Waxman-Markey (H.R. 2454) Refining Sector Impact Assessment

prepared for the
American Petroleum Institute
by

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Assessment Goal & Methods

- **Objective**
  - **Identify and assess potential impacts of House passed Waxman-Markey H.R. 2454 on US refining sector**
- **Methods and Key Baseline Assumptions**
  - **Used EnSys' *WORLD* refining model**
  - **Reference and scenario cases based upon EIA's analysis of Waxman-Markey**
    - **Including Baseline, Basic and No International/Limited cases**

Key Findings

- **Based on EnSys' modeling, by 2030, Waxman-Markey would:**
  - **Reduce US refining throughput by up to 4.4 mbd**
    - **Gulf Coast and California refineries hit especially hard**
    - **Rest of the world refining throughput increases by up to 3.3 mbd**
    - **US consumption of imported refined products is projected to increase from 9.6% in the baseline case to up to 19.4% of US product supplied**
  - **Reduce annual US refining investments by up to $89.7 billion (up to 88% decline in investment)**
  - **Reduce refinery utilization rates from 83.3% to as low as 63.4%**
  - **Lead to significant gains in non-US refinery capacity, investment and employment at the expense of the US refining sector**

Key Findings (*continued*)

- **In addition, EnSys' modeling shows that under Waxman-Markey:**
  - **Much of the GHG emissions reductions realized in the US would be offset by increases in GHG emissions in the rest of the world**
  - **For example net global refinery GHG emissions would drop by up to 39 million Mt CO2e in 2030; 3% of estimated 2030 worldwide refinery emissions (1,242 million Mt CO2e)**

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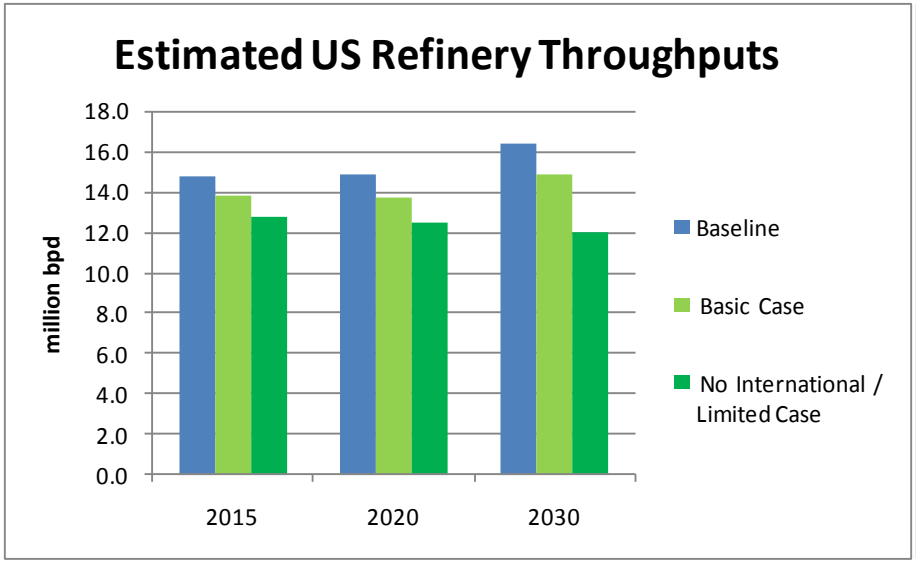
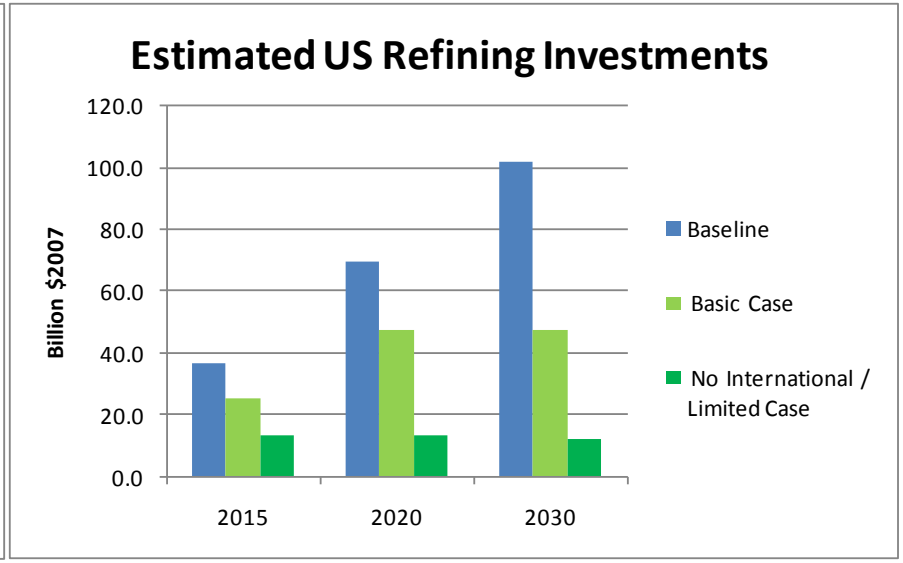
Assessment of Key Findings

