Section 8 – BENEFITS ESTIMATES

This section contains conceptual and/or provisional benefits estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

8 BENEFITS ESTIMATES

8.1 INTRODUCTION

SDG&E and many of its key stakeholders believe that implementing strategic, intelligent Smart Grid investments will produce long-term benefits for customers, market participants, the environment and society as a whole. This section presents SDG&E's approach to cataloging, measuring and monetizing the benefits associated with the Smart Grid in its service territory.

Determining future benefits from technology innovations is an inexact science. In 2006, SDG&E began working to determine the benefits from a full deployment of smart electric and gas meters throughout its service territory. Some of the benefits were apparent, such as saving the existing cost for manually reading meters. Others, such as how much demand response the ability to verify hourly interval usage would enable and the value of such an energy shift, were more difficult to project with an adequate level of certainty. Just as no one predicted there would be revenue from ringtone sales for cell phones, predicting other value streams for SDG&E's customers once the advanced metering infrastructure was deployed was an exercise limited by the utility's and customers' experiences and expectations at that moment in time. Those benefits are just starting to be realized now, with increasing benefits over time.

Although no single project in the currently envisioned SDG&E Smart Grid Deployment Plan is as large as Smart Meter, the challenges of benefit valuation for them are similar. Nascent and future technology, inability to predict customer adoption rates, a lack of models to value benefit, economic fluctuations and environmental policy all contribute to high levels of uncertainty in determining benefits. However, as was the case when telecommunications first went digital, the opportunities for further benefits in the future are limited only by our imagination.

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Societal benefits are the broadest category to calculate taking into account all benefits to all customers such as added efficiency, avoided generation costs including line losses, avoided transmission and distribution costs, reliability benefits to customers (determined through value of service studies) and environmental benefits.

The societal perspective is the one generally used to evaluate cost-effectiveness by focusing on efficiency in the production and delivery of energy and environmental quality improvement. This type of benefit evaluation is used to determine the cost effectiveness of energy efficiency programs; storage as it relates to the effective integration of more renewable resources, reduced air emissions from generation; and improved utilization of grid assets (i.e., generation and T&D equipment). In most cases, societal benefits are accompanied by an internalizable or partially internalizable benefit. For example, a utility customer uses storage to reduce on-peak energy use. An internalizable benefit accrues to that customer in the form of reduced cost; however, other societal benefits may accrue to utility customers as a group and/or to society as a whole. For example, reduced peak demand could lead to reduced air emissions and a general improvement of businesses' cost competitiveness.

Empowering customers and maintaining and/or improving the reliability of the grid in the face of great change are pressing drivers for Smart Grid projects. Both of these drivers are difficult to value. Empowering customers with choice and the tools required to support their new preferences and behaviors has greater value to participating customers than to those that do not exercise their choice or adopt new behaviors. Additionally, determining the number of customers that will engage and the level of their engagement is also challenging to forecast with precision. While SDG&E customers are currently leading the country in renewable energy adoption, the depth of market penetration over the long term is as yet undetermined. Moreover, it is also difficult to determine a precise value for new functionality, but certainly many customers expect that SDG&E will provide them with modern tools to interact with the company and their energy information. (Compare today's exercise in estimating Smart Grid deployment benefits to the challenge years ago when it was difficult to cost justify having a website or email.)

Grid reliability is an expectation of modern society. However, the grid was not designed for the challenges posed by modern society such as plug-in electric vehicles, fuel cells, batteries, wind, and rooftop photovoltaics. Estimating adoption rates of these technologies and their impact to reliability is inexact, which requires careful consideration to quantify the benefits of enabling technologies. However, given the current high levels of reliability of today's grid and our customers' growing appetite for high-quality energy, it is imperative that no loss in reliability or quality occur through the transition to a modern grid. However, absent the deployment of the Smart Grid, the reliability and quality of service will deteriorate as more and more electric vehicles and intermittent energy resources are deployed.

