Renewable Generation in Rates: The Colorado Experience

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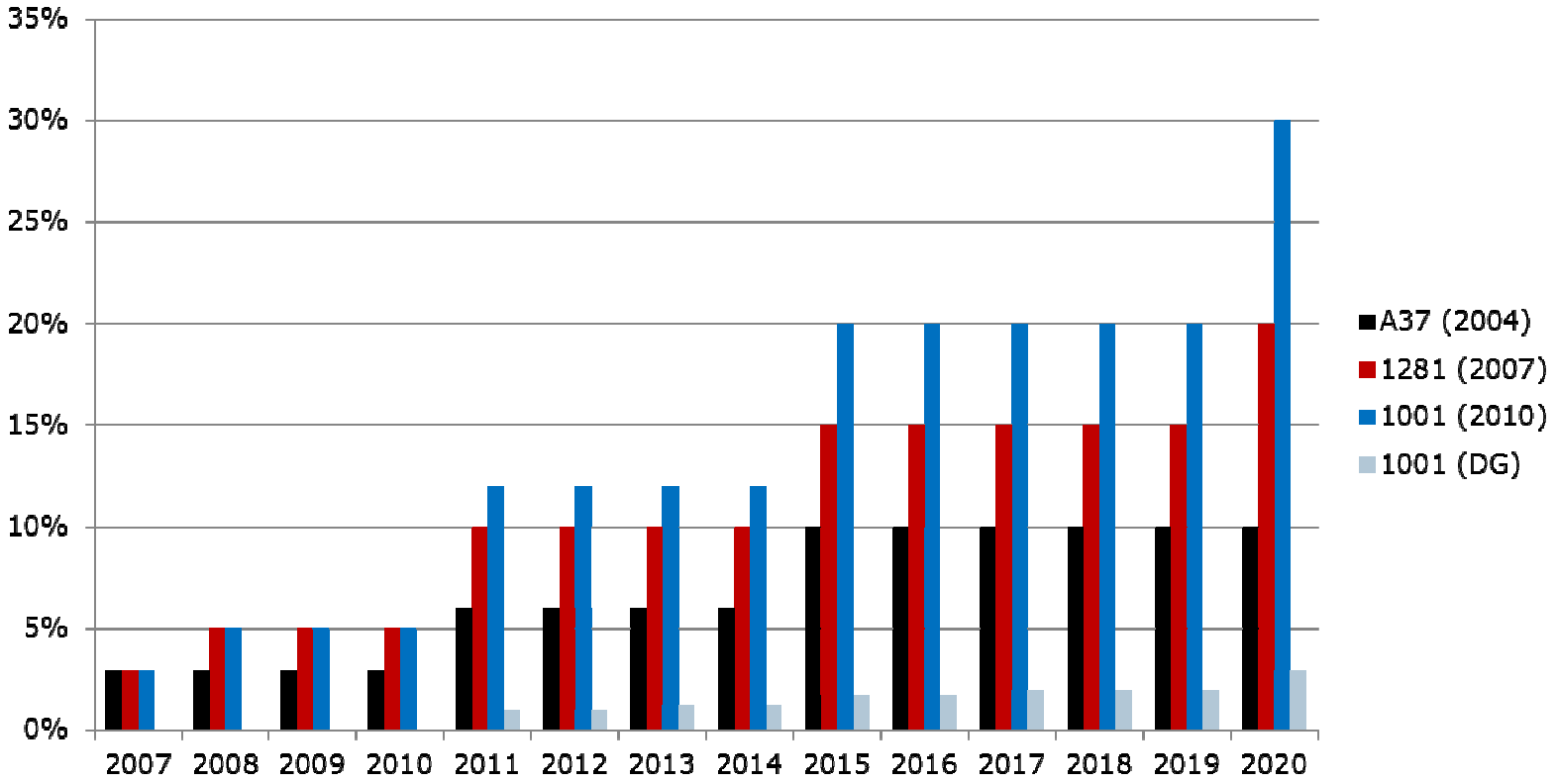
Renewable Energy Standard

