

Price Forecasting for PAT and Other Cap-and-Trade Markets

Indiapowertrading.info

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<http://indiapowertrading.info/>

Meet Your Presenters



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Who we are

- **Indiapowetrading.info**: India's first and only real time analytics and information platform dedicated to short term power trading that aggregates data from over 120 public domain sources.
- **Our offerings**
 - India's only real time electricity price forecast terminal.
 - Access to over 70 live graphs. Dynamic. Interactive.
 - Daily PDF publications (Morning Megawatt, DAM Price Forecast Report)
 - Online tools to compare 10 million data points
 - Guarantees 99% data accuracy and at least 95% uptime.
 - Regular publications to help you stay abreast with India power market trade currents.
 - Reinforcing trading decisions through information.

Who we are

- Climate Connect Ltd. : Information business that provides news, data, forecasts and related media solutions to companies involved in new emerging energy environment markets
- Founded in 2010, it runs a network of media outlets and develops enterprise level solutions that provide access to information.
- Network of websites include:
 - www.CaliforniaCarbon.info
 - www.CleantechDeals.com
 - www.ChinaCarbon.net.cn
 - www.IndiaPowerTrading.info
 - www.Carbonmarkets.info

Agenda

- Perform Achieve and Trade (PAT)
 - Implementation of PAT
 - Current Situation
 - Challenges
- Case Study:- WCI Cap-and-Trade
- Price Forecast for Carbon Allowances
- Price forecast for power traded at exchange in Day Ahead Market
- Steps for price forecast of ESCerts
- Conclusions

Perform Achieve and Trade (PAT)

Introduction

- Perform Achieve and Trade (PAT)- Crucial step towards creating market support for energy efficiency.
- Targets energy consumption reductions of 6.6 million tonnes of oil equivalent from 478 facilities across the eight targeted sectors.
- Plant specific average reduction target of 4.8%
- These 8 sectors together were responsible for approx. 60% of India's Greenhouse Gas (GHG) emissions in 2007. Success of PAT appears crucial for achieving GHG emissions reduction target.
- Energy efficiency measure under PAT were expected to reduce emissions by 26 million tonnes of CO₂e by 2014
- Energy Saving Certificates (ESCerts)- key program under PAT

Implementation of PAT

- Bureau of Energy Efficiency (BEE)-nodal body for implementation of PAT
- Specific targets were assigned to designated consumers (DC's) to reduce energy consumption according to their baseline by March 2015.
- DC's which meet their target would be able to issue ESCerts w.r.t saved energy. These ESCerts could be sold in closed auction.

Current Situation

- Market scope for ESCerts trading is limited- only DC's are allowed
- Difficult for high efficient performing sector to meet the target beyond a limit
- Low efficient performing sector are expected to create demand for ESCerts
- To increase Liquidity of ESCerts trading :-
No. of DC's meeting their target < No. of DC's not meeting their target

Challenges with ESCerts

- Government intervention needed
- Drastic change in Electricity Act, policy and regulation
- Synchronizing & correlating the ESCert's trading with oil (commodity) trading process- it's outreach will be maximum to investors (not limited to DC's) with provisions of multiple trading in exchange and such system already exists in case of crude oil trading in exchanges, only thing needed to be done is synchronizing(Policy & Regulations) it with the existing trading mechanism.

Case Study:-

Western Climate Initiative (WCI) Cap-and-Trade Program

WCI Cap-and-Trade Program

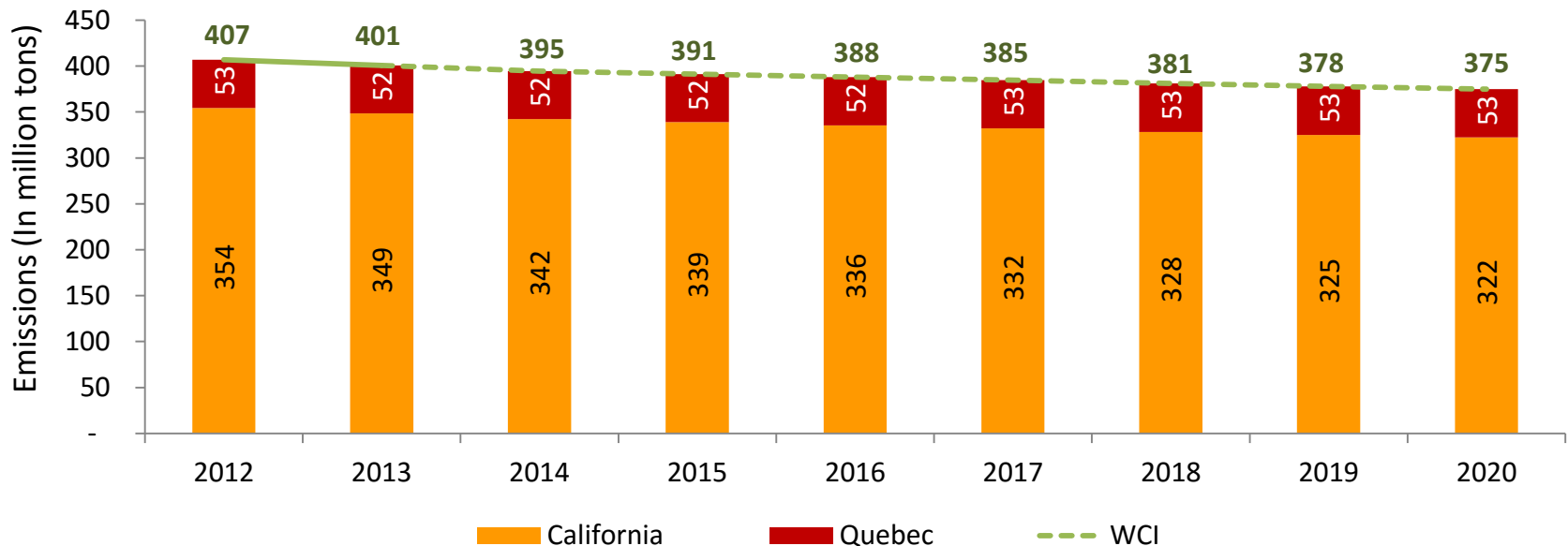
- **WCI**- a non-profit corporation formed to provide administrative and technical services to support the implementation of state and provincial greenhouse gas emissions trading programs.
- California and Quebec
- On September 17th 2015, Minister David Heurtel proposed greenhouse gas (GHG) emissions reduction target in the order of 37.5% below 1990 level by 2030.

California (The Executive Order (EO) B-30-15)

- On April 29th 2015, Governor Edmund G. Brown Jr announced a new interim California statewide GHG emission reduction target of 40% below 1990 levels by 2030.
- Crucial step in meeting 2050 target of reducing GHG emissions to 80% below 1990 levels.

California GHG Emissions Analysis Till 2020

2020 GHG emissions forecast



- California accounts for 86% of total WCI emissions.
- 2020 Capped Sector Emissions (In MMT): California (322), Quebec (53), WCI (375)
- Expected 2020 Cumulative Surplus: 300 million
- 2020 Average CCAs price will remain at floor: US\$16.5-US\$17.0
- 2020 Expected Reserve Price: US\$16.2

CaliforniaCarbon.info's 2014 GHG Emissions Forecast

Economy-wide Emissions: 451MMT

Capped Sector Emissions: 342 MMT
(99.2% accuracy)