- **Reduced US refining investments, throughputs & utilizations**





- **These are largely offset by gains at non-US refineries**

Source: EnSys *WORLD* Modeling, 2009

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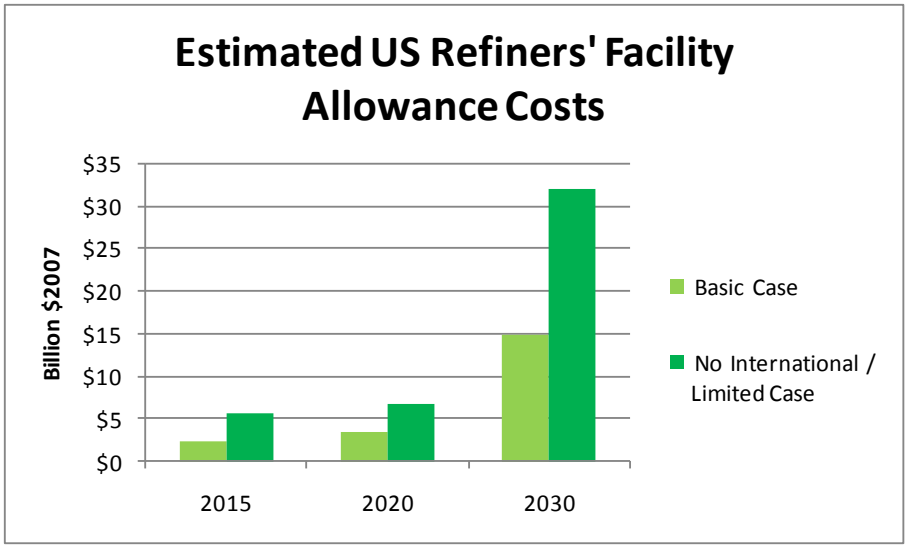
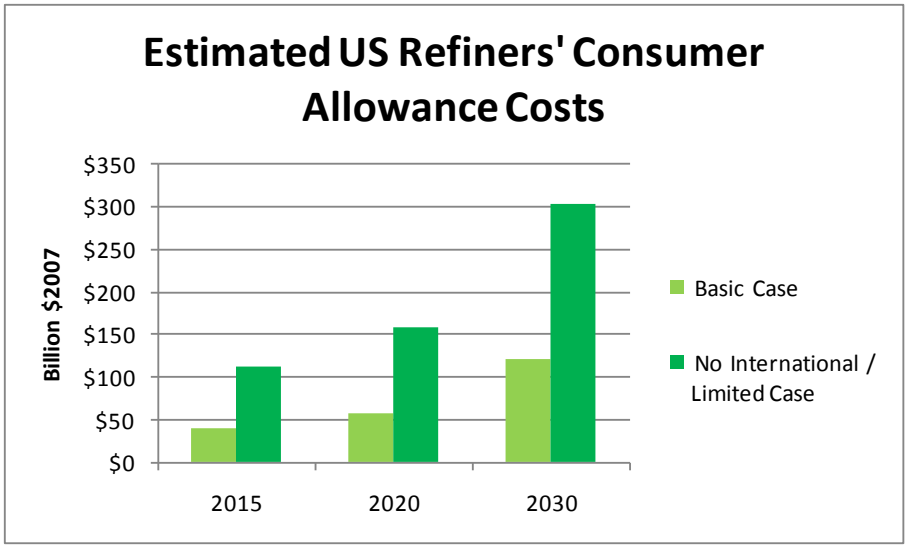
Assessment of Key Findings

- Increased US refining costs





- Hence reduced competitiveness versus non-US refineries

Source: EnSys *WORLD* Modeling, 2009

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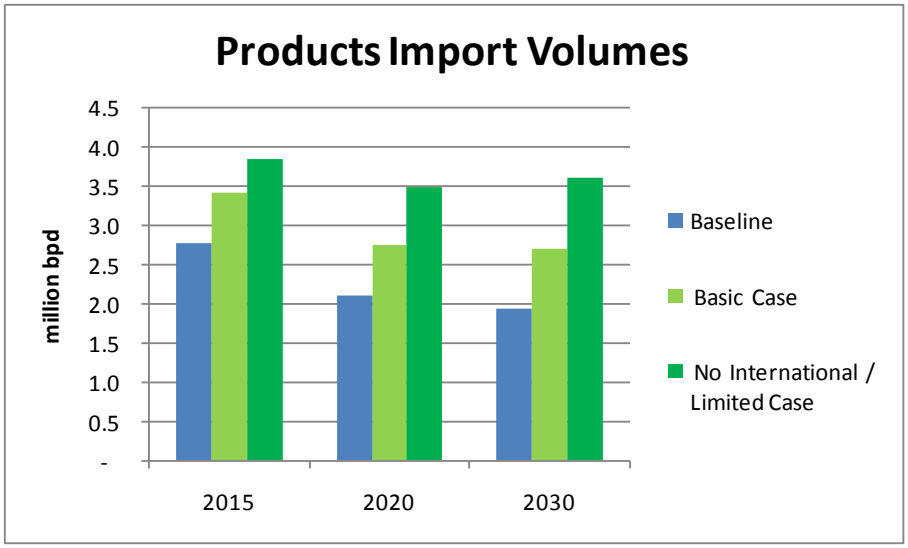
