



**California Emerging Technology Fund**  
**Affordable Housing Development Broadband Connectivity Costs**  
**May 20, 2011**

**Purpose**

The purpose of this document is to provide information on installation, maintenance, and operation costs of deployed wireless and wireline Internet connectivity projects in affordable housing developments throughout California.

**Background**

A powerful strategy to reach disadvantaged Californians is to provide broadband connectivity in all publicly-supported housing units. If the State of California, local governments, and redevelopment agencies adopted smart housing policies requiring broadband as part of construction, whenever public funds are utilized, the quest to close the Digital Divide would be measurably advanced.

Statewide, only 49% of households with an average income of \$40,000 per year or less subscribe to broadband. Residents in low-income households frequently state that the cost of high-speed Internet access (which is the basic definition of broadband service) is a significant barrier to adopting the technology.

CETF defines Affordable Smart Housing as a publicly-funded housing project that possesses an independent Advanced Communications Network to drive economies of scale that can result in a significantly reduced cost basis for residents. An Advanced Communications Network in an Affordable Smart Housing development project is in addition to the standard cables and infrastructure required for power, television, and telephone service. It is a broadband infrastructure that, at a minimum, makes available affordable market-comparable high-speed Internet access service to all units via the aggregation and consolidation of service across the property.

**Methodology**

CETF has contacted Internet service providers and affordable housing developers that provide broadband service to their residents in Northern and Southern California. The process of gathering information has been challenging due to the fact that organizations either do not have all the requested information at hand, have bundled the connectivity costs with other services they provide to their residents (e.g. cost of Digital Literacy instruction at computer labs), are unable to differentiate the components, and/or choose to withhold the information.

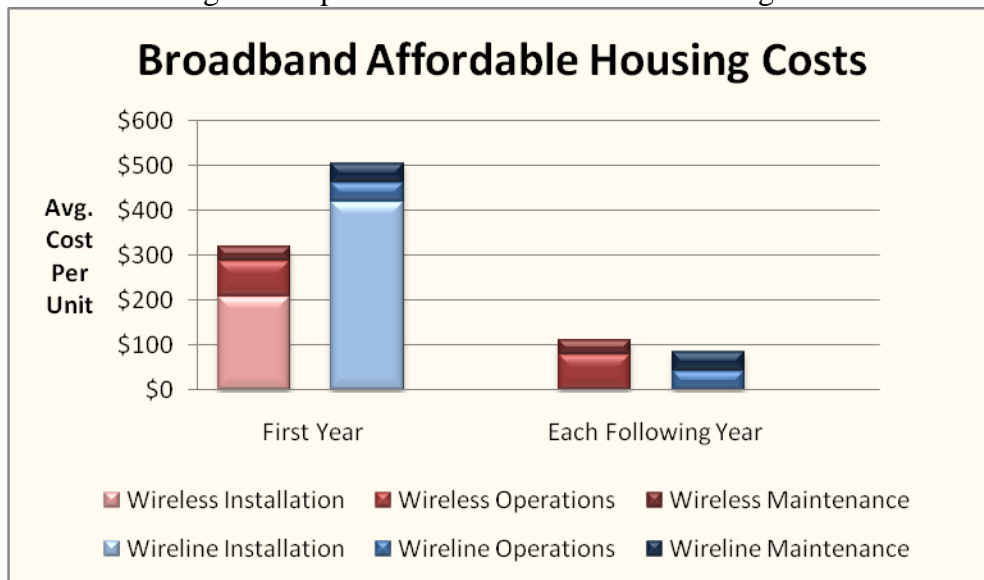
CETF gathered the initial installation cost, the annual operation cost, the annual maintenance cost, and the number of units for wireline and wireless broadband affordable housing

developments. The cost per unit for installation, maintenance, and operations were calculated and the results divided between wireline and wireless infrastructure types. Comparisons between the two infrastructure types could then be completed utilizing the average costs per unit within each individual projects, and then the overall cost per unit for all projects of the same infrastructure type. This method permitted highly granular comparisons, while not skewing the overall results due to a few large or very small housing developments with abnormally high or low costs. The properties analyzed range in size from 20 to 700 units, representing an excellent distribution of small to very large affordable housing developments. Charts 1 and 2 represent averages of the average cost per unit for both wireline and wireless projects, while Charts 3, 4, and 5 represent the average cost per unit for each individual project.