As with any other investment in technology, the benefits to SDG&E customers from Smart Grid investments will occur over time after this equipment and software has been installed and capabilities enabled. As with other investments, customers will not see immediate rate reductions as the investments are made, but rather will see increasing benefits, including cost savings and increased functionality, during the useful life of the investments. Another factor that cannot be overlooked is that without these investments, reliability and quality of electricity delivery will deteriorate. Simply maintaining reliability and quality of service will be a daunting challenge that SDG&E's customers expect it to meet. And, while some benefits directly reduce electric rates, such as the reduction in meter field personnel as a result of smart meter installation, many benefits are not directly reflected in lower rates, but instead provide enabling technology for the customer to take more active control over and participate in energy management.

These ‘soft’ benefits take other forms such as reduced environmental impact through the safe and reliable integration of renewable generation, which Smart Grid investments ensure can be accomplished in the most cost-effective way, impacting electric rates less than alternative methods. By enabling customers with energy management tools and greater information about energy consumption and associated cost, SDG&E customers will be able to manage their total electric bill and, more importantly for some, save personal time. In addition, leveraging digital and advanced technology to safely and reliably integrate new products, such as PEVs and PV systems, will directly benefit some customers through lower fuel costs, as well as the societal benefit of lessening environmental impact and achieving American energy independence at the lowest cost. While these societal and environmental benefits are not reflected in electric rates, these softer benefits provide significant value.

Consistent with D.10-06-047, SDG&E has developed benefit estimates to support the Smart Grid Deployment Plan. The total estimated benefits of Smart Grid deployment described in this plan for the San Diego region are between approximately $3.8 - $7.1 billion, including societal and environmental benefits for the years 2011–2020 of approximately $760 million - $1.9 billion.

Table 8-1 breaks these benefits down by their source:

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Table 8-1: Societal and Environmental Benefits 2011 – 2020

Societal / Environmental Benefit Source	Societal / Environmental Benefit Range	Estimated tons of CO_2e Avoided[59]
Estimated Avoided Emissions from Energy Reductions and Peak Load Shifting	\$12 MM - \$83 MM	~ 0.7 million
Estimated Avoided Emissions Reduction by Integrating Centralized Renewable Energy	\$85 MM - \$612 MM	~ 5.4 million
Estimated Avoided Emissions Reduction by Integrating Distributed Generation	\$10 MM - \$79 MM	~ 0.7 million
Estimated Avoided Net Emissions Reduction by Integrating Electric Vehicles	\$284 MM - \$550 MM[60]	~ 0.9 million

[59] NO_x, SO_x, and PM_{10} were also included in the monetized benefits estimates.
[60] A significant portion of these benefits are valued from avoided NO_x emissions (approximately 13,000 tons in the base case).

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In addition, the potential fuel savings benefits for customers adopting electric vehicles have been identified and estimated as follows:

Table 8-2: Potential Fuel Cost Savings for Adopting Electric Vehicles

Benefit Source	Benefit Range	Purchased Gallons of Gasoline Avoided
Estimated Avoided Fuel Cost by Integrating Electric Vehicles	$369 MM - $615 MM[61]	~ 207 million

These benefits will be explained in more detail in section 8.3.1.

In addition, estimates were calculated for economic and reliability benefits (which are primarily "soft" benefits) for 2006-2020, including their associated terminal value (post-2020), totaling approximately $3.0 billion - $5.1 billion.

Table 8-3 breaks down these benefits by investment category:

[61] Benefit range for avoided fuel cost is based on a low and high gasoline price derived from a forecast base case in report no. CEC-600-2011-001 prepared by the California Energy Commission titled "*Transportation Fuel Price Cases Demand Scenarios: Inputs and Methods for the 2011 Integrated Energy Policy Report*" dated February 2011 and available at http://www.energy.ca.gov/2011publications/CEC-600-2011-001/CEC-600-2011-001.PDF

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Table 8-3: Economic and Reliability Benefits 2006 – 2020

Investment Category	Economic and Reliability Benefits 2006 – 2020 and Terminal Value
Benefits identified related to previously authorized funding (Smart Meter[62], OpEx 20/20 Smart Grid projects)[63]	$1,378 MM
Benefits identified for projects in TY2012 General Rate Case[64]	$966 MM - $2,263 MM
Benefits identified for other active applications (Demand Response[65])	$29 MM - $139 MM
Estimated incremental investment benefits – CPUC	$253 MM - $491 MM
Estimated incremental investment benefits – FERC	$434 MM - $906 MM

These benefits will be explained in more detail in section 8.3.2.

