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Integrated Modeling Approach for Energy Planning and Climate Change Mitigation Assessment in the State of Florida

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Abstract**—**An integrated modeling approach was used in this study for energy planning and climate change mitigation assessment. The main objective of this study was to develop various green-house gas (GHG) mitigations scenarios in the energy demand and supply sectors for the state of Florida. The Long range energy alternative planning (LEAP) model was used in this study to examine the energy alternative and GHG emissions reduction scenarios for short and long term (2010-2050). One of the energy analysis and GHG mitigation scenarios was developed by taking into account the available renewable energy resources potential for power generation in the state of Florida. This will help to compare and analyze the GHG reduction measure against "Business As Usual" and 'State of Florida Policy" scenarios. Two master scenarios: "Electrification" and "Energy efficiency and Lifestyle" were developed through combination of various mitigation scenarios: technological changes and energy efficiency and conservation. The results show a net reduction of the energy demand and GHG emissions by adopting these two energy scenarios compared to the business as usual.

Keywords**—**Integrated modeling, energy planning, climate change mitigation assessment, greenhouse gas emissions, renewable energy, energy efficiency.

I. Introduction

THE international panel on climate change suggests a reduction of 50-80% of the emissions from the 2000 level by 2050. At the same time to meet the energy demand worldwide the energy supplies must double by 2050 [1]. To meet future energy demands and reduce the greenhouse gas emissions, energy planning and climate change mitigation assessment methods and strategies are needed. The analysis should include renewable and more efficient energy systems to assess the impact of incorporating these clean energy technologies on greenhouse gas emissions reductions.

The climate change is global in scale but the responses to this problem can be at local and regional levels. The actions taken at the local and regional levels not only will help to mitigate the climate change problem but will also help to reduce the reliance on non-renewable energy sources. The first step is to start with the assessment of the local greenhouse gases, local energy resources, and the potential impacts and risks associated with the climate change [1]-[4].

Renewable energy sources (solar, wind, biomass, geothermal, ocean) and energy efficiency and conservation are the best alternative for the development of clean energy and greenhouse gas emissions reductions [5]. An integrated modeling approach is needed to assess the incorporation of renewable energies and energy efficiency scenarios in the future energy mix and their impact on greenhouse gas emissions. The integrated modeling approach will help to (1) track energy consumption, production, and resource extraction, (2) track greenhouse gases emissions and (3) analyze emissions for local and regional air pollutions.

The long range energy planning (LEAP) model is used in this study for short and long term energy and GHG emissions reduction analysis for the state of Florida. The integrated modeling methodology will help to evaluate the alternative energy scenarios and examine emissions-reduction strategies in Florida by 2020, 2030, 2040 and 2050 relative to 2010 levels.

The United States of America is the second largest energy consumer country in the world in terms of total energy usage in 2010. It ranks seventh in terms of per capita energy use. Its per capita energy consumption in 2010 was 317 Million Btu per person, which is more than four times to the overall world per capita energy consumption (74 Million BTU per person).

Florida is the fourth largest economy in the United States. Florida is also the fourth most populated state in the U.S. however, its per capita energy consumption is ranked 44th among 50 states. It has very minor oil and gas reserve resources, and hence its natural gas and crude oil production is not much. There are no oil refineries or coal mines in the state. Electricity demand per capita in residential and commercial sector in Florida is among the highest in the United States that is in part because of the need of air-conditioning throughout the year. However, because of relatively low industrial electricity demand, overall per capita electricity consumption is ranked 30th out of 50 states. In terms of energy consumption by End-Use sector, Residential and Transportation sector Florida ranked 3rd in per capita energy consumption. It also ranked 4th in commercial sector per capita energy consumption. However, due to lack of industrial sector development, per capita energy consumption for industry sector, Florida ranked 20th out of 50 states.

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Fig. 1 shows the energy consumption by fuel type for the state of Florida. The most consumed fuel type is "Natural Gas", which is about 1250 Trillion Btu for the year of 2011. Motor Gasoline was consumed around 955 Trillion Btu, which also represents significant transportation sector energy consumption. The coal was consumed about 552 Trillion Btu. For electricity generation, the Biomass and Nuclear energy were consumed around 250 Trillion Btu each. Other Renewables (e.g. Wind, Solar, etc.) was only consumed about 75 Trillion Btu.