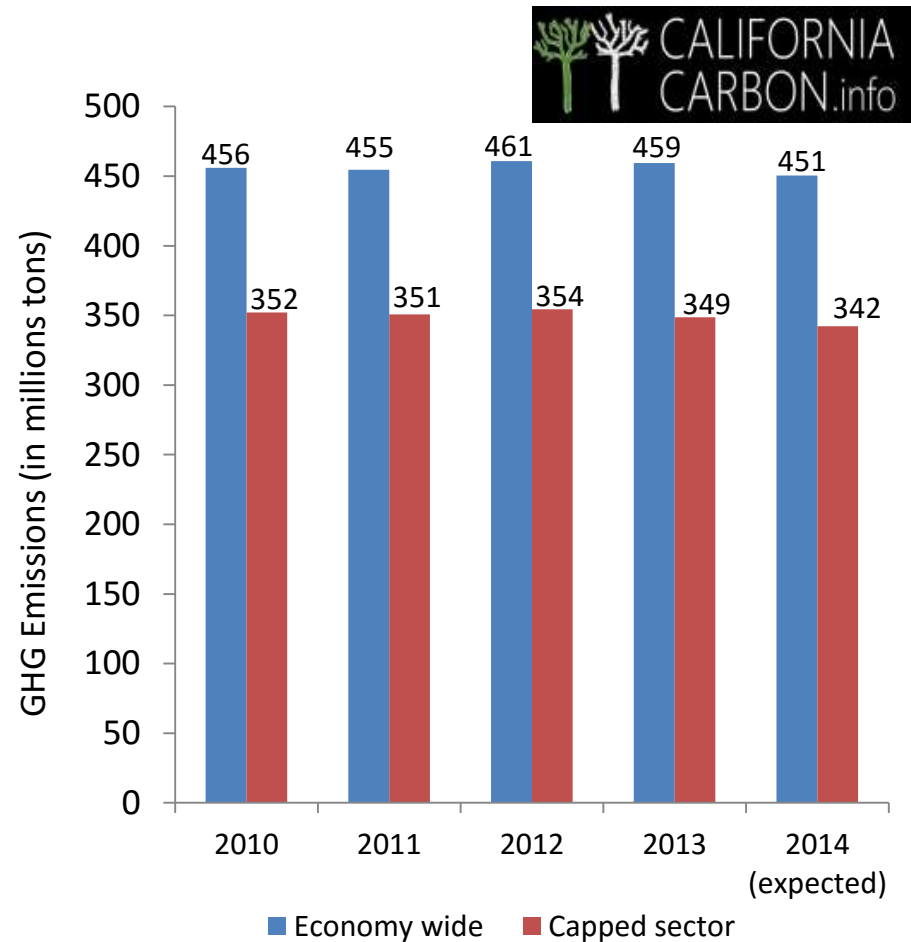
A decline of 1.8% over 2013 level
(349 MMT)

Reasons for decline in emissions:

A 1.2% decline in electricity imported from non-renewable sources of energy. 80,402 GWh (2013) to 79,444 GWh (2014)

Expected marginal decline in petroleum usage, 3,371 trillion Btu (2013) to 3,310 trillion Btu (2014)

California GHG emissions

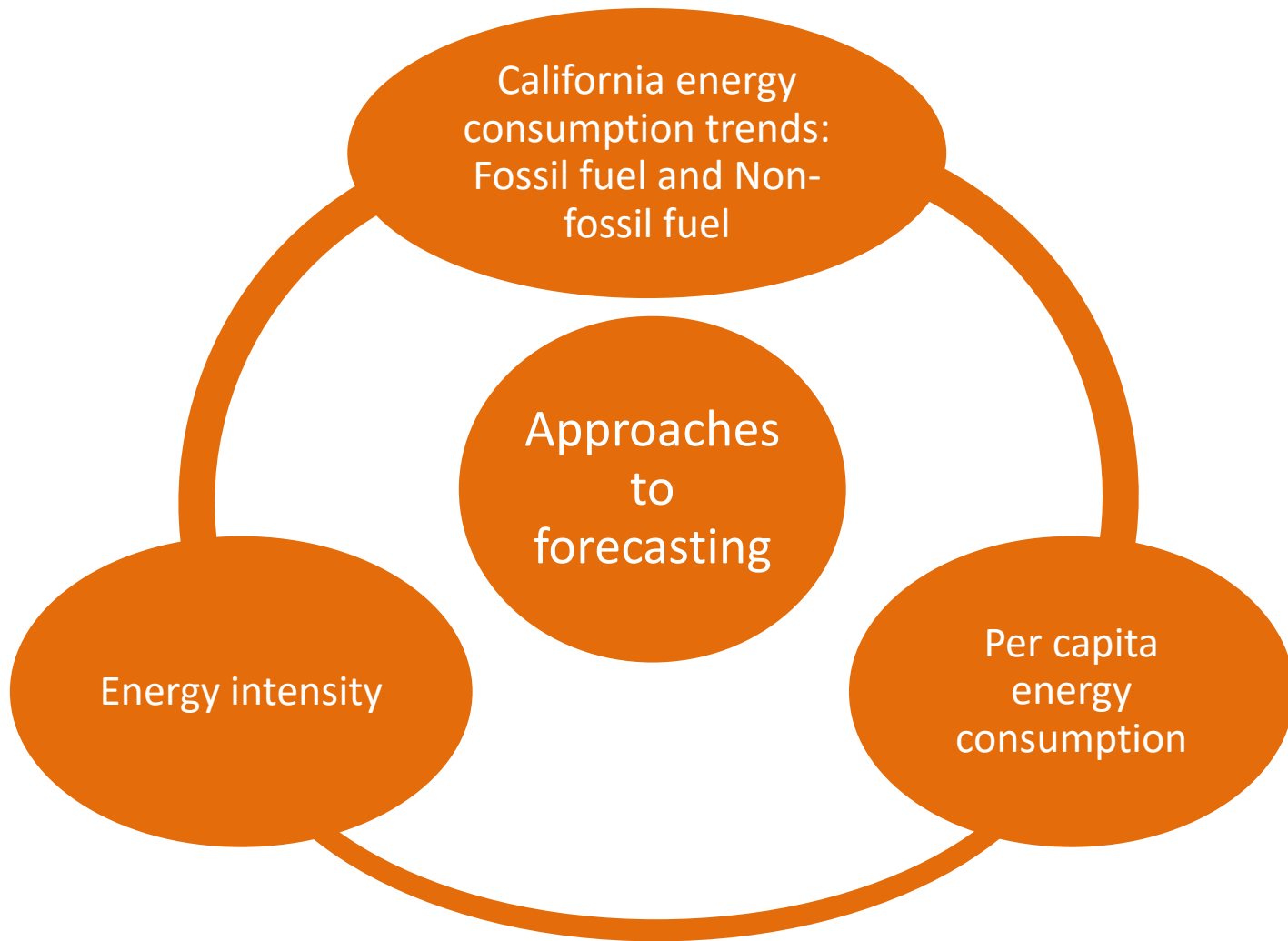


WCI EMISSIONS FORECAST

Assumptions

Parameter	California	Quebec
Real annual GSP growth (2015-2030) (Base case scenario)	1.5%	1.5%
Share of capped-sector emissions in economy-wide emissions	76% (2013) 72% (2030)	90%
Annual population growth (2015-2030)	0.9%	0.9%
Per capita energy consumption (MMbtu)	200 (2014) 195 (2020) 185(2030)	
Base case 2030 emissions reduction target	40% below 1990 level	40% below 1990 level
Annual inflation	1%	1%
Allowances held in price containment reserve	7% (2021-2030)	
Banking of allowances beyond 2020	Allowed	
Banking of offsets beyond 2020	Allowed	