[62] Smart Meter benefits were sourced from the original CPUC application (A.05-03-015).
[63] Benefits in the Smart Grid Deployment Plan may differ from any shown in SDG&E's TY2012 General Rate Case (A.10-12-005) because of differences in presentation of data.
[64] Ongoing benefits for projects in SDG&E's TY2012 General Rate Case (A.10-12-005) have been forecast beyond the period reflected in the application to the CPUC.
[65] Only the Smart Grid related benefits for the Demand Response program are included and have been forecast beyond the period reflected in the application to the CPUC (A.11-03-002).

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8.2 APPROACH

At the same time program costs were compiled, SDG&E also engaged in a comprehensive exercise to identify the corresponding benefits associated with its Smart Grid programs and projects. Wherever possible, SDG&E sought to not only identify the benefits, but also convert them into a monetary figure. In the interest of using a common set of benefit categories and methodologies that is unbiased, clear and easily understood, SDG&E chose to model its benefits framework after the benefits evaluation model that EPRI included in the report titled *"Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects*".[66]

SDG&E's approach leveraged the benefit categories defined by EPRI as follows:

- Economic – includes avoided or reduced costs and investments due to improved system efficiency or asset utilization.
- Reliability – includes avoidance or reduction in electrical service interruptions and improvements in power quality and the reliability benefits to customers that are determined through value of service studies.
- Environmental – includes avoided or reduced emissions which impact climate change and adversely impact human health and various ecosystems.
- Other – includes improvements to cyber security, worker/customer safety, customer satisfaction as well as reduction in oil dependence.

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[66] Final Report No. 1020342,"*Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects"*, dated January 2010 and available at http://my.epri.com/portal/server.pt?space=CommunityPage&cached=true&parentname=ObjMgr&parentid=2&control=SetCommunity&CommunityID=404&RaiseDocID=000000000001020342&RaiseDocType=Abstract_id

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Furthermore, SDG&E also augmented the EPRI categories with additional types of benefits identified through best practices and independent research. The resulting benefits framework served as the model used to identify all potential benefits associated to each of the SDG&E Smart Grid program areas. To help quantify the economic value of the Smart Grid benefits, efforts were made to translate identified benefits into a monetary value using factors provided by external sources where possible. The following table (8-4) provides a summary of the scope of benefits for each category as a guidance utilized during the identification, quantification and monetization process.

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Table 8-4: SDG&E Benefits Framework

Category	Benefit Type
Economic	Improved Asset Utilization
	Transmission & Distribution Capital Savings
	Transmission & Distribution Operating Expenses Savings
	Theft Reduction
	Energy Efficiency
	Electricity Cost Savings
Reliability	Power Interruptions
	Power Quality
Environmental	Air Emissions
Other	Security & Safety
	Customer Satisfaction
	Energy Independence

The majority of projects within SDG&E's Smart Grid program areas were identified as providing either qualitative and/or quantitative benefits. Numerous factors dictated the type and extent of the benefits each Smart Grid project provided, as well as impacted the accuracy of the estimated benefits. Some of the factors include the following:

- Project type – Projects classified as Policy, which meet a regulatory mandate or policy, may have fewer benefits as they are implemented to meet specified requirements. Pilot projects may also have fewer benefits, as they are used to

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test the viability of new technologies whose exact benefits have yet to be fully understood.