### Observations

The following observations are based on 19 wireless and 24 wireline broadband infrastructure deployment projects installed at, or quoted for, affordable housing developments in Northern and Southern California.

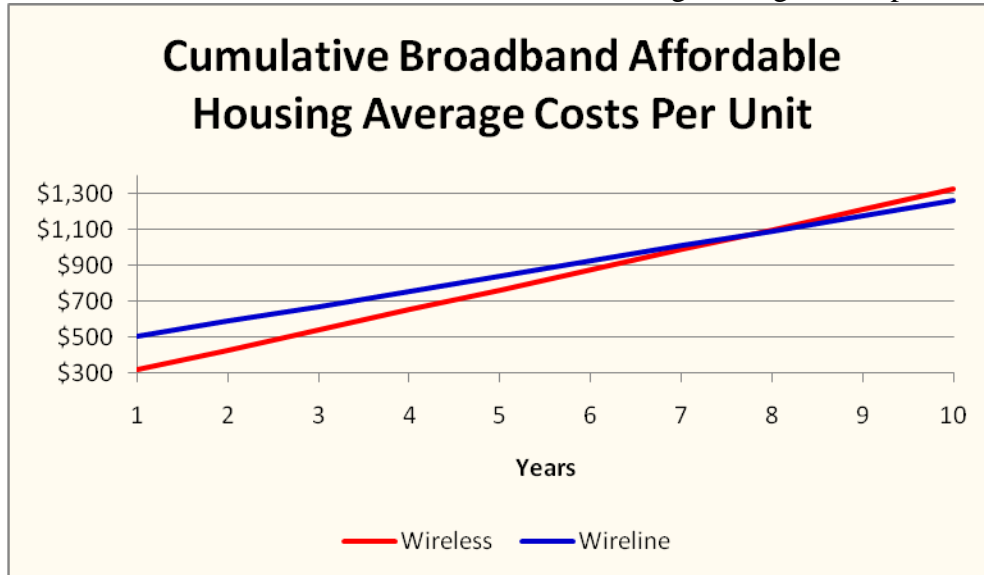
Chart 1. Average Costs per Broadband Affordable Housing Unit



- The first year average wireless total costs per unit, including installation, operations, and maintenance, is approximately 38% more cost-effective than wireline total average cost per unit. The wireline average installation cost per unit accounts for the bulk of the total cost in the first year as a result of expensive “Carrier-Grade” Digital Subscriber Line Access Multiplexer (DSLAM) equipment, subscriber in-unit MoDem (Modulator Demodulator) equipment, and cabling fees. Wireless equipment deployments tend to utilize fewer electronic devices and components, with less cost.

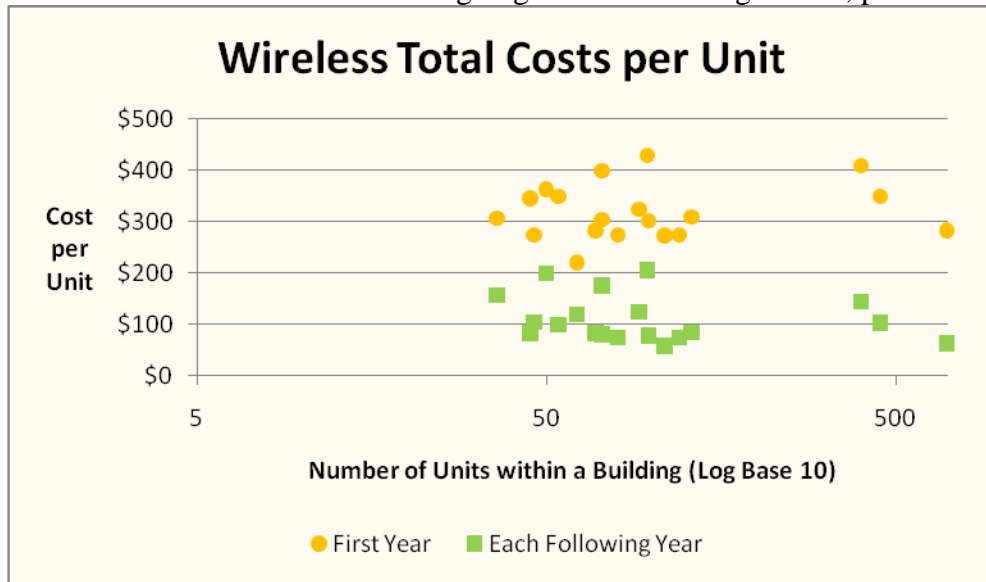
- For all years following the installation year, the average annual wireless cost per unit exceeds that of wireline projects. Wireline solutions can better aggregate the bandwidth from all the housing development into a single Internet connection, whereas a typical wireless solution has an Internet connection for each gateway. Maintenance costs for wireline deployments tend to be lower due to the carrier grade reliability of the equipment utilized, as opposed to small-office, home office, and/or residential equipment most often utilized for wireless networks.