Methodology

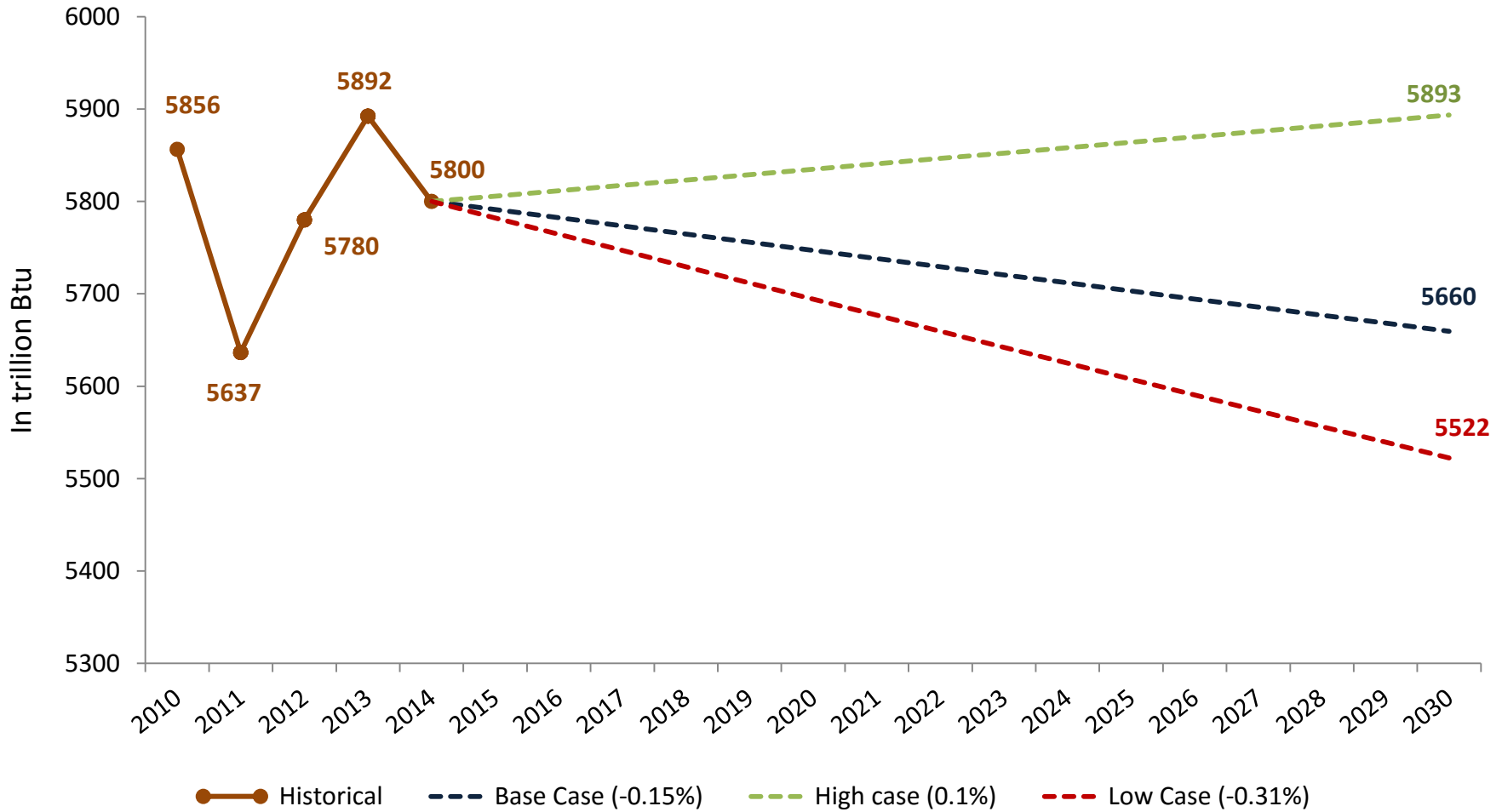


Methodology

- Elasticity Factor: Degree of responsiveness
 - Emissions to GDP: % change in emissions due to 1% change in GDP
 - Fossil fuel emissions to fossil fuel consumption
 - Emissions to other sources of energy consumption
 - Base year: 2010
- A combination of elasticity factors has been used to generate the emissions growth rate

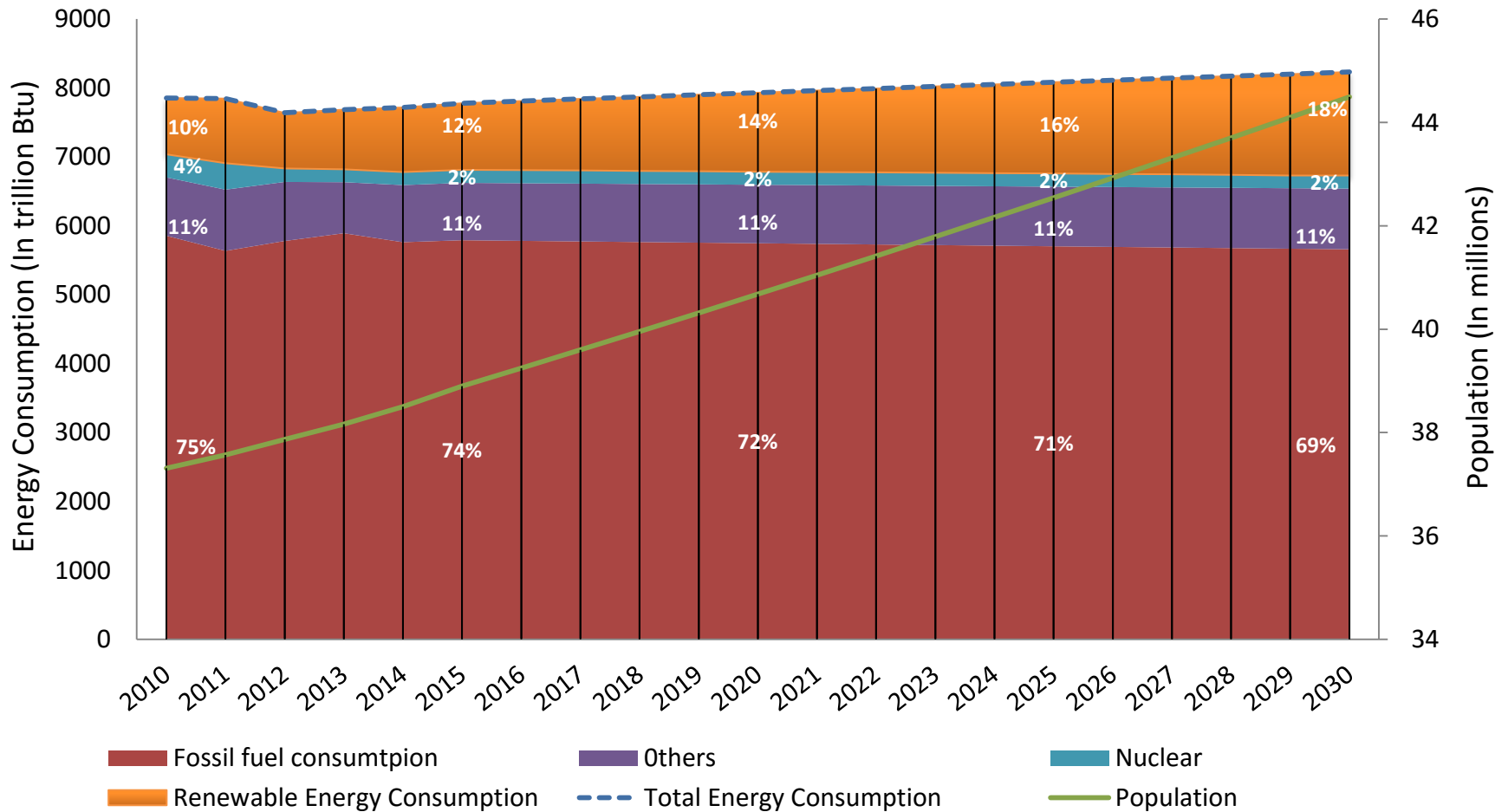
California 2030 Energy Consumption Forecast