- New or future technologies – Quantifying and estimating the monetary benefit of new, emerging or future technologies can be difficult given the lack of precedence and/or sufficient historical data.
- Qualitative benefits – Certain benefit types by nature are difficult to quantify, let alone convert into a monetary value (e.g. customer engagement, reduction of reliance on oil). Measuring such benefits may be difficult and/or there is no methodology to calculate the benefit's economic value or the methodology is overly complex or time-consuming for deployment planning purposes.
- Inconsistencies of standards – Conversion factors are used to convert specific benefit units (e.g. MWh, MW) into monetary units. The conversion factor values themselves can vary greatly depending upon the source, where the inconsistency is attributed to varying calculation methodologies.
- Lack of historical adoption rate data – Certain technologies (e.g. PEVs) are new to the market. As a result, the magnitude and extent of their benefits realized are largely dependent upon their rates of adoption by consumers or their rates of penetration into the industry, both of which are difficult to predict.

Project benefits were calculated in a similar fashion as project costs, where each project was reviewed for benefits as defined within the benefits framework. Historical benefits were noted for in-flight projects that have already realized benefits, and benefit projections were made for roadmap projects slated for the 'conceptual' 2011-2015 timeframe and/or the 'provisional' 2016-20 project time frame.

In order to account for the difficulty of estimating benefits, the benefit forecast for Smart Grid projects used a range of potential values for both conceptual and provisional estimates. These range values (as a percent of the base forecasted benefit) reflect what are believed to be a reasonable range above (+) and below (-) the estimated benefit projections.

Table 8-5 summarizes the conceptual and provisional contingency values incorporated into 2011-2020 benefit estimates to reflect the uncertainty associated with the methodology and a long timeframe. Supporting a conservative view towards attaining benefits, and the greater uncertainty in the longer term, the range is 50 percent below to 30 percent above for the years 2011 to 2015, and 75 percent below to 75 percent above forecasted benefits for the years 2016 to 2020.

Table 8-5: Conceptual and Provisional Range Factors for 2011-2020 Benefits Estimates

Range	Conceptual Range Factors Benefits 2011-2015	Provisional Range Factors Benefits 2016-2020
High	+30%	+75%
Low	-50%	-75%

In addition to historical and projected benefits, terminal values were also calculated. For each of the Smart Grid Deployment Plan projects, a terminal value accounts for ongoing net benefits that continue to accrue for the working life of capital assets beyond 2020. Thus, the terminal values complement the historical, projected conceptual and provisional timeframe benefits to provide a complete end view of the total anticipated benefits associated with a given Smart Grid project.

As discussed, all benefit estimates are presented in nominal dollars (i.e. not discounted) and reflect the best available information at this time. These estimates are not intended for use in new requests for funding and will change as new information becomes available.

8.3 SOCIETAL AND ENVIRONMENTAL BENEFITS

SDG&E collaborated with the Environmental Defense Fund (EDF), a leading environmental non-governmental organization (NGO), in its effort to quantify the societal and environmental benefits of its Smart Grid Deployment Plan, particularly those that are expected to result from the integration of centralized and distributed renewable resources and PEVs. While the economic and reliability benefits were estimated on a project-level basis, and summarized by program and classification in

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section 8.3.2, the calculation of the following societal and environmental benefits were calculated at the portfolio level, because these benefits are a result of multiple Smart Grid projects or programs and have significant dependencies on external factors. Consistent with our conservative approach towards benefits, terminal values are not reflected in estimates for societal benefits from these sources.

8.3.1 ESTIMATED AVOIDED EMISSIONS FROM ENERGY REDUCTIONS AND PEAK LOAD SHIFTING

SDG&E estimated the avoided emissions reduction benefits associated with reduced energy consumption, more efficient grid operations and peak load shifting enabled by new Smart Grid technologies and other investments, using the following assumptions and methods:

- Quantification of kWh of energy avoided or reduced and kWh of energy shift from peak to non-peak periods.
- Conversion of kWh to emissions reduction based on tons of CO_2e, NO_x, SO_x and PM_{10}.
- Prices per ton of CO_2e, NO_x, SO_x and PM_{10} based on a report prepared by the California Environmental Protection Agency (Cal/EPA).[67]

As a result, a potential range of benefits in this category was estimated at $12 MM - $83 MM for the 2011-2020 time period.

