical network defaults are 120,000 m^3/year of recovered treated water at $0.70/$m^3$ marginal production/treatment cost. Both values are illustrative owner-approved screening assumptions, not annual Omaha observations. Together they represent $84,000/year of avoided water-resource cost. The 22 annual avoided emergencies save the difference between $20,000 emergency and $10,000 planned repairs, or $220,000/year. Combined with the $76,000 monitoring/upkeep cost, the result is $228,000 net annual operating savings before lifecycle renewal. The 15-year, 6% owner/public NPV is approximately +$499,118; simple payback is 4.89 years and sustained discounted payback is Year 11 because of the Year 10 renewal. The public BCR is approximately 1.203. Low / Typical / High 15-year NPVs are about –$1,151,964 /

+$499,118 / +$1,276,098. Replace editable assumptions with local utility data; do not annualize Omaha’s cumulative study results.

For Municipal Water District — Smart Metering, the Typical manual-reading baseline is also illustrative: 1,000 customer meters × 12 reads/year, at 5 minutes to read plus 4 minutes for travel/access, produces 1,800 paid field hours or 1.0 FTE at 1,800 productive hours. A $55,000 base salary plus 30% burden is $71,500; $8,500 allocated fleet cost makes $80,000 annual baseline reading expense. The editable 90% avoidable share gives $72,000 annual savings and $8,000 residual cost. The selected alternative may instead be drive-by AMR, which uses a bundled illustrative $0.875/read, or existing fixed-network AMI, which receives no automatic route savings unless actual retired annual costs are entered. These two water scenarios do not share leak, water-volume, billing, or repair benefits.

Separate marginal production/treatment from pumping only if the costs are independently measured. Open the water breakdown to see reading costs, avoided repairs, recovered-water value, recurring costs, renewals, NPV drivers and break-even. Low, Typical and High are editable screening assumptions, not forecasts or installed bids. Custom provides editable inputs.

Scenario reference

Original project · build your own comparison

Scope: Custom project

Unit: One asset or site, as you define it

Project: Define what you have today, what you would install, and the scale of the comparison.

Owner: Enter the investment, operating costs, and any documented revenue or savings.

Public: Add evidenced public benefits separately.

Assumptions: Starting values are placeholders. Replace them with project data.

Chicago · 270,000 connected LED streetlights

Scope: Citywide streetlighting program

Unit: One streetlight

Project: Replace high-pressure sodium lamps with connected LEDs and remote outage monitoring.

Owner: Save electricity and reduce routine service and lamp replacements.

Public: More reliable streetlighting and lower emissions are potential public gains.

Assumptions: The Chicago rollout and ComEd rebates are documented. The planning count, rebate timing and operating assumptions are simplified.

Mid-size city · 12,000 smart LED streetlights

Scope: City streetlighting program

Unit: One streetlight

Project: Replace older high-pressure sodium fixtures with efficient connected LEDs.

Owner: Lower electricity and field-service costs.

Public: Residents may benefit from better outage response and lower emissions.

Assumptions: This mid-size city is illustrative. Use the utility tariff and a local fixture inventory.

Smart Parking — 2,000 Spaces with Real-Time Availability

Scope: Existing paid parking facilities using occupancy sensors, wireless communications, monitoring software and a real-time space-discovery app; optional reservations, electronic payments, forecasting and responsive pricing depend on the installation.

Unit: One parking space; the preset models 2,000 spaces.

Project: Upgrade existing facilities so drivers can see where spaces are available. The editable public case estimates search time and fuel avoided from annual searches, app use, minutes saved, distance and vehicle fuel economy.

Owner: The operator may capture occupancy and payment revenue or avoid labor and enforcement costs where supported. Receipts from shifting drivers among lots are not a net citywide economic benefit.

Public: Drivers and nearby communities may gain time, fuel, convenience and access. CO■ is estimated from the entered driving distance and fuel economy. Congestion is not separately monetized in this preset.

Assumptions: The 16-to-20 kWh per space/year electricity change, occupancy gain and travel assumptions are illustrative, not measured consumption or performance. Gateways, signs, communications, payment and software may add real operating costs; battery sensors do not necessarily draw grid power. SFpark combined real-time information with demand-responsive pricing and other interventions; its measured results are not a forecast for this facility.

BMS — Optimize Existing Controls

Scope: Individual commercial building

Unit: One building

Project: Tune and commission existing controls instead of replacing the whole system.

Owner: Reduce electricity, unnecessary service, and operating work.

Public: Lower energy use can reduce emissions.

Assumptions: Commissioning evidence informs the scope. This building’s costs and savings are illustrative.

BMS — New Integrated Installation

Scope: Individual commercial building

Unit: One building

Project: Install integrated controls and fault detection as an upgrade over conventional HVAC controls.