California primary fossil fuel consumption in-state

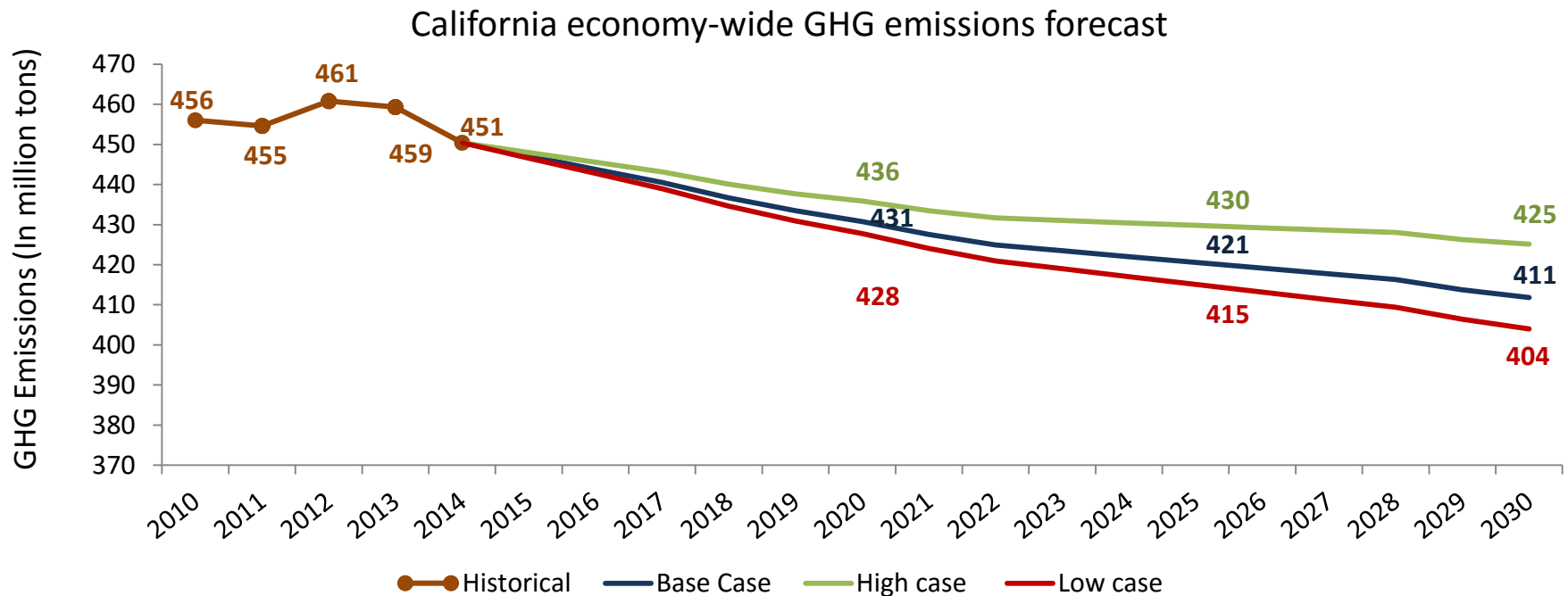


California 2030 Energy Consumption Forecast

California population growth vs. energy consumption trend



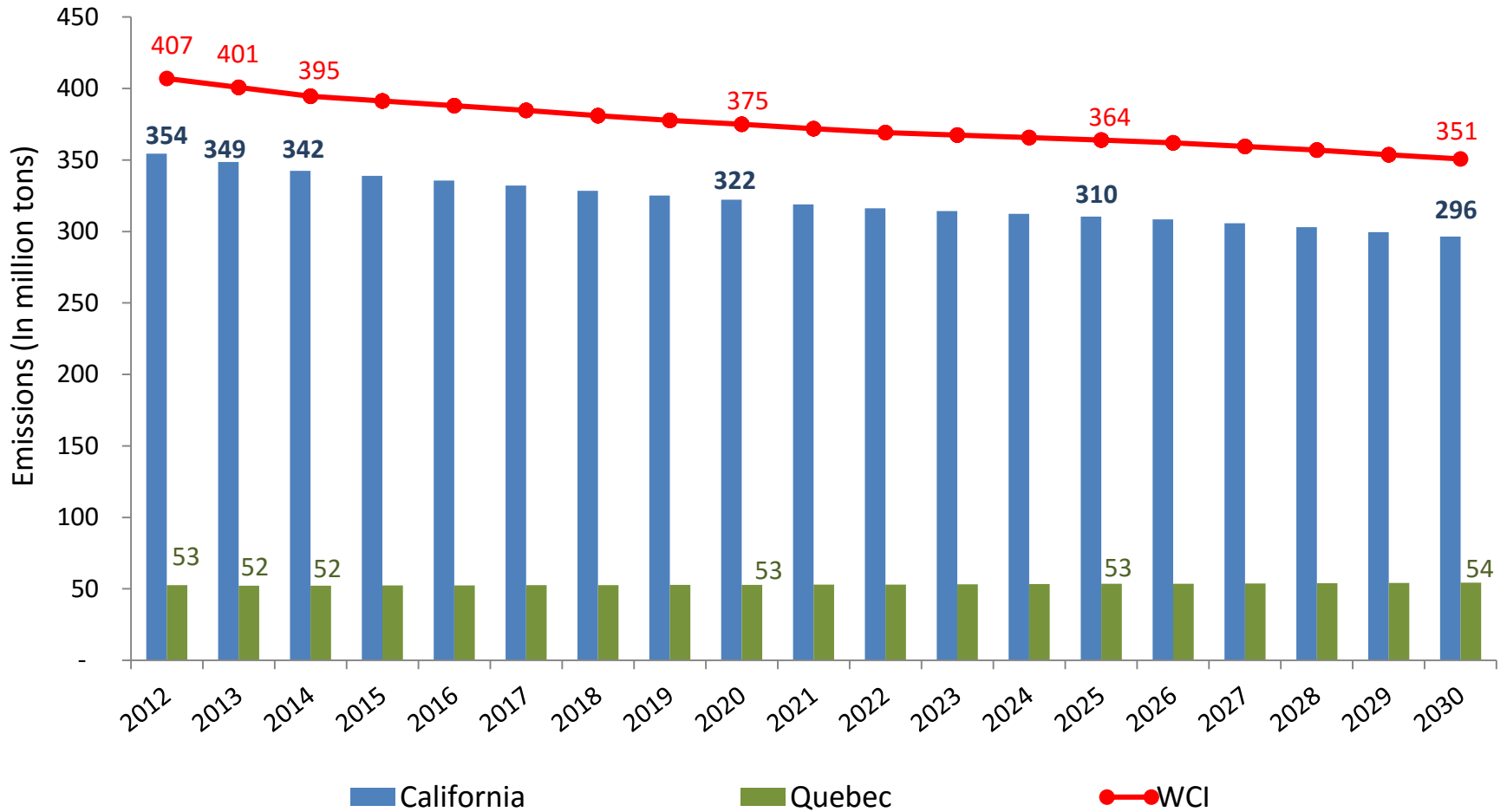
California 2030 Economy-wide GHG Emissions Forecast



- Fossil fuel consumption elasticity (with real GSP): **-0.10**
- Fossil fuel consumption growth rate (2015-2030): **-0.15 per year (base case)**
- Emissions Intensity of fossil fuel consumption (Emissions per unit of fossil fuel consumption, in tons per million Btu): **0.060 (2014), 0.057 (2030)**
- Emissions growth rate from non-fossil fuel energy source : **-1.0%**

WCI 2030 Base Case Emissions Forecast for Capped Sectors

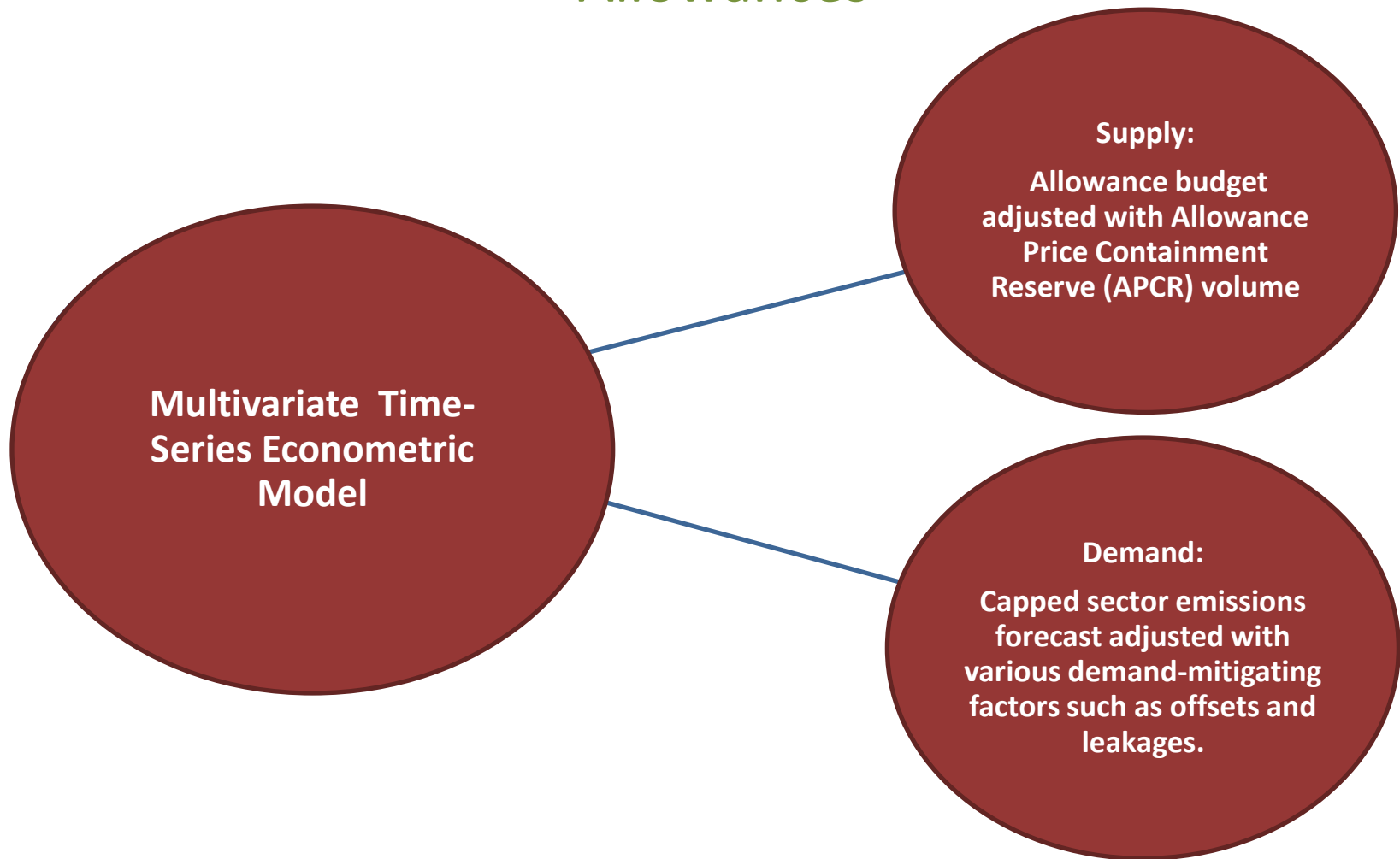
Base case capped sector emissions forecast for WCI carbon market