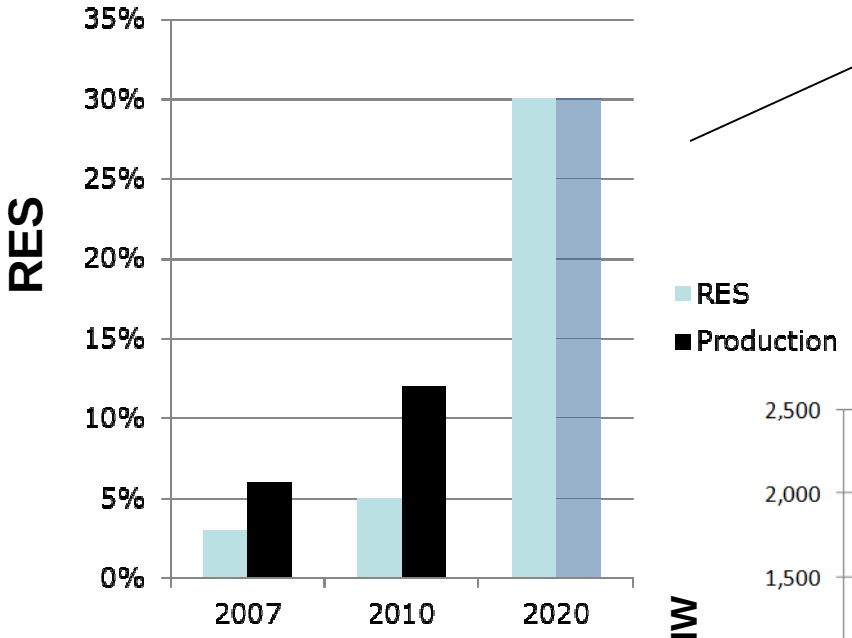
2004
10% by 2015

2007
20% by 2020

2010
30% by 2020

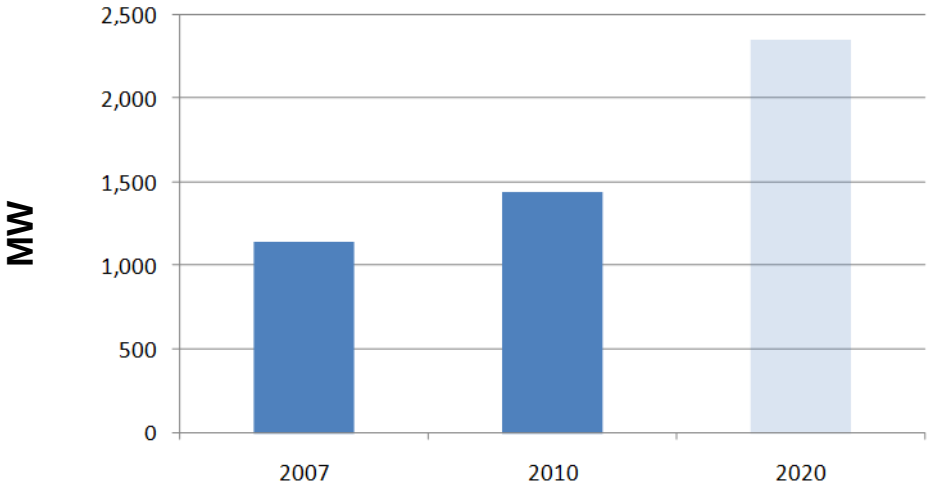


Public Service RES Compliance



- Sufficient resources to meet "non-DG" RES through 2021

Renewables Acquired
(Nameplate)



Public Service Performance 2011

- RES: 12% of sales in 2011
- Sales: 28,482,792 MWh
- Total RES Requirement: 3,417,935 RECs*
- Actual production: 5,158,766 RECs (18% of sales)
- Spending: $290 million