[67] Prices based on report prepared by the California Environmental Protection Agency titled *Updated Economic Analysis of California's Climate Change Scoping Plan* dated March 24, 2010 and available at http://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf

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8.3.2 ESTIMATED AVOIDED EMISSIONS REDUCTION BY RELIABLY INTEGRATING CENTRALIZED RENEWABLE ENERGY

SDG&E estimated the avoided emissions reduction benefits associated with the integration of centralized renewable energy using the following assumptions and methods:

- Integration of centralized renewable energy up to 20 percent RPS can be done without Smart Grid, resulting in zero benefits. RPS increase from 20 percent to 33 percent requires Smart Grid investment.
- Prices per ton of CO_2e, NO_x, SO_x and PM_{10} based on a report prepared by the Cal/EPA.[68]

As a result, a potential range of benefits in this category was estimated at $85 MM - $612 MM for the 2011-2020 time period.

8.3.3 ESTIMATED AVOIDED EMISSIONS REDUCTION BY INTEGRATING DISTRIBUTED GENERATION

SDG&E estimated the avoided emissions reduction benefits associated with the integration of distributed renewable energy generation using the following assumptions and methods:

- Conversion of kWh to emissions reduction based on tons of CO_2e, NO_x, SO_x and PM_{10}.
- Prices per ton of CO_2e, NO_x, SO_x and PM_{10} based on a report prepared by the Cal/EPA.[69]

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[68] Ibid.
[69] Ibid.

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- Applied time differentiated emission production factors.

As a result, a potential range of benefits in this category was estimated at $10 MM - $79 MM for the 2011-2020 time period.

8.3.4 ESTIMATED AVOIDED NET EMISSIONS REDUCTION BY INTEGRATING ELECTRIC VEHICLES

SDG&E estimated the avoided emissions reduction benefits associated with the integration of PEVs using the following assumptions and methods:

- Net emissions reductions calculated based on the differential of consumption of electricity to supply energy needs versus gasoline consumption.
- MPG standards for California market based on report prepared by California Air Resources Board.[70]
- Conversion of kWh to emissions reduction based on tons of CO_2e, NO_x, SO_x and PM_{10}.
- Prices per ton of CO_2e, NO_x, SO_x and PM_{10} based on a report prepared by the Cal/EPA.[71]

As a result, a potential range of benefits in this category was estimated at $284 MM - $550 MM for the 2011-2020 time period.

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[70] MPG standards based on report prepared by the California Air Resources Board titled *Comparison of Greenhouse Gas Reduction Under CAFE Standards and ARB Regulations Adopted Pursuant to AB1493* dated January 2, 2008 and available at http://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf

[71] Prices based on report prepared by the California Environmental Protection Agency titled *Updated Economic Analysis of California's Climate Change Scoping Plan* dated March 24, 2010 and available at http://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf

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8.3.5 ESTIMATED AVOIDED FUEL COST BY INTEGRATING ELECTRIC VEHICLES

SDG&E estimated the avoided fuel cost benefits associated with the integration of PEVs using the following assumptions and methods:

- Avoided fuel cost calculated based on the differential of cost of gasoline versus electricity.
- Forecast of gasoline prices based on a report prepared by the California Energy Commission (CEC).[72]
- Forecast of electricity prices based on a report prepared by the CEC.[73]

As a result, a potential range of benefits in this category was estimated at $369 MM - $615 MM for the 2011-2020 time period.

8.4 ECONOMIC AND RELIABILITY BENEFITS ESTIMATES BY PROGRAM AREA

Provided below is a summary of the monetized economic and reliability Smart Grid benefits, grouped by program area and project classification. Please note subtotals in tables in section 8.4 may differ due to rounding.