The goal set by the state of Florida is to cut the GHG emission by 80% of 1990 level by 2050. It is clear that Coal, Natural gas and Motor Gasoline consumption need to be reduced and Biomass, Nuclear, and other renewables energy share needed to grow significantly. To achieve this goal, technological changes, renewable energies, energy efficient and conservation, lifestyle changes and adaption are necessary. The main objective of this study is to evaluate the current energy demand and GHG emissions, identification of energy efficiency and renewable energy technologies and emission reductions strategies (personnel and freight transportation, residential and commercial buildings, industrial consumption, power generation, waste processing) and the projection of future energy and GHG emissions.

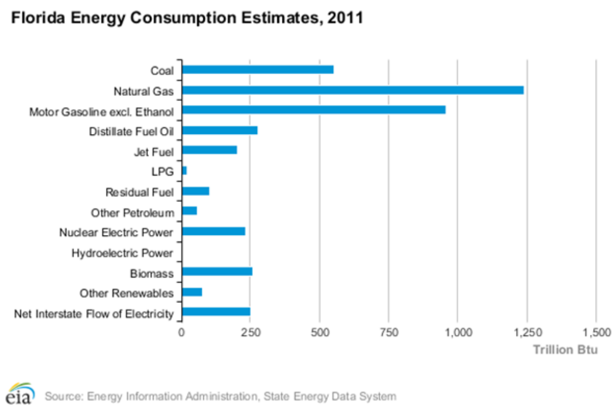

Fig. 1 Florida Energy Consumption by Fuel, 2011

II. Integrated Modeling Approach

For the energy planning and climate change mitigation assessment, the long-range energy alternative planning system (LEAP) model was used. Energy planning and modeling for local, regional or global level is highly dependent upon geographic and macroeconomic factors. Data needs to be collected and used as input conditions for the model.

For this study, the data was collected through resources available via U.S. Energy Information Administration. The data was further validated through U.S. Census Bureau. The Electricity Transformation data was collected through Florida Public Service Commission (FPSC). Most of the Transportation Sector data was taken from National Transportation Database. Aviation and Freight Transportation data was taken from Bureau of Transportation Statistics.

Bureau of Economic Analysis as well as Bureau of Labor Statistics was used for collecting data for key macro-economic assumptions of Energy Planning Model. Several other local and federal agencies were also involved in key data collection for Energy Model. The growth rate for forecasting data was based upon Annual Energy Outlook (AEO) published by U.S. Energy Information Administration.

For the emissions data, most of the emission factors were collected through LEAP's Technology and Environmental Database (TED). Some of the factor were externally developed through literature review and based upon current demographical conditions.

The development of scenario-based storylines has various assumptions on penetration of new technologies. It also integrates the renewable resources technical potential assessment within the scenarios. To meet the goal by 2050 to reduce emission by 80% of 1990 level, the scenarios has been created with higher efficiency (e.g. higher vehicle mileage, fluorescent lighting, etc.) as well as with energy conservation (efficient housing and offices, complete elimination of wood and waste consumption, etc.). Few Scenarios has included Low Carbon Fuels and Fuel Mixes, while a significant numbers of scenario involves lifestyle adaption and changes (e.g. smaller housing, smaller cars, reduction in airline travel, increase (2.5 times) in public transportation, etc.).The details of each scenario along with its influence on specific sector (e.g. residential, commercial, etc.) are given in the next sections.

A. Integrated Modeling Tool – Energy Planning and GHG Emissions

The complexity of energy systems and interdependency with other economic factors as well as demographic conditions requires a comprehensive approach to build an integrated energy model involving macroeconomic picture, demographic information, supply-demand scenario, resource use, transformation of resources and environmental footprint. Integrated energy planning models are extensively used in developing future energy supply and demand scenarios of a country or region. These are used in energy supply and demand outlook as well as GHG emission analysis over a period of timeframe.

Long Range Energy Alternative Planning System Model (LEAP) is an integrated energy-environment modeling system. It can be used as an energy accounting framework, which gives a physical and analytical description of an energy system, estimates of abatement costs, and environmental impacts based on developed scenarios-based-storylines. It is a demand driven program. The data can be built starting from demand sector to supply sector along with resource and transformation sector. The model can be used to analyze data over short to long term user defined planning horizon (10 or 40 years).

Modeling of energy scenarios are highly data intensive and LEAP has extensive in-built database as well as the framework to handle the energy flow characteristics from the reserves to final end use to balance-out the energy flow and consumption [2], [4].