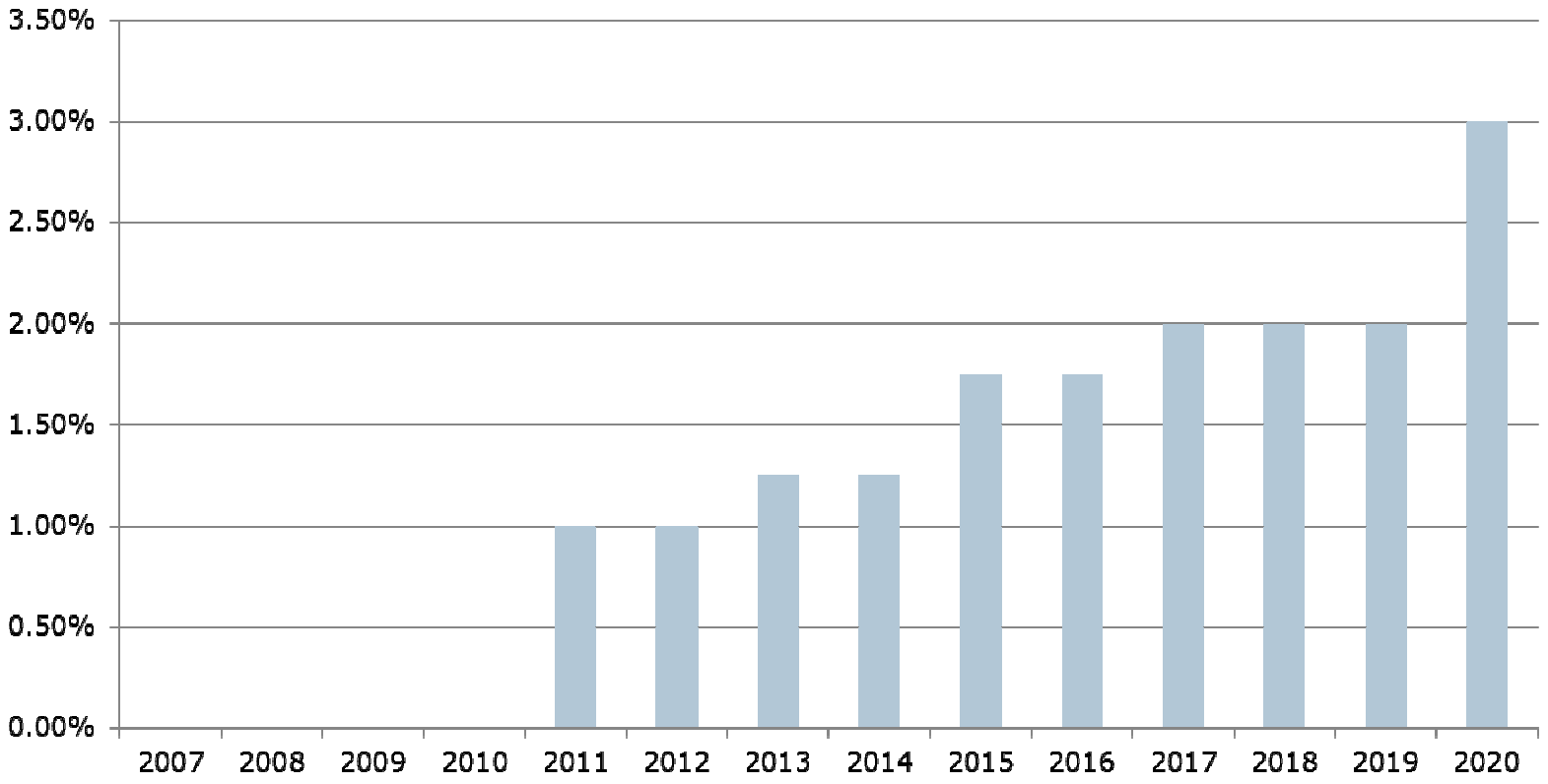
- 1 Renewable Energy Credit (REC) = 1 MWh from Renewable Resource