Chart 2. Cumulative Broadband Affordable Housing Average Costs per Unit



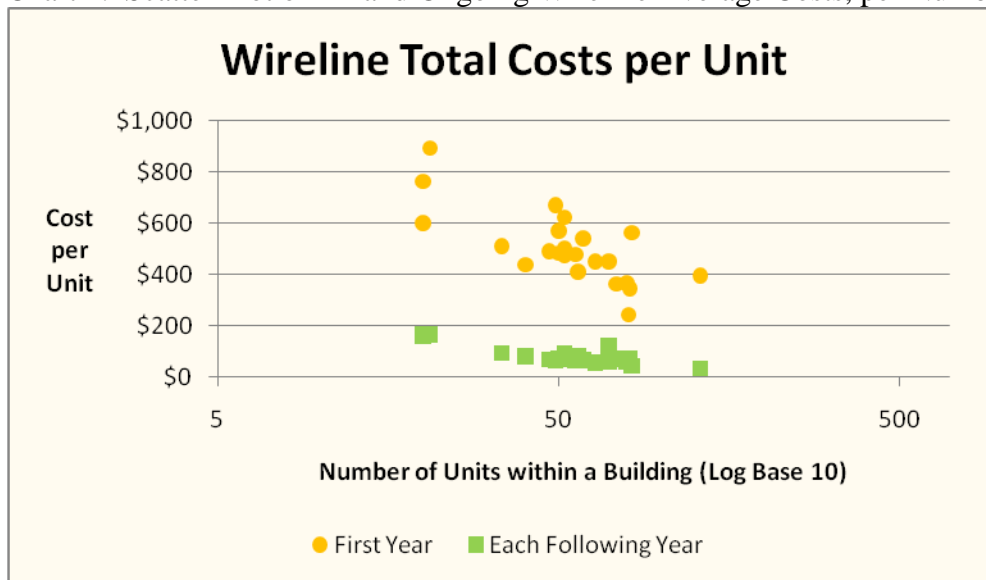
- Although wireless first year total cost per unit are lower than wireline first year total cost per unit figures, wireline are slightly more cost effective over a 10 years period. The variance between the wireline and wireless cumulative cost per unit will continue to expand beyond the 10-year period.
- The higher wireless operations and maintenance average cost per unit causes the cumulative cost difference between wireless and wireline to diverge. Within 7 years of deployment, the cumulative average cost per unit for wireless and wireless are at par, with wireline being more cost-effective from that point on.
- It should be noted that wireless solutions based on IEEE 802.11 (A,B,G, and N) protocols support a finite amount of shared bandwidth, as little as 87 Mbps per access point, and when that threshold is approached additional equipment would be required. A wireline solution typically offers greater scalability due to the non-shared nature of the zero-mile loop. As a result, a wireline solution would require less ongoing investment into equipment and further expand the cumulative cost variance between the two categories over time.