B. Model Structures and Calculation Flow Chart

LEAP modeling methodology is based upon creating a tree-structure scenarios-based-storylines. These scenarios can be further analyzed for energy and emissions assessment. It simulates and assesses the scenarios in terms of physical, analytical, economic, and environmental impacts (See Fig. 2). LEAP consists of six modules as described below:

1. Demand module keeps an account of the end-use energy demand of primary fuel as well as secondary fuel.
2. Transformation module handles the conversion of primary fuel to secondary fuel, transmission and distribution (T&D) losses and electricity generation.
3. Resource module has the details of all the primary and secondary fuel in consideration.
4. Technology and Environment Database (TED), which has the detailed account of all the emissions factors of primary and secondary fuels.
5. Non Energy module consists of solid waste, forestry, land-use change, agriculture, waste-water treatment, industrial processes, and natural gas and oil systems energy consumption and emission assessment.
6. Indicators module displays emission reduction level against 1990 level, as well as renewable resources availability.

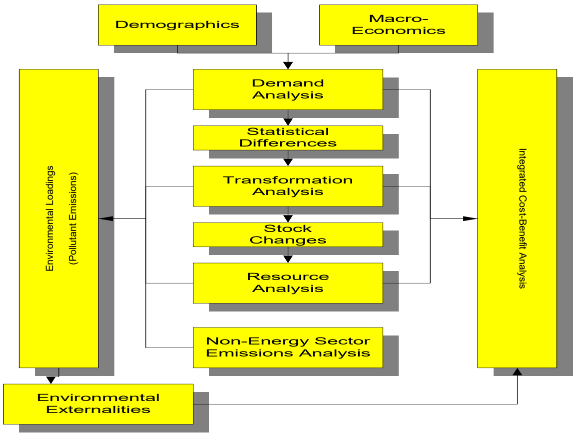

Fig. 2 Calculation Flow Chart

C. Key Assumptions

One of the main features of the LEAP is that the users can provide key assumptions on a local, global or regional level depends upon the level and scale of the analysis. It helps to develop an overall socio-economic as well as energy demand outlook model for that specific region or state or country. Key assumption data are taken from various federal and state level governmental agencies. The key assumptions include demographics, economics, residential, commercial, and transport sectors, transformation (conversion of primary fuels to electricity) and other supplies.

Demographics segment consist of several population, households and employment related variables for State of Florida. In the *Current accounts*, the historical data (1990-2010) is mentioned, while forecasting trends were used based on the Annual Energy Outlook (AEO) 2013 and U.S. Census Bureau. Employment rate data is extracted from Bureau of Economic Analysis and US Bureau of Labor Statistics.

Economics segment has four variables; GSP (Gross State Product), Industry GSP, Income (Per Capita) and Industry Fraction. The variables values along with forecast data were taken from Bureau of Economic Analysis and US Bureau of Labor Statistics.

For residential applications, the area of existing housing is available through Energy Information Agency (EIA) database of state of Florida; all other variables are used for forecasting energy consumption in residential sector. These entire "(%) Intensity Target" values for different-different variables (e.g. TV, Fridge Freezer, Dryer etc.) are reduced 10-20% for future energy consumptions.

For commercial energy sector, the average area available per employee is available for the state of Florida through Center of Real Estate, University of San Diego. For example, the lighting Intensity target is 60%, which is based on the Florescent Lighting Technology Energy Savings Trends. For buildings and for the next 40 years of spam, taking energy conservation into the account, 4 different types of retrofit buildings will be used. The energy intensity per end use will be reduced in each level of retrofits compare to existing and previous level of retrofit housing type.

Transportation sector has the most complicated structure. In this sector, there are about twenty-four parameters considered. The "Ethanol Fraction of Gasoline" is available through Bureau of Transportation Statistics, while "Truck Target Share" and LDV (Light Density Vehicles) Target Load Factor" has been set up through current data of Vehicle Miles Travelled (VMT) and Passenger Miles Travelled (PMT) Shares through Florida Transportation Statistics. Biofuels penetration was also taken into account in the calculation. For a specific scenario, specific values of the variables have been used for future calculations. The life cycle GHG factor is taken as 16 for bio-fuels, which means 16% reduction in Green House Gases (GHGs) compare to Gasoline.