Public Service Renewables 2011

Category		MW	MWh
Large	Wind	1,677	4,466,768
	Central Solar	86	71,438
Medium	Biomass	4	22,318
	Hydro	75	233,767
	Wind	86	226,873
Small	On-Site Solar*	112	137,602
TOTAL		2,040	5,158,766

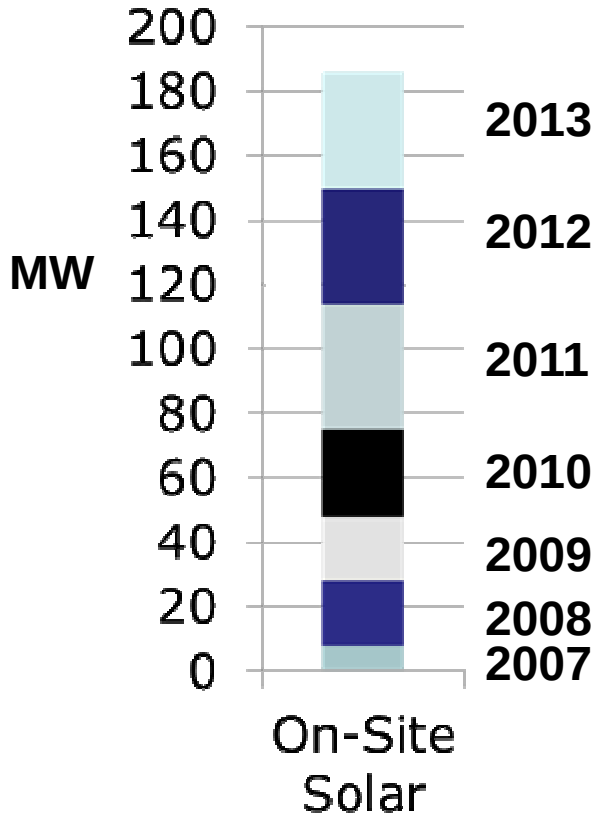
Distributed Generation (DG)

At Least 50% Retail DG (On-site PV)
The Balance is "Wholesale" DG (< 30 MW)



Public Service DG RES Compliance

- Commission approved 36 MW per year of new retail DG (on-site solar)
- Caps on spending
- Lower and declining incentive levels



Net Metering

- Customer's retail electricity usage offset by the generation from on-site solar (small PV), provided that:
  - The generation supplies no more than 120% of the customer's average annual electricity consumption
  - The rated capacity of the generation does not exceed the customer's service entrance capacity
- Excess kWh rolled over from month to month and credited against the customer's usage in subsequent months.
  - Alternative: Customer compensated for accrued excess kWh credits at the utility's average hourly incremental cost over the most recent calendar year

Customer Incentives for Solar

- Standard rebates
  - Initially $2/watt
  - Now $0/watt
- 20-year contracts for renewable energy credits (RECs)
  - Initially payment all up for small systems
  - But now all performance payments over time
  - Residential systems receive $0.10-$0.15/kWh produced
  - Trending toward $1/REC