Chart 3. Scatter Plot of Y1 and Ongoing Wireless Average Costs, per Number of Units



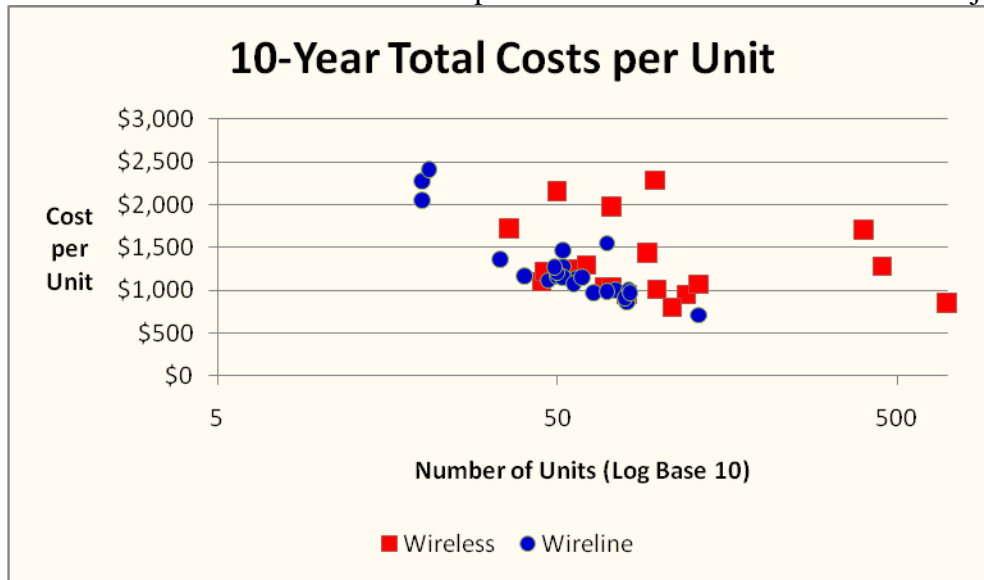
— All 19 wireless quotes are presented in this single summary chart. All installations consistently place the first year per unit costs between \$200 and \$450 regardless of how many units are within the building. Similarly, each following year, regardless of the amount of units within the housing development, the cost per unit is between \$85 and \$210.

Chart 4. Scatter Plot of Y1 and Ongoing Wireline Average Costs, per Number of Units



— All 23 wireline quotes, from 4 different vendors, are presented in this single summary chart. It is clear that the average installation cost steadily decreases as the amount of units within the housing development increase. Regardless of the amount of units within the housing development, ongoing per unit yearly costs remain mostly below \$100.

Chart 5. 10-Year Cumulative Costs per Unit for Wireless and Wireline Projects



- The wireless deployment 10-year cumulative cost per unit in housing developments, regardless of the amount of units, has a broad range of values. This suggests that wireless technologies deployed in these housing developments do not benefit from economies of scale.
- Wireline deployment 10-year cumulative cost per unit results are tightly associated to the amount of units within housing development. As the amount of units increases, the wireline 10-year cumulative cost per unit significantly decreases. Economies of scale play a significant role in such deployments.

### Preliminary Conclusions

Based on the research performed and analysis of data received, it is concluded that installation costs for wireline deployments, the first year average wireless total costs per unit, including installation, operations, and maintenance, are more cost-effective than wireline total average costs per unit. However, for all years following the installation year, the average annual wireless costs per unit exceeds that of wireline projects. As a result, wireline projects are slightly more cost effective over a 10 years period than wireless projects.

Industry experience confirms that wireline deployments: 1) Tend to have less maintenance and operational issues than wireless deployments due to the carrier grade reliability of equipment utilized; 2) Provide higher sustained transmission rates to end users because each user receives service over a non-shared circuit; 3) Are less susceptible to external interference than wireless networks; 4) Provide far greater overall aggregated Internet upstream capacity into the housing development due to the centralized distribution design of wireline networks; and 5) Offer greater scalability due to the non-shared nature of the zero-mile loop, requiring less ongoing investment into equipment.

As a result of the technical and long-term economic benefits identified, it can be generalized that wireline deployments for affordable housing developments are the most effective method to provide broadband Internet access to the units. Specific circumstances exist where one deployment technology may be favored over another, such as with issues related to: (1) Individual building configuration; (2) Multi-building complex design; (3) Existing cable infrastructure and quality; (4) Building materials utilized in construction; (5) Number of units; and (6) Telecommunication services available.

It is critical that property developers exploring broadband Internet access methods for affordable housing developments consult with skilled professionals, and receive competitive quotes identifying service definitions, limitations, scalability, service level agreements, and management requirements, in order to select the ideal solution.