III. GHG Mitigation Scenarios

Mitigation Scenarios are generally defined as a comprehensive detail and quantified projections on how GHG emission and total Energy Consumption can be reduced in comparison with Business As Usual Scenario [6]-[9]. They are developed to analyze and understand the core information corresponding to the all possible technological advancement and socio-economic factors including possible implication associated with GHG reduction. These scenarios can be developed by "What-If" question. (Example: What-if more efficient housing will be introduced in near future?). Hence the Mitigation scenarios can be developed for all major sectors based upon possible policy changes and technological advancements. The Mitigation Scenarios are developed in accordance with Clean Energy, Sustainable Technology, and Energy Savings. Retrofit housing and buildings, efficient vehicles, etc. are prime examples of developed Mitigation Scenarios. There are more than 100 different-different scenarios are developed all over residential, commercial, industry, transport, transformation and other miscellaneous sectors and sub-sectors. These are some examples of mitigation scenarios used in this study:

1) Transport – Electric Vehicles:

This scenario is developed through Cambridge Systematics analysis. In this Scenario, it has been assumed that, by 2050, 56% of light duty vehicles (Cars and Light trucks) are pure electric. While 22% are plugin electric, and 22% are hybrids. It has considered Medium Market Penetration (%) for Electric Vehicles (Light Duty) in State of Florida. This scenario has other sub-scenarios associated with it. These sub-scenarios represent High and Low Electric Vehicles Shares in State of Florida

a) 90% Pure Electric Vehicles

By 2050, 90% of light duty vehicles are pure electric, 5% are plugin electric, and 5% are hybrids.

b) 60% Pure Electric Vehicles

By 2050, 60% of light duty vehicles are pure electric, 20% are plugin electric, and 20% are hybrids.

2) Transport – 70% Biofuel vehicle

By 2050, 70% of light duty vehicles run on "Biofuel" and 30% will be "Pure Electric". The impact of "70% Biofuel Vehicles" Mitigation Scenario on Energy Demand, Environmental and Transformation Sector is as similar as of "Electric Vehicles" scenarios impact on corresponding sectors.

3) Transport - Smaller Cars

In this scenario, the energy intensity of cars is reduced by 26% in 2050, due to smaller cars use. The "Smaller Cars" are considered of German Size Car Standards. Hence, Energy Savings derived through comparing current American Cars with Standard German Size Cars. For reference, it should be noted that, German has the biggest size Cars in entire European Union. This scenario has other sub-scenarios associated with it. These sub-scenarios represent High and Low Energy Intensity Savings by introduction of Smaller Cars in State of Florida.

a) Fewer Smaller Cars

In this scenario, less aggressive reduction in the energy intensity of cars (By 15%) in 2050 was used in the simulation due to smaller cars.

b) More Smaller Cars

In this scenario, a quite aggressive reduction in the energy intensity of cars (By 33%) in 2050 was used for smaller cars.

4) Transport – Switch "Within Florida" Air-Travel to Rail

In this Mitigation Scenario, the Air-travel within FL will be switched to Rail Mode. Federal Aviation Administration Statistics shows that every year about 5% of passengers boarding from Florida results into destination airport of within Florida only.

5) Transport - Improve Transit Load Factors

In this Mitigation Scenario, the assumption is by 2050, transit load factors will increase by 20% over "Business As Usual" scenario. The Transit Load Factor Improvements are obtained through Department of Energy Research Division.

6) Transport - Double Transit Service

In this Mitigation Scenario, it is assumed that by 2050, VMT (Vehicles Miles Travelled) for buses, light subway, heavy subway, and commuter rail is twice as high as it would otherwise have been.

7) Transport - Electrify Commuter Rail

In this Mitigation Scenario, by 2050, 100% Electrified Commuter Rail.

8) Transport - 40% Biofuel Aircrafts

In this Mitigation Scenario, by 2050, 40% of commercial aircraft PMT (Passengers Miles Travelled) using planes running on biofuels.

9) Residential – smaller house size

In this Mitigation Scenario, the average residential housing size (Existing and New both) is 120 Square Meter per Household. Currently (2010), the Average Residential Housing (Existing and New both) Area is 154.96 Square Meter per Household.

10) Commercial – Lighting Efficiency

In this Mitigation Scenario, consider 50% higher Energy Efficient lighting what it otherwise would have been.