Incentive/Net Metering Example

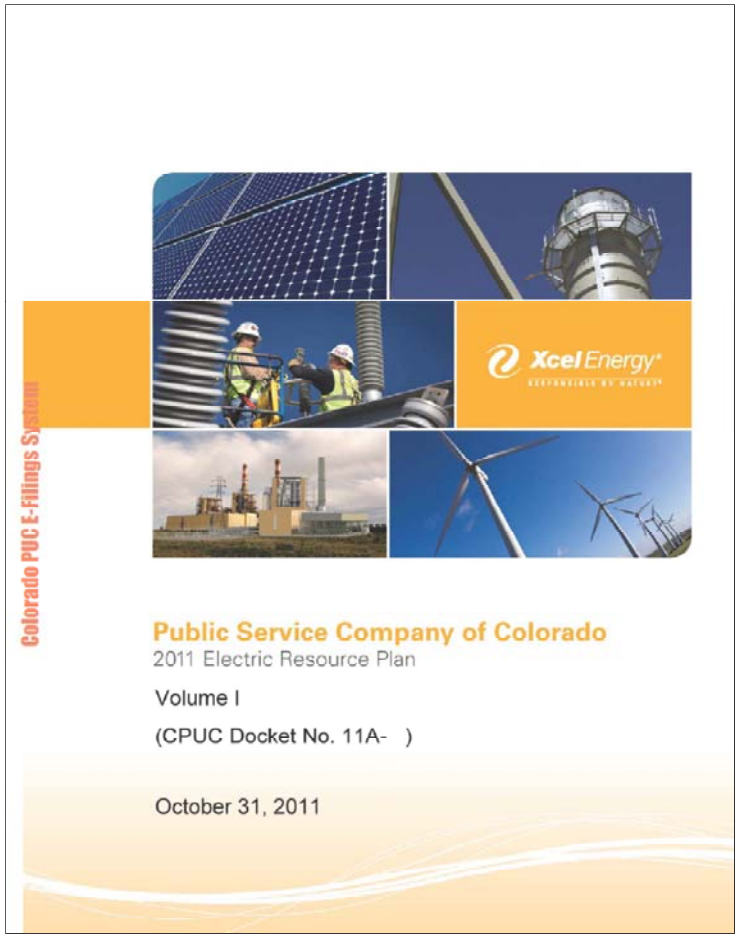
Customer usage	700	kWh
On-site solar production	850	kWh

	Standard Bill			Net Metered Bill		
	Charge	Usage	Total	Charge	Usage	Total
Customer charge	$ 6.75		$ 6.75	$ 6.75		$ 6.75
First 500 kWH	$0.04604	500	$ 23.02	$0.04604	0	$ -
All over 500 kWH	$0.09000	200	$ 18.00	$0.09000	0	$ -
ECA	$0.02665	700	$ 18.66	$0.02665	0	$ -
PCCA	$0.00693	700	$ 4.85	$0.00693	0	$ -
DSMCA	$0.00131	700	$ 0.92	$0.00131	0	$ -
RESA			$ 1.44			$ 0.94
Total			$ 73.64			$ 7.69
Rollover kWh Credits*		0			150	
REC Payments	$0.10000	0	$ -	$0.10000	850	$ (85.00)
Net Bill			$ 73.64			$ (77.31)

*If customer does not elect to rollover unused kWh credits, the customer will receive an annual payment for excess credits at the average hourly incremental cost of electricity supply over the most recent calendar year

Electric Resource Planning

- Reliability
- Cost-effectiveness
  - Best mix of new utility resources
  - Colorado's public policy objectives (renewables, efficiency)
  - Consideration of the benefits and cost of various alternatives
  - Competitive bidding to ensure just and reasonable rates



Public Service 2007 ERP

- Renewables
  - Photovoltaic and highly concentrating photovoltaic projects: ~100 MW
  - Concentrating solar thermal with 4 to 8 hours of storage : up to 250 MW
  - Wind: ~700 MW
- Thermal
  - ~900 MW of gas generation

Public Service 2007 ERP (Modified)

- Renewables
  - Photovoltaic and highly concentrating photovoltaic projects: ~~~100 MW~~ **60 MW**
  - ~~Concentrating solar thermal with 4 to 8 hours of storage: up to 250 MW~~
  - Wind: ~700 MW
- Thermal
  - ~900 MW of gas generation