2030 WCI Allowance Supply and Demand Forecast



Methodology for Demand-Supply Forecast of Carbon Allowances

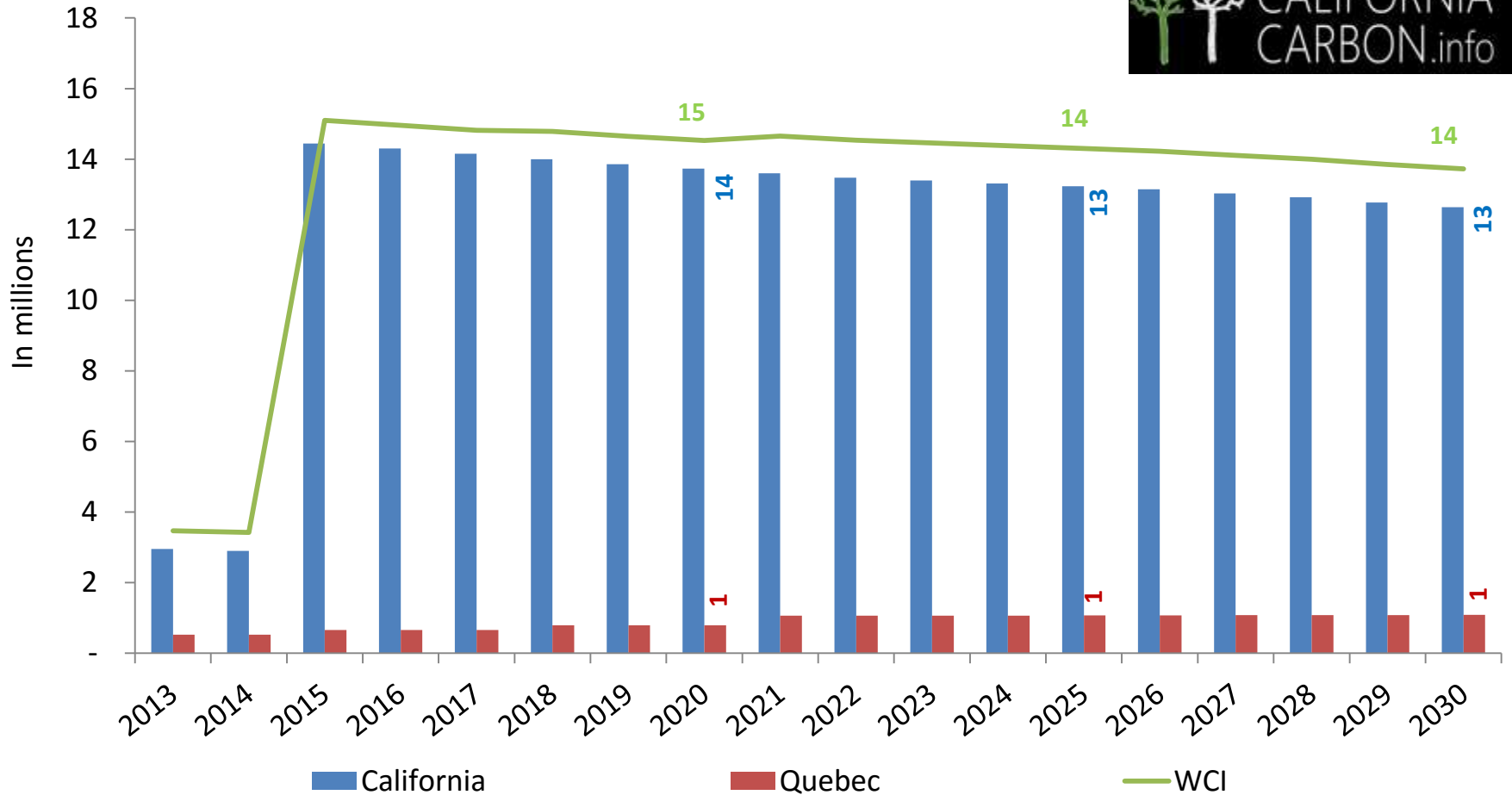


Methodology for Demand-Supply Forecast of Carbon Allowances

- 2030 Supply scenarios:-
 - 40% below 1990 level
 - 30% below 1990 level
 - 25% below 1990 level
- APCR: 7% (3rd Compliance Period onward)
- Expected Offset usage:
 - Emissions > 15MMt (7%)
 - 10MMt < emissions > 15MMt (5%)
 - 5MMt < emissions > 10MMt (4%)
 - 2.5MMT < emissions > 5MMt (3%)
 - 0 <emissions > 2.5MMt (1%)

WCI- Offsets Usage

Expected levelised annual offset usage



WCI 2030 Carbon Allowances Demand-Supply Forecast

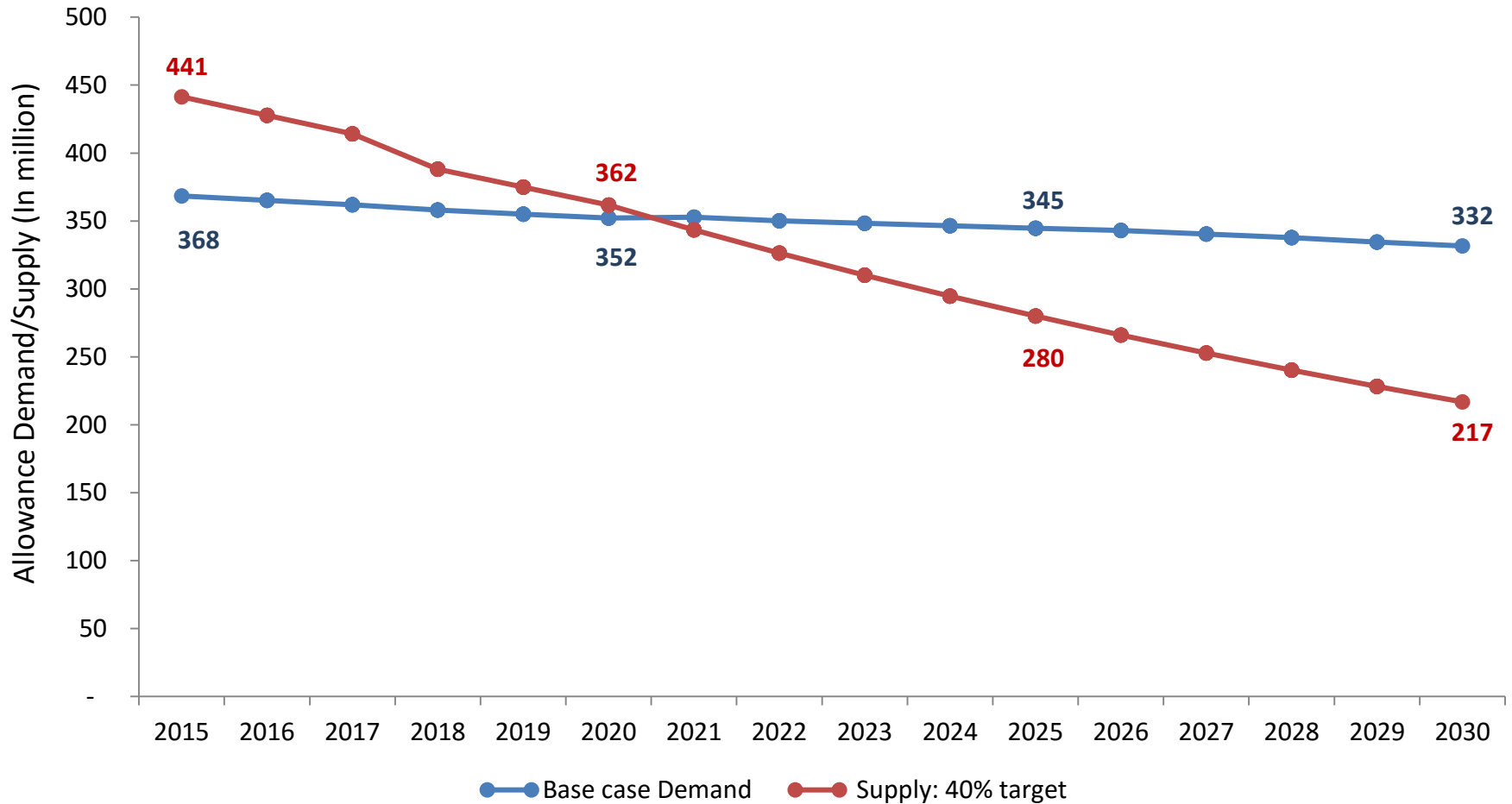
- Average Emissions Growth Rate (2015-2030):-
 - Base Case (-0.89% p.a.)
 - High Case (-0.70% p.a.)
 - Low Case (-1.0% p.a.)
- WCI Carbon Allowances Supply Scenarios (2030):
 - 40% below 1990 level (or 2020 level)
 - 30% below 1990 level (or 2020 level)
 - 25% below 1990 level (or 2020 level)