8.4.1 CUSTOMER EMPOWERMENT

As discussed in the Roadmap (section 6.0 of this plan), SDG&E's Customer Empowerment program will ensure customers have the information and capabilities

[72] Forecast of gasoline prices based on report no. CEC-600-2011-001 prepared by the California Energy Commission titled "*Transportation Fuel Price Cases Demand Scenarios: Inputs and Methods for the 2011 Integrated Energy Policy Report*" dated February 2011 and available at http://www.energy.ca.gov/2011publications/CEC-600-2011-001/CEC-600-2011-001.PDF

[73] Forecast of electricity prices based on report no. CEC-200-2009-012-CMF prepared by the California Energy Commission titled "*California Energy Demand 2010-2020 Adopted Forecast*" dated December 2009 and available at http://www.energy.ca.gov/2009publications/CEC-200-2009-012/CEC-200-2009-012-CMF.PDF

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that they need in order to make energy management decisions that meet with their values, needs and desires.

The Smart Meter project drives the large majority of benefits under the Customer Empowerment program. The deployment of smart meters has and will continue to provide substantial cost savings by reducing distribution operational costs, curtailing energy theft, and improving demand response efficiency. The conceptual and provisional benefit estimates for SDG&E's Customer Empowerment program are as follows:

Table 8-6: Customer Empowerment Program Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$3,898	$10,134	$12,445	$87,114	$16,342	$97,247	$10,833
Value	$69,491	$379,480	$402,395	$337,296	$424,888	$786,266	$896,775	$365,447
Pilot	$0	$2,195	$5,706	$1,510	$10,573	$3,705	$16,280	$7,544
Subtotal	$69,491	$385,572	$418,235	$351,251	$522,575	$806,314	$1,010,301	$383,824

For the corresponding costs of the Customer Empowerment program, please see the Cost Estimates section.

8.4.2 RENEWABLE GROWTH

As discussed in the Roadmap, SDG&E customers are continuing to install significant numbers of PV electric generation systems at residential and non-residential premises. To support distribution-level renewable generation, SDG&E plans investments that increase measurement, control, and management capabilities.

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Investments to improve SCADA technologies and expand their deployment will drive the majority of benefits by increasing the overall reliability of energy delivery to customers.

Other projects generate significant benefits by introducing dynamic line ratings and augmenting phasor measurement capabilities to defer capital infrastructure expenses and reduce operational expenses. The conceptual and provisional benefits estimates for SDG&E's Renewable Growth program are as follows:

Table 8-7: Renewable Growth Program Conceptual and Provisional Benefits Estimates

	Benefits					**Total Estimated Benefits**		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$59,431	$154,520	$64,243	$449,701	$123,674	$604,221	$321,374
Value	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$59,431	$154,520	$64,243	$449,701	$123,674	$604,221	$321,374

For the corresponding costs of the Renewable Growth program, please see the Cost Estimates section.

8.4.3 ELECTRIC VEHICLE GROWTH

As discussed in the Roadmap, SDG&E is preparing for the increased public adoption of plug-in electric vehicles. In anticipation of this growth, SDG&E plans investments that will help promote the adoption of electric vehicles, educate the public on their usage with regard to the electric grid, and assist parties involved with the electric vehicle ecosystem to ensure the successful integration of electric vehicles within the grid.

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Investments that install smart transformers are expected to enable cost savings by reducing equipment failures associated with the increase in load from electric vehicles. Other infrastructure and technology investments to support electric vehicle adoption will improve the efficiency of electric distribution and reduce usage and reliance on ancillary services. The conceptual and provisional benefits estimates for SDG&E's Electric Vehicle Growth program are as follows:

Table 8-8: Electric Vehicle Growth Program Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$14,343	$37,293	$24,051	$168,355	$38,394	$205,648	$107,978
Value	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$14,343	$37,293	$24,051	$168,355	$38,394	$205,648	$107,978

For the corresponding costs of the Electric Vehicle Growth program, please see the Cost Estimates section.

8.4.4 RELIABILITY AND SAFETY

As discussed in the Roadmap, SDG&E's goal is to maintain and/or improve reliability in the face of intermittent resources and electric vehicles through improving its measurement, control, protection, recording, and management and optimization abilities. Investments into the aforementioned abilities will supplement the existing technology investments made to improve accuracy and speed of fault isolation and system restoration time.

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Under the Reliability and Safety program, strategic investments in technologies to help balance and regulate voltage on transformers will result in a notable cost avoidance benefit by precluding the need to construct a new power generation plant altogether. Other projects to improve electric reliability, such as improvements to synchrophasors, are expected to reduce costly major grid outages.