Owner: Reduce energy and avoid evidenced operating expenses, offset by higher upfront costs.

Public: Lower energy use can reduce emissions.

Assumptions: Incremental capital and energy reduction are illustrative. Enter bids and measured baseline loads.

Solar PV · residential rooftop (8 kW)

Scope: Individual residential property

Unit: One home with an 8 kW reference system

Project: Add rooftop solar to a grid-only household.

Owner: Avoid retail purchases for electricity used on site; exports earn a separate rate.

Public: Reduced grid generation can lower emissions.

Assumptions: The EIA rate is a state benchmark; installation, output and tariffs are illustrative. No automatic tax incentive.

Solar PV · commercial rooftop (250 kW)

Scope: Individual commercial property

Unit: One site with a 250 kW reference system

Project: Add commercial rooftop solar to grid electricity service.

Owner: Offset daytime purchases and earn eligible export receipts.

Public: Lower grid electricity demand can reduce emissions.

Assumptions: Prices, solar yield and on-site use are illustrative. Enter actual tariffs and only documented demand reductions.

Solar PV · municipal buildings (1 MW)

Scope: Municipal facility or campus

Unit: One site with a 1 MW reference system

Project: Add a municipal solar array to grid service.

Owner: Offset electricity used locally and earn eligible export receipts.

Public: Reduced grid purchases can lower emissions.

Assumptions: The EIA rate is a benchmark. Production and costs are illustrative; no direct payment or tax credit is assumed.

Municipal Water Network — Acoustic Leak Detection

Scope: Municipal water distribution district

Unit: One acoustic monitoring device/location; default project has 1,000 locations

Project: Municipal acoustic monitoring identifies underground pipe leaks early, allowing utilities to schedule repairs before failures become costly emergencies.

Owner: Annual repair savings equal avoided emergency costs less planned repair costs; water benefits use marginal production/treatment cost. Costs include initial equipment/setup, monitoring/upkeep, and scheduled full renewal.

Public: No additional public externalities are assumed. Avoided repair resource costs and marginal water-production costs are counted once; customer tariffs and utility transfers are excluded.

Assumptions: Omaha M.U.D. documented 1,000 devices and $1.115 million equipment/setup, with cumulative reported savings. The default 22 avoided repairs/year, 120,000 m³ water/year, $76,000 annual operating cost, and $1.075 million renewal every 10 years are owner-specified illustrative assumptions, not annual Omaha observations.

Municipal Water District — Smart Metering

Scope: Municipal customer-meter reading modernization

Unit: One customer water meter/account; Typical project size is 1,000 meters

Project: Replace conventional customer meters with smart meters that transmit readings remotely. The project evaluates avoided meter-reading work, not leak detection.

Owner: The baseline cost is derived from reading frequency, physical and travel time, productive hours, fully burdened salary and fleet expense. The proposed cost retains the share of reading operations that automation does not eliminate.

Public: No water-loss recovery, leak-repair savings, billing revenue, or separate customer/public benefits are assumed. Avoided reading resource costs are counted once when the assumed budget reduction is achievable.

Assumptions: The Typical manual-reading case uses 12 reads per meter annually, 5 minutes of reading and 4 minutes of travel/access per read, 1,800 productive hours/FTE, $55,000 salary, 30% burden and $8,500 annual fleet expense. These are owner-approved illustrative inputs, not measured averages. The 90% avoidable-cost share is also illustrative.

Adaptive signals · 100 intersections

Scope: Municipal intersection program

Unit: One signalized intersection

Project: Replace fixed or manually timed signals with detectors and adaptive timing.

Owner: Reduce documented controller operations or upkeep expenses where supported.

Public: Less delay, fuel use and crash harm are possible if verified locally.

Assumptions: Travel and safety benefits and capital costs are illustrative, not guaranteed outcomes.

Planned Fleet Replacement — Gasoline vs. Electric

Scope: Municipal fleet replacement; both alternatives purchase new vehicles at project start

Unit: One vehicle; default project size is 100 vehicles

Project: Compare 100 new gasoline service vehicles with 100 new battery-electric service vehicles plus charging infrastructure.

Owner: The owner pays each alternative's Year 0 vehicle cost. EV electricity and charging operations are compared with gasoline fuel, maintenance, service, and lifecycle replacement costs.

Public: Lower gasoline combustion emissions may create public environmental value; this is separate from owner cash savings and depends on electricity generation and the entered emissions assumptions.

Assumptions: Gasoline purchase starts at $33,000 per vehicle. The EV preset starts at $41,000 per vehicle, $1,500 installation per vehicle, and $600,000 charging infrastructure. These are editable illustrative costs, not a procurement quote. Annual fuel, electricity, maintenance, renewal schedules, and incentives are also editable.