2030 Cumulative Shortage of WCI Carbon Allowances (In millions)

		Carbon Allowances Supply Scenarios		
		25% target	30% target	40% target
Emissions Scenarios	Base Case	34	141	370
	High case	130	247	450
	Low case	10	82	250

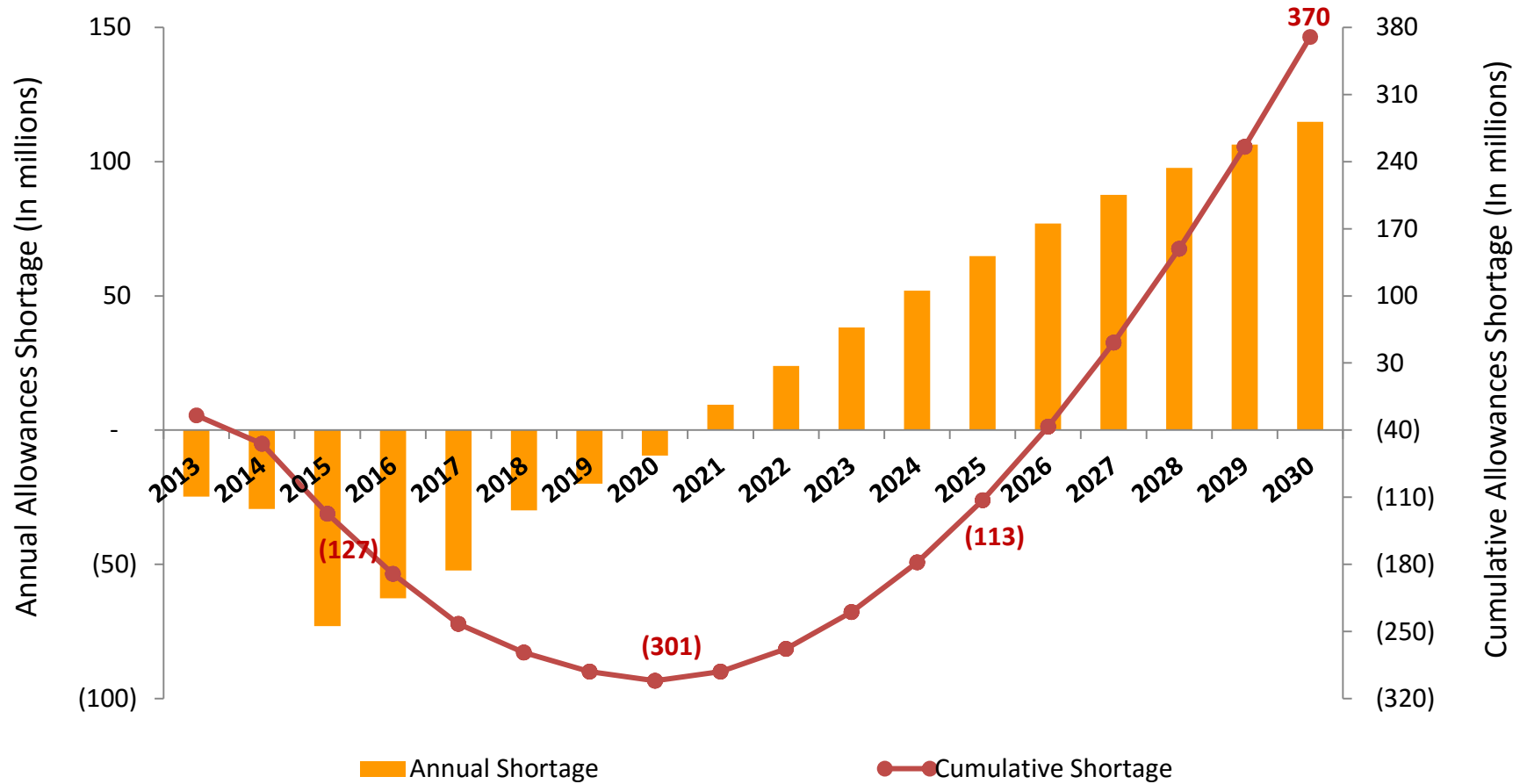
WCI Carbon Allowances Demand-Supply Forecast

WCI carbon allowances demand/supply forecast



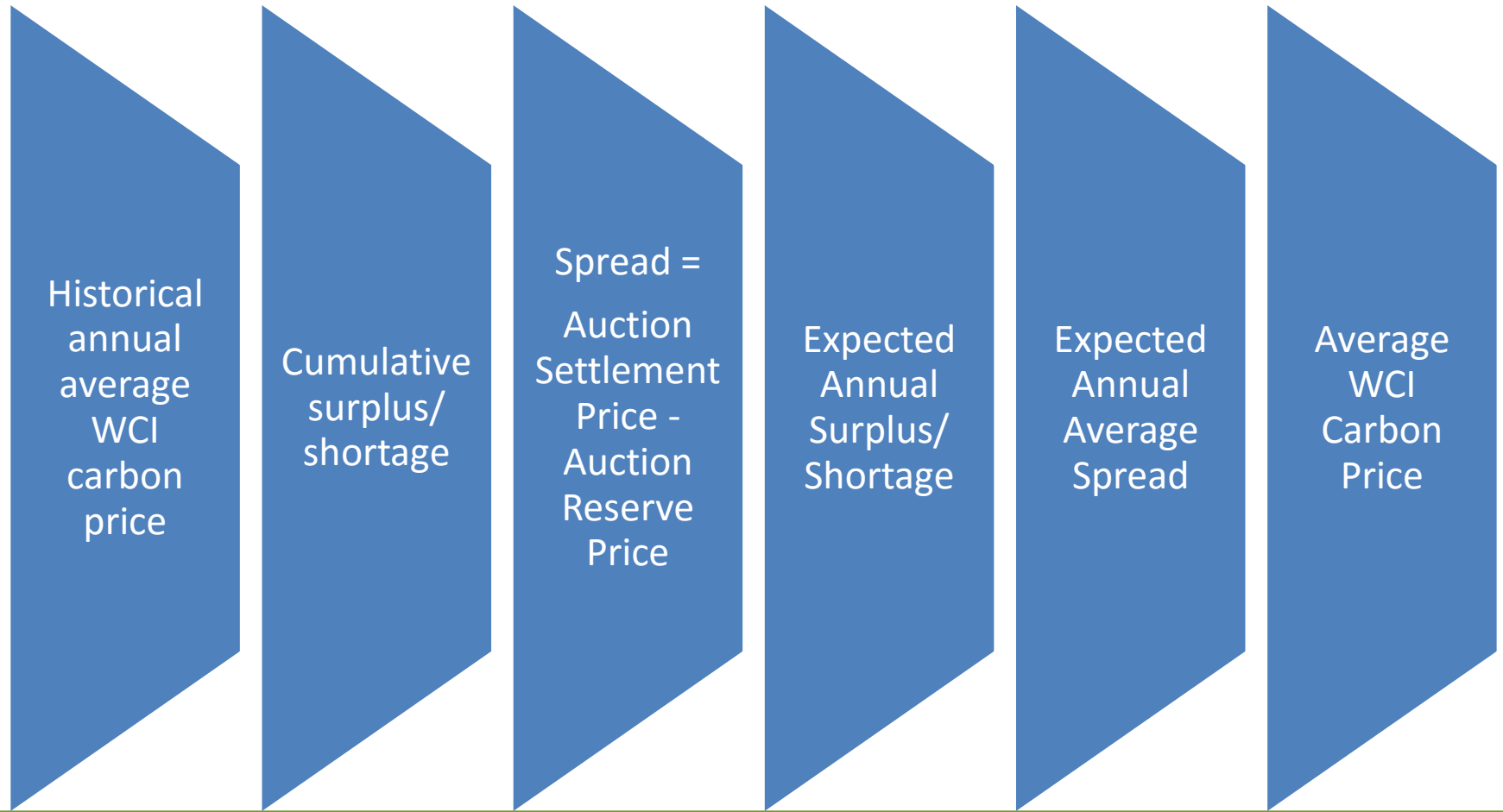
WCI Carbon Allowances Demand-Supply Forecast