The conceptual and provisional benefit estimates for SDG&E's Reliability and Safety program are as follows:

Table 8-9: Reliability and Safety Program Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$243,460	$632,995	$6,144	$43,011	$249,604	$676,006	$120,239
Value	$0	$47,849	$124,408	$45,657	$319,596	$93,506	$444,004	$202,918
Pilot	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$291,309	$757,403	$51,801	$362,607	$343,110	$1,120,010	$323,157

For the corresponding costs of the Reliability and Safety program, please see the Cost Estimates section.

8.4.5 SECURITY

As discussed in the Roadmap, the core tenets of SDG&E's security strategy are: adherence to security principles, broaden awareness, converge security governance, and distribute security controls. SDG&E plans to support these tenets by investing into a portfolio of security projects.

Collectively, SDG&E's investments in security-related initiatives are expected to provide significant benefits by minimizing disruptions in power and avoiding data breaches. This

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figure excludes the invaluable societal benefits arising from improved security measures. Significant societal benefits include maintaining customer data privacy and enforcing national security by preventing foreign cyber attacks on the electrical grid.

The conceptual and provisional benefit estimates for SDG&E's Security program are as follows:

Table 8-10: Security Program Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$41,176	$107,057	$22,824	$159,766	$64,000	$266,823	$7,938
Value	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$41,176	$107,057	$22,824	$159,766	$64,000	$266,823	$7,938

For the corresponding costs of the Security program, please see the Cost Estimates section.

8.4.6 OPERATIONAL EFFICIENCY

As discussed in the Roadmap, SDG&E has designed an Operational Efficiency program to improve its ability to monitor, operate, and optimize its system. To advance the overall efficiency of its grid operations, SDG&E will invest in a number of projects in its Operational Efficiency program.

Technology investments, such as Light Detection and Ranging (LIDAR) and Geographic Information Systems (GIS), will improve energy reliability through a combination of improving the ability to take pre-emptive measures to avoid faults, or increasing the efficiency of electric restoration after an outage has occurred. Such technologies will

This section contains conceptual and/or provisional benefits estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

also avoid significant capital expenses by reducing costly equipment repair or replacement costs and extending the life of existing assets.

The conceptual and provisional benefit estimates for SDG&E's Operational Efficiency program are as follows:

Table 8-11: Operational Efficiency Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$0	$0	$0	$0	$0	$0	$0
Value	$48,462	$97,235	$128,094	$80,524	$182,313	$226,220	$358,869	$81,313
Pilot	$0	$15	$38	$13	$92	$28	$129	$120
Subtotal	$48,462	$97,249	$128,132	$80,537	$182,405	$226,248	$358,998	$81,433

For the corresponding costs of the Operational Efficiency program, please see the Cost Estimates section.

8.4.7 SMART GRID RESEARCH, DEVELOPMENT, AND DEMONSTRATION

As discussed in the Roadmap, many of the Smart Grid technologies are still in the nascent stages of development or are only concepts. SDG&E plans to promote the development and realization of such technologies by investing in projects to research and pilot these technologies.

Smart Grid RD&D projects, by design, are not meant by themselves to return significant financial benefits. Instead, their purpose is to explore new technologies and test ideas which in turn can be leveraged in the future to generate significant economic and societal value. As a result, the Smart Grid RD&D projects were not a key source of benefits. The conceptual and provisional benefit estimates for SDG&E's Smart Grid Research, Development, and Demonstration program are as follows:

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Table 8-12: Research, Development and Demonstration Program Conceptual and Provisional Benefits Estimates

	Benefits					Total Estimated Benefits		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$0	$0	$0	$0	$0	$0	$0
Value	$0	$0	$0	$0	$0	$0	$0	$0
Pilot	$0	$6,799	$17,677	$1,719	$12,035	$8,518	$29,712	$7,156
Subtotal	$0	$6,799	$17,677	$1,719	$12,035	$8,518	$29,712	$7,156

Benefits shown in the Smart Grid Research, Development and Demonstration program include approximately $7.5 million awarded through a Renewable and Distributed Systems Integration (RDSI) grant from the DOE[74], and approximately $2.8 million awarded through a Public Interest Energy Research (PIER) grant from the CEC[75].