Decision whether to acquire more solar deferred to 2011 resource plan

Limon II Wind Planning Costs

Annual Production 789GWh

Annual Costs	**2013**	**2017**	**2020**	**2025**	**2030**
Total Costs ($ thousands)					
Contract Costs	$ 21,743	$ 24,257	$ 26,328	$ 30,164	$ 34,581
Wind Integration Costs	$ 3,432	$ 4,403	$ 5,200	$ 6,656	$ 7,295
Coal Cycling Costs	$ 805	$ 805	$ 584	$ 457	$ 457
Curtailment Costs	$ 1,147	$ 497	$ 77	$ -	$ -
Total Costs	$ 27,127	$ 29,962	$ 32,189	$ 37,277	$ 42,333
Unit Costs (per MWh)					
Unit Contract Costs	$27.56	$30.74	$33.37	$38.23	$43.83
Unit Integration Costs	$4.35	$5.58	$6.59	$8.44	$9.25
Unit Cycling Costs	$1.02	$1.02	$0.74	$0.58	$0.58
Unit Curtailment Costs	$1.45	$0.63	$0.10	$0.00	$0.00
Unit Total Costs	$34.38	$37.97	$40.80	$47.25	$53.65
Natural Gas Costs ($/MMBtu)	$5.30	$6.48	$7.20	$9.15	$10.11

Renewables in Rates

- Most renewables costs are purchased energy costs (PPAs)
- Purchased energy costs recovered through the "fuel clause" (Electric Commodity Adjustment or ECA)
- Some costs recovered through Renewable Energy Standard Adjustment (RESA)
  - 2% cap on RESA
  - The "incremental costs of renewables"

Public Service Spending 2011

Year	RESA Rider	RES Percent of Sales	Renewable Energy Costs[1,2]	Total RESA Spending[3]	Total RESA Revenue	RESA Deferred Balance
2006	0.60%	n/a	n/a	$8,204,713	$9,435,158	$1,230,445
2007	0.60%	3.0%	$76,272,752	$19,080,847	$12,563,855	($5,286,547)
2008	1.46%	5.0%	$185,674,553	$36,455,751	$31,410,272	($10,332,026)
2009	2.00%	5.0%	$206,289,255	$62,104,210	$47,907,926	($24,528,311)
2010	2.00%	5.0%	$239,511,092	$77,839,177	$55,793,359	($46,574,129)
2011	2.00%	12.0%	$290,728,617	$98,503,116	$93,709,830	($51,367,418)
2012 thru May	2.00%	12.0%	$175,201,992	$41,282,639	$53,759,385	($38,890,672)
TOTAL	--	--	$1,173,678,261	$343,470,453	$304,579,785	--

Renewables Spending in Context

- Total Utility Costs (Annual) — $2.65 billion
  - 1.3 million customers
  - 7,900 MW
  - Sales of 28,482,792 MWh
- Generation (non-fuel, non-IPP), Transmission, and Distribution — $1.4 billion
- ECA/RESA (~fuel clause) — $1.0 billion
  - $300 million renewables
  - $275 million coal, $288 million gas
  - $137 million other purchased energy
- Purchased Capacity — $200 million
- Efficiency/Demand Response — $50 DSM

Public Service Spending(2011)

Category	Generation Type	Renewable Energy Cost[1]	RESA[2]	ECA
Non DG	Wind	$200,374,571	$12,997,623	$187,376,948
		$0.048/kWh		
	Wind	$13,508,902	$5,055,895	$8,453,007
Wholesale DG	Biomass	$1,205,619		$1,205,619
	Hydro	$8,391,982		$8,391,982
	Central Solar	$10,881,917	$5,689,501	$5,192,416
		$0.170/kWh		
Retail DG	Onsite-Solar	$70,816,710	$69,831,714	$984,996
Total Generation		$305,179,701	$93,574,733	$211,604,968
Solar*Rewards Administration			$1,028,700	
RESA Deficit Interest			$3,559,321	
TOTALS		$305,179,701	$98,162,754	$211,604,968

RESA

- Presently set at 2%, matches statutory cap
- Designed to cover “incremental costs” of renewables

  incremental costs = total cost of renewables – avoided costs
- Avoided costs primarily natural gas costs (fuel costs)
- Avoided costs can include costs of emissions
- Savings from wind resources (negative incremental costs) were expected to offset the higher costs of solar resource (positive net incremental costs)
- RESA now complicated by low natural gas costs

RESA Deficit

- Large negative balance of RESA account
  - Reaching $100 million in 2011
  - Now about $35 million
- Caused by spending on on-site solar
  - Rebates paid upfront ($2 / watt)
  - REC payments made upfront (20 years worth)
- More cash going out than coming in

Public Service Spending(2011)

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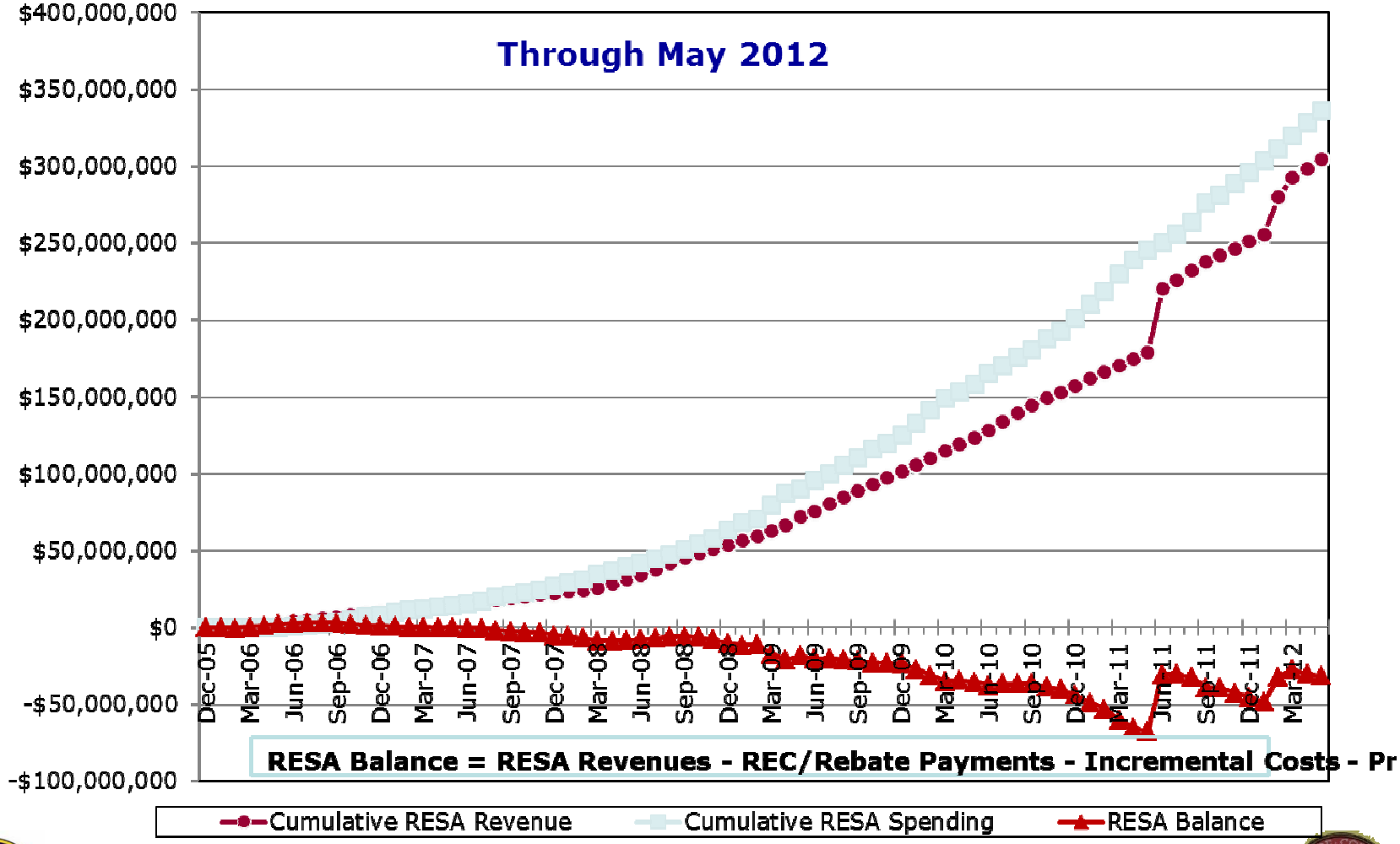
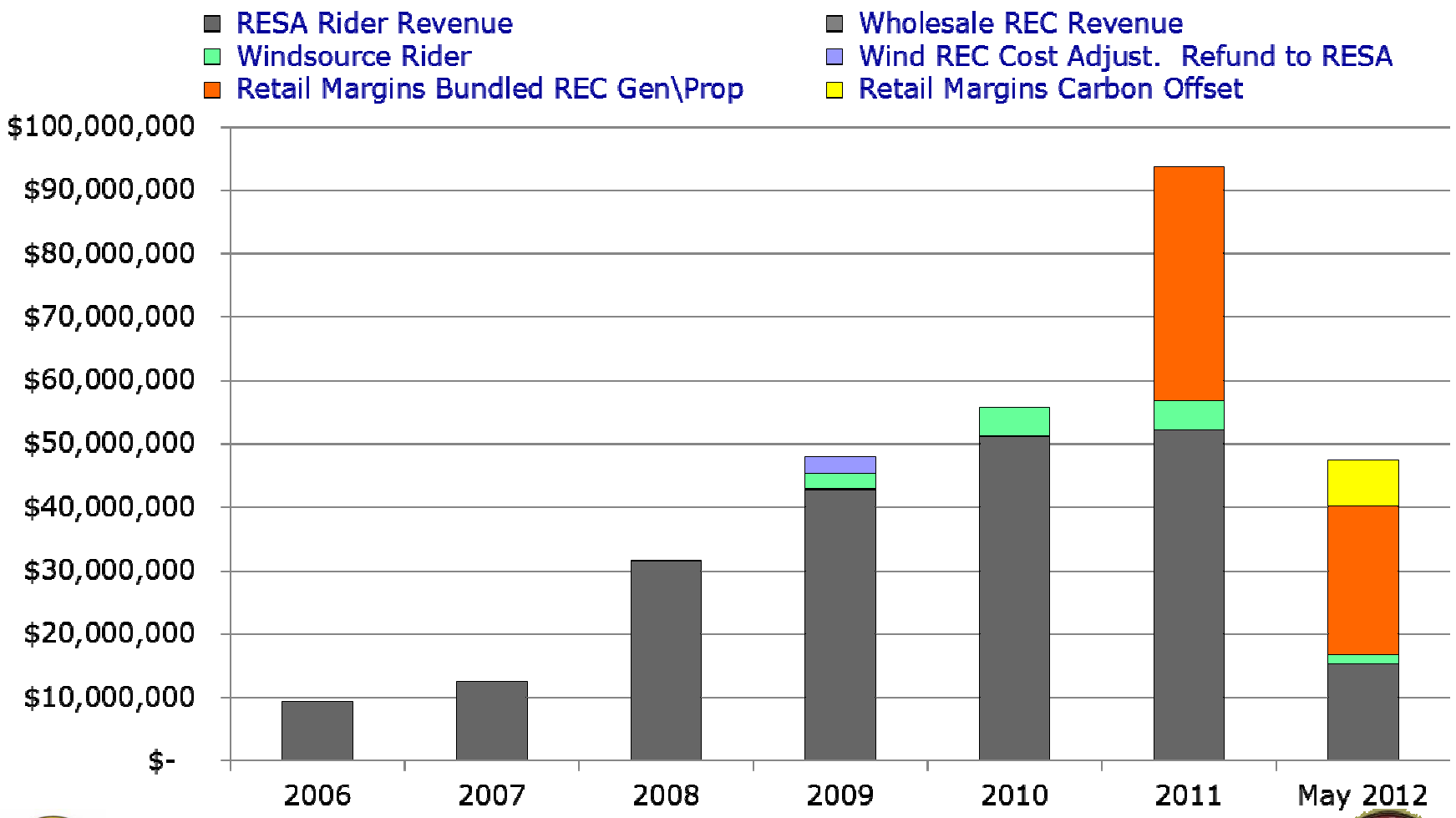
RESA Spending and Balance



RESA Revenues



RESA Spending