Expected WCI allowance shortage



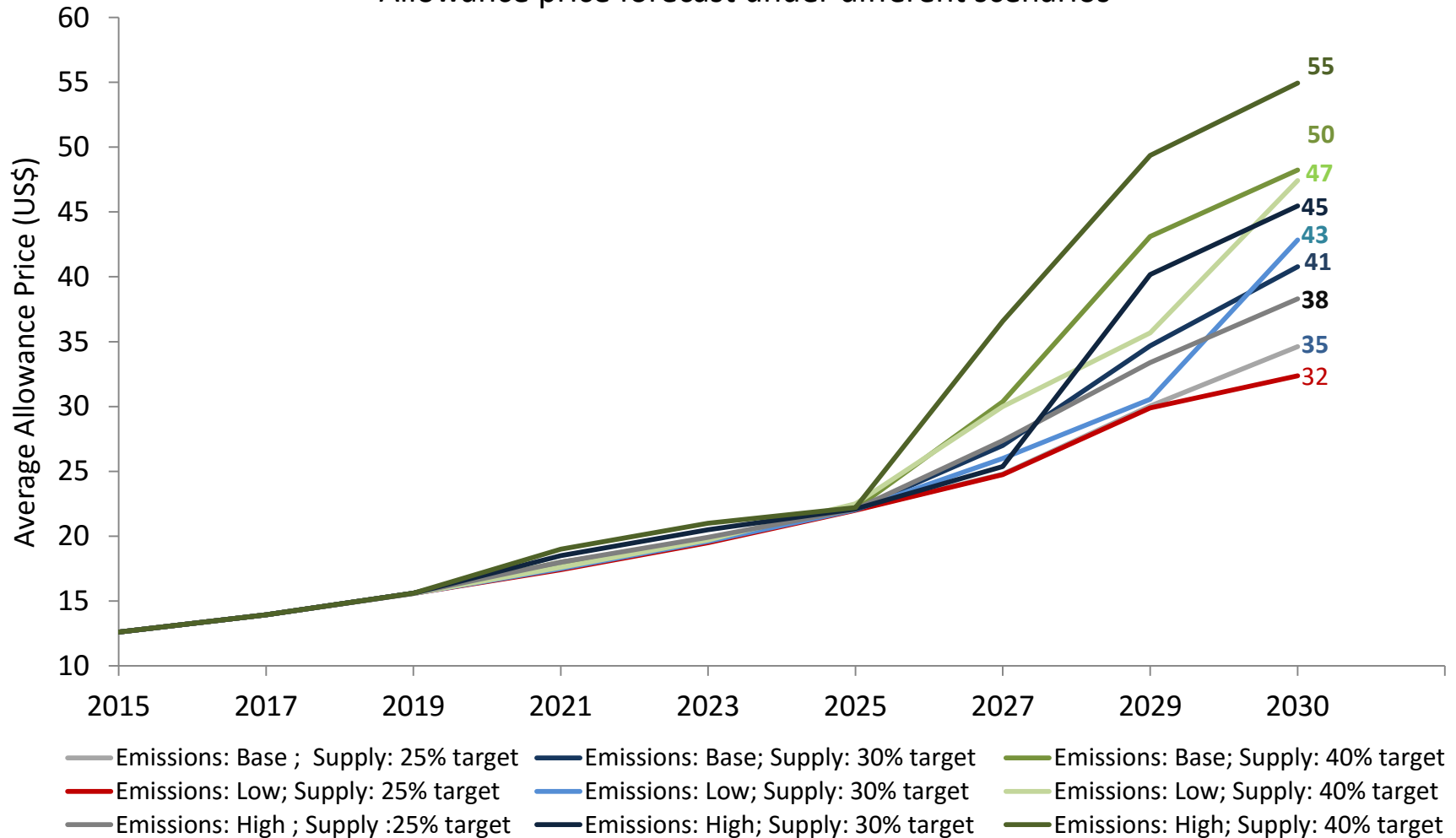
2030 WCI Carbon Price Forecast

WCI : Demand-Supply Price Forecast for Carbon Allowances



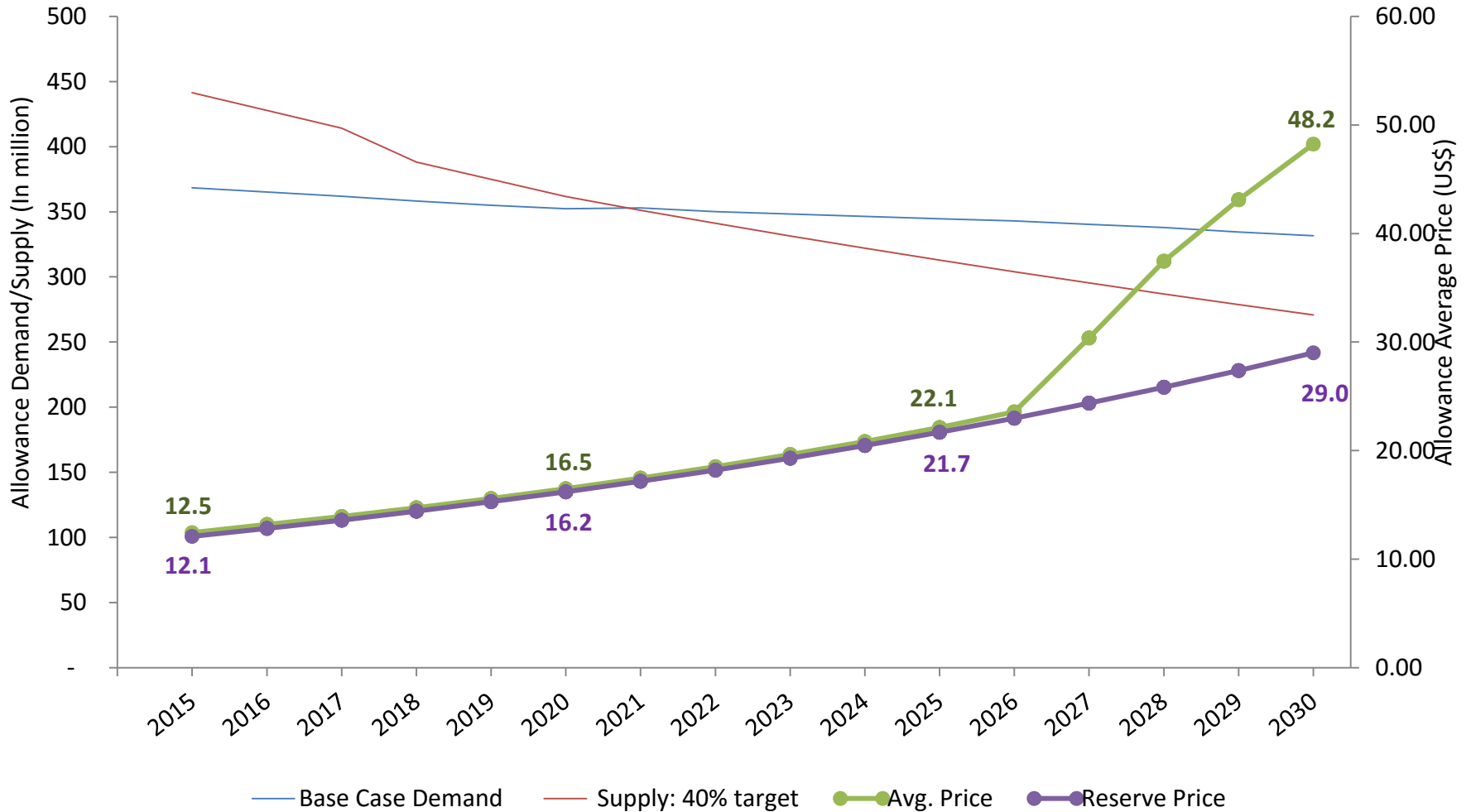
WCI 2030 Carbon Allowance Price Forecast

Allowance price forecast under different scenarios



WCI 2030 Carbon Allowance Price Forecast

Annual demand-supply price forecast for allowances under base case scenario



Price Forecast of Power Traded at Day Ahead Market

Indiapowertrading.Info's DAM Price Forecast

Quantitative forecasting:

- numerical information about the past is available
- some aspects of the past patterns will continue into the future.