For the corresponding costs of the Smart Grid RD&D program, please see the Cost Estimates section.

8.4.8 INTEGRATED AND CROSS-CUTTING SYSTEMS

As discussed in the Roadmap, SDG&E recognizes the need to develop a robust enterprise-wide application platform to support its Smart Grid applications. This platform will enable new systems to co-exist with legacy systems as well as support the adoption and integration of increasingly complex data management and analytics as

[74] http://events.energetics.com/rdsi2008/pdfs/presentations/wednesday-part1/Merrill%20Eric%20RDSI_Review_102908.pdf
[75] http://www.energy.ca.gov/2010publications/CEC-500-2010-018/CEC-500-2010-018-CMF.PDF

This section contains conceptual and/or provisional benefits estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

well as grid communications. To create this application platform, SDG&E will invest in numerous projects to advance its application and communications infrastructure.

For example, the use of phasor measurement information both for real-time grid monitoring and operational control requires the existence of a precision time service to ensure all data streams are correlated and assessed correctly. Likewise, new communications systems are required to bring all these new data "home" to achieve Smart Grid operations. The deployment of a next generation, high-speed communications network will provide numerous system efficiencies. These efficiencies in turn enable notable costs savings by reducing the effort and investments needed to operate and maintain the grid, lowering capital expenditures, as well as avoiding other more costly capital investments needed to support a high-speed enterprise communications platform.

The conceptual and provisional benefit estimates for SDG&E's Integrated and Cross-cutting Systems program are as follows:

Table 8-13: Integrated and Cross-cutting Systems Program Conceptual and Provisional Benefits Estimates

	Benefits					**Total Estimated Benefits**		
	Historical	Conceptual Estimates 2011-2015		Provisional Ranges 2016-2020		2006-2020 Total		Beyond 2020
Project Class	**2006-2010**	**Low**	**High**	**Low**	**High**	**Low Range**	**High Range**	**Terminal Value**
Policy	$0	$0	$0	$0	$0	$0	$0	$0
Value	$0	$31,068	$80,776	$13,423	$93,961	$44,491	$174,737	$173,059
Pilot	$0	$0	$0	$0	$0	$0	$0	$0
Subtotal	$0	$31,068	$80,776	$13,423	$93,961	$44,491	$174,737	$173,059

For the corresponding costs of the Integrated and Cross-cutting Systems program, please see the Cost Estimates section.

This section contains conceptual and/or provisional benefits estimates reflecting the best available information at the time of preparation of the Smart Grid Deployment Plan. These estimates are not intended for use in new requests for funding and are subject to change as new information becomes available.

8.4.9 WORKFORCE DEVELOPMENT

As discussed in the Roadmap, a key element in the success of the SDG&E Smart Grid Deployment Plan resides in the education and adoption of the plan within its current and future workforce. SDG&E plans on investing in several human resource projects that will help deploy organizational structures as well as tools that maximize SDG&E's ability to manage and support its Smart Grid program. Through its collaborative vision and ongoing stakeholder outreach to regional workforce development, academic and technology organizations, SDG&E will help facilitate the development of a broader Smart Grid savvy workforce in its service territory, including local businesses and diverse business enterprises (DBEs).

Similar to the Security program, the monetary benefit of the Workforce Development program is difficult to quantify since its real value is more qualitative in nature. Projects in the Workforce Development program are integral to educating present and future utility personnel on the benefits of Smart Grid technology, maximizing the successful adoption and deployment of the program, and realizing the program's full potential and associated benefits.

Workforce development is critical to the success of Smart Grid implementation. While there are no specific, individual, cost reductions or quantifiable benefits directly tied to the Workforce Development program activities, workforce development is a critical enabler of each Smart Grid initiative.

For the corresponding costs of the Workforce Development program, please see the Cost Estimates section.