11) Transformation – 40% Renewables

In this Mitigation Scenario, "Transformation" sector was set up in such a way that it maximizes the renewable resources potential available in the State of Florida. In this scenario, it has been assumed that electricity generation capacity is shifting away from conventional resources to the renewable resources. "Solar" has the highest electricity generating capacity by 2050. (This is quite obvious given that State of Florida is also known as "Sun-Shine State"). The main reason of achieving such a large capacity for "Solar" is that the study is based on the assumption that "Every Residential and Commercial buildings will install Solar PV on at least 30% of available roof space for residential sector and 60% for Commercial Sector. For wind energy, some small class 4-5 Wind farms along with reasonable offshore wind potential is given "Wind" second highest generating capacity after solar. Biomass and tidal energy were also included as potential energy sources to generate electricity in the state of Florida. "Gulf Stream" originates at the tip of Florida and follows eastern coastline, Florida Coastline has significant renewable energy generation potential, and hence "Tidal" also has significant Electricity Generation Potential.

IV. MASTER MITIGATION SCENARIOS

Two master mitigation scenarios ("Electrification" and "Energy Efficiency/Life style") were created in this study for the state of Florida.

1) Electrification

This complex mitigation scenario is a comprehensive combination of various individual mitigation scenarios related to "Electrification" for the major sectors: residential, commercial, transportation and industry (see Fig. 3). In the complex "Electrification" master scenario, only individual mitigation scenarios related to "Electrification" of the major energy resources are included. There are also few "Efficiency", "Biofuel" and "Energy Conservation" related mitigation scenarios as a part of the "Electrification" Master Mitigation Scenario.

Fig. 3 Tree Data Structure for the "Electrification Mitigation Scenario

2) Energy Efficiency/Life style

This mitigation scenario is a comprehensive combination of various individual mitigation scenarios as shown in Fig. 4. In this complex mitigation scenario, the higher energy efficient and energy conservative scenarios will be added compared to "Electrification" scenario. There are quite few scenarios, which are common to both "Electrification" as well as "Efficiency and Lifestyle" such as "Plug Load Reduction", Reduced Low Density Vehicles (LDV) and VMT (Vehicle Miles Travelled)). The Mitigation Scenarios related to "Biofuel" are also common in both Master Mitigation Scenarios ("Electrification" and "Efficiency and Lifestyle"). Transit Transportation related scenarios are more aggressive in "Efficiency and Lifestyle" compare to "Electrification" Master Mitigation Scenario. Similarly, "Efficiency" related scenarios corresponds to any of the major sector (Residential, Commercial, Industry, Transport) are also more aggressive in "Efficiency and Lifestyle" compare to "Electrification" Master Mitigation Scenario. It is quite clear that effective implementation of the Master Mitigation Scenario "Efficiency and Lifestyle" is far more challenging than the "Electrification". For the implementation of "Electrification" Master Mitigation Scenario, the technological advancement is required, while to implement "Efficiency and Lifestyle" we not only require technological advancement but also a different perspective and point of view from general population as life-style changes (e.g. smaller housings, smaller cars) are essential to achieve and implement the Master Mitigation Scenario "Efficiency and Lifestyle".

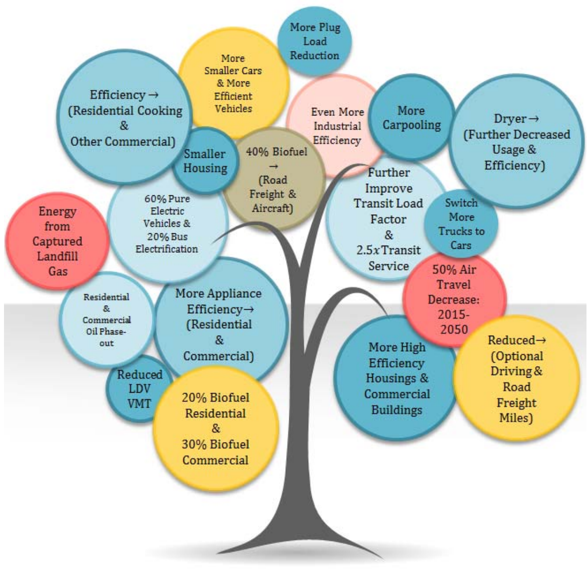

Fig. 4 Tree Data Structure for the "Energy Efficiency/Life Style" Mitigation Scenario

V.RESULTS S

The simulation results for the total energy consumption and GHG emissions with the two master scenarios are presented in this section and compared with those obtained with "Business As Usual" Scenario.

"Electrification" versus "Business as Usual":

The overall energy consumption/demand and GHG emissions associated with "Electrification" Master Mitigation Scenario in comparison with "Business As Usual" scenario are presented in this section. The analysis will include the energy demand within each sector: residential, commercial, industry, and transportation. Similarly, the global warming potential (GWP) by 2050 with for "Electrification" master mitigation scenario in comparison with "Business As Usual" is also presented. The GWP will include methane (CH_4), Nitrous Oxide (N_2O) and Carbon Dioxide (CO_2) and non-biogenetic GHG emissions. Fig. 5 shows the results of the overall energy demand for state of Florida between 1990 and 2050 with both "Electrification" and "Business As Usual" scenarios. The simulation results show an overall energy demand of 4582 Million GJ by 2050 for Business as Usual" but only 1621 Million GJ by 2050 with the "Electrification". Hence by adopting Electrification Master Mitigation Scenario, almost 65% energy demand reduction is feasible by 2050 in comparison to Business As Usual (see Table I). The "white" bar-graph in Fig. 5 shows the avoided energy demand by "Electrification" versus Business As Usual. For residential and commercial sectors respectively 54% and 41% energy demand reduction is feasible by 2050 by adopting "Electrification" scenario in comparison to Business As Usual (see Table I). For the transportation sector, adopting "Electrification" provides the most energy demand reduction (74%) by 2050 compare to any other sector (see Table I). The industrial sector, adopting "Electrification" provides the least energy demand reduction (33%) by 2050 compare to any other sectors (see Table I).

Fig. 6 shows the carbon dioxide emissions in millions metric tonnes of non-biogenic CO2 equivalent for both "Electrification" and "Business as Usual" scenarios for different sectors. A reduction of 60% of non-biogenic CO2 equivalent is obtained in 2050 with "Electrification" compared to "Business as Usual" scenario (see Table II).

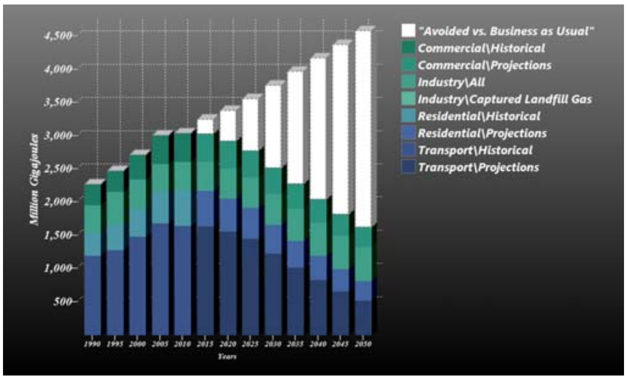

Fig. 5 Overall Energy Demand for State of Florida (1990-2050)

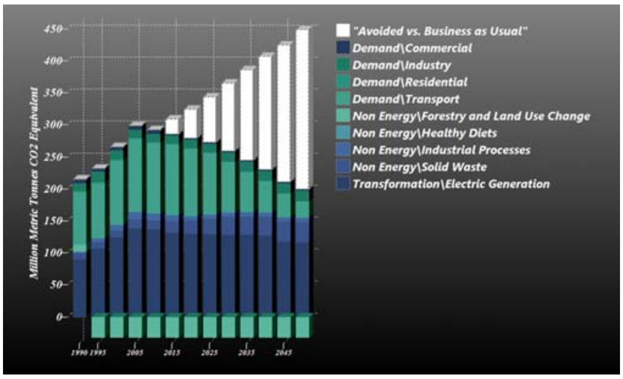

Fig. 6 Non-biogenic CO_2 emissions for the State of Florida (1990-2050)

TABLE I
ENERGY DEMAND (MILLION GJ) BY 2050

Sector	Business As Usual	Electrification	Reduction %
Residential	633.8	291.8	54
Commercial	499.1	295.6	41
Transport	2688.4	520.9	81
Industry	760.7	512.5	33
Total	2313.3	1657.9	65

TABLE II
CO_2 EQUIVALENT (MILLION TONES) BY 2050

Sector	Business As Usual	Electrification	Reduction %
CH_4	662	644.4	3
N_2O	23.3	8.7	63
CO_2 Non-biogenic	417.4	167.7	60

"Energy Efficiency/Life Style" versus "Business as Usual":

Fig. 7 shows overall residential energy demand for state of Florida for 1990 – 2050. For the Business As Usual, the overall energy demand is 633.8 Million GJ by 2050, for Efficiency and Lifestyle Scenario the overall Energy Demand is 201 Million GJ by 2050. By adopting Efficiency and Lifestyle Master Mitigation Scenario, 68% residential energy demand reduction is feasible by 2050 in comparison to Business As Usual (see Table III). Table III shows also by adopting Efficiency and Lifestyle Master Mitigation Scenario, almost 71% total energy demand (residential, commercial, transport) reduction is feasible by 2050 in comparison to Business As Usual.

The carbon dioxide CO2 emissions in millions metric tonnes for both "Energy Efficiency/Life Style" and "Business as Usual" scenarios for different sectors are summarized in Table IV. A reduction of 67% of non-biogenic CO2 equivalent is obtained in 2050 with "Energy Efficiency/Life Style" compared to "Business as Usual" scenario.

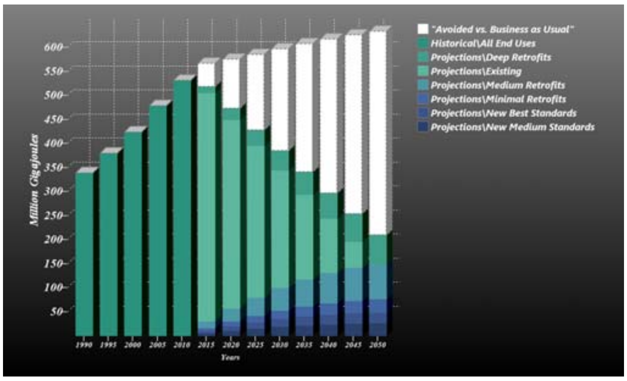

Fig. 7 Overall Residential Energy Demand for State of Florida (1990 – 2050) - Energy Efficiency/Lifestyle Scenario

TABLE III
ENERGY DEMAND (MILLION GJ) BY 2050

Sector	Business As Usual	Energy Efficiency/ Life Style	Reduction %
Residential	633.8	201	68
Commercial	499.1	270.4	46
Transport	2688.4	420.8	84
Industry	760.7	417.7	45
Total	2313.3	1318.9	71

TABLE IV
CO_2 EQUIVALENT (MILLION TONES) BY 2050

Sector	Business As Usual	Energy Efficiency/ Life Style	Reduction %
CH_4	662	644.9	3
N_2O	23.3	8.8	64
CO_2 Non-biogenic	417.4	139	67

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VI. Conclusion

Integrated modeling approach and the long range alternative planning software (LEAP) were used in this study for details energy analysis and climate change mitigation assessment in the state of Florida. Two master scenarios ("Electrification" and "Energy Efficiency/Life style") were created based on the energy resources, energy demand, technology development, and policies in the state of Florida. The model was tested and the results were compared with those obtained with the "Business as Usual" scenario. The results show:

- "Efficiency and Lifestyle" Master Mitigation Scenario adoption is more efficient compare to "Electrification" Master Mitigation Scenario in terms of overall energy reduction (%) versus Business As Usual (BAU) Scenario. "Efficiency and Lifestyle" implementation result into 71% overall energy reduction by 2050 compared to "Business As Usual" for State of Florida, while adoption of "Electrification" provides 65% (6% lower) energy demand reduction by 2050 in comparison with BAU.
- For residential and commercial energy sectors, "Efficiency and Lifestyle" implementation result in 68% and 46% energy demand reduction accordingly by 2050 compared to "Business As Usual". For these two sectors, and using "Electrification" scenario, only 54% and 41% energy demand reduction is feasible accordingly by 2050 compared to "Business As Usual" Scenario.
- For the transportation sector, "Efficiency and Lifestyle" implementation results in 84% energy reduction by 2050 compared to BAU Transportation sector, while with "Electrification" adoption results in 81% energy reduction by 2050 compare to BAU Transport sector.
- For the transformation sector, "Efficiency and Lifestyle" and "Electrification" implementation provides 51% and 28% energy demand reduction by 2050 in comparison with BAU.
- The resources consumption/demand comparison shows 56% reduction by 2050 through "Electrification" implementation, while 66% reduction is obtained through "Efficiency and Lifestyle" in comparison with BAU.
- Similar to energy demand analysis, greenhouse gases (GHG) emission assessment data (CH_4, N_2O, CO_2 biogenic, and CO_2 non-biogenic emissions) show net emission reduction in the state of Florida by 2050 using "Electrification" and "Energy efficiency/Life style" scenarios compared to "Business as Usual".

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