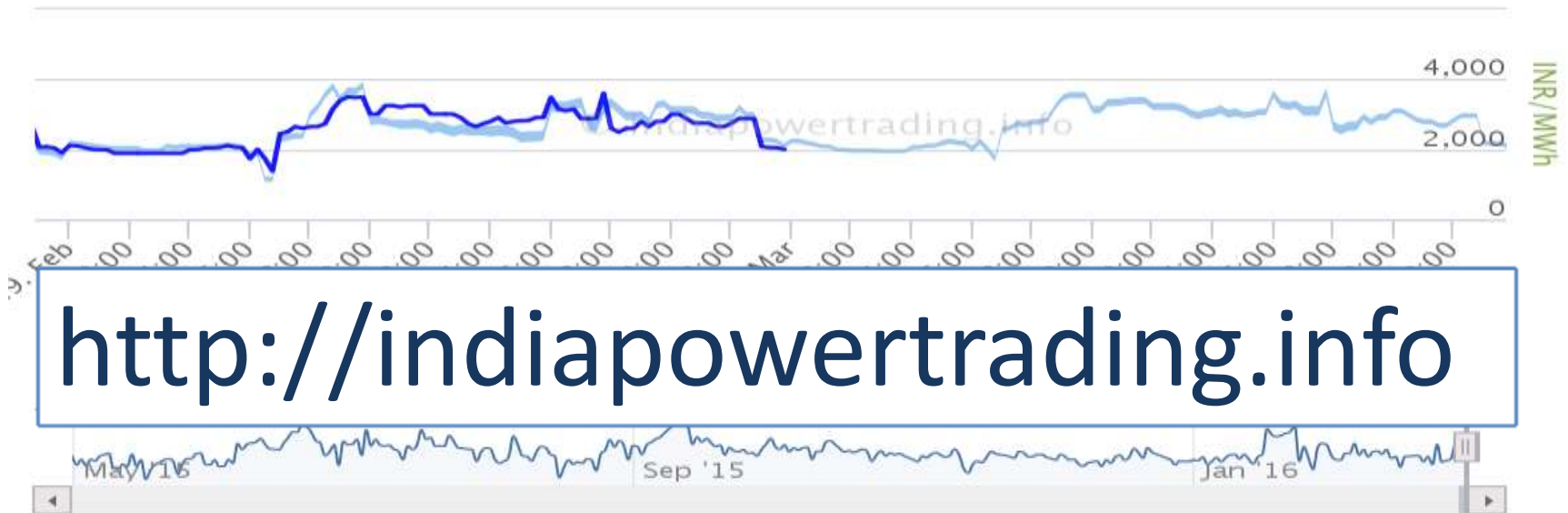
Types of Models:

- Regression models
- Time Series Models (eg. Arima)
- Machine Learning Techniques (eg. Neural Networks)

Indiapowertrading.Info's forecast

Area-wise IEX-DAM price forecast for region N2

Zoom 5d 15d 1m 3m 6m 1y All From Feb 28, 2016 To Mar 1, 2016



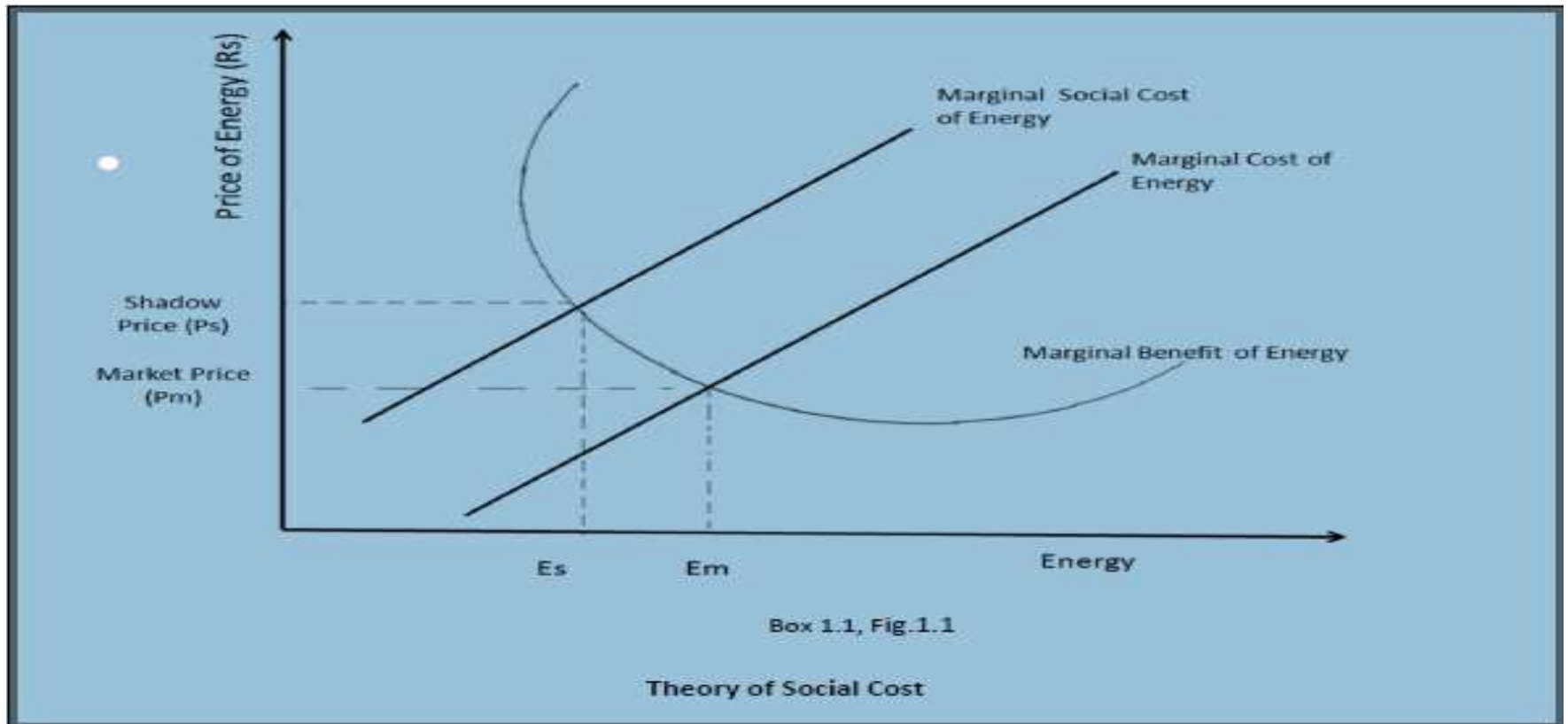
— Market clearing price at IEX IPT.info Forecasted Range

- Consistently achieving an accuracy of over 90 % for Round the clock trading hours.

Price Forecast for ESCerts

Sector Specific Demand-Supply Scenario

- Projection of energy use across sector
- Prices of Energy in India



Sector Specific Demand-Supply Scenario and price forecast

- Sector specific energy consumption forecast vis-à-vis continuous economic growth combined with technologic innovation
- Probability to each facility achieving their energy consumption reduction targets.
- Expected surplus/shortage of ESCerts (depending on no. of DC's meeting their target and no. of DC's not meeting their target)
- Price Forecast Model depending on surplus/shortage scenarios
- Shadow price of energy = cost of increasing energy consumption by one MTOE = cost of reducing energy consumption by one MTOE or the abatement cost of reducing 1 MTOE energy consumption = Price of ECSert.
- With existing framework of price forecast for carbon allowances traded in WCI carbon market- it can be very easily replicated for ESCerts

Conclusions

- Government intervention needed for more clear policy framework with specific changes in regulation as and when required.
- Required more accurate data to define coverage, establish baseline, set goals and monitor performance
- More awareness at facility level
- Invest in strengthening institutional and human capacity

References

- [http://www.teriin.org/projects/nfa/pdf/Energy Saving Certificates.pdf](http://www.teriin.org/projects/nfa/pdf/Energy_Saving_Certificates.pdf)
Energy saving instrument – ESCerts in India
- <http://powermin.nic.in/Energy-Efficiency>
- http://www.ripublication.com/ijesdmspl/ijesdmv4n3_07.pdf
- <http://cdkn.org/project/inside-stories-on-climate-compatible-development/>
- <http://www.iexindia.com/products.aspx?id=11&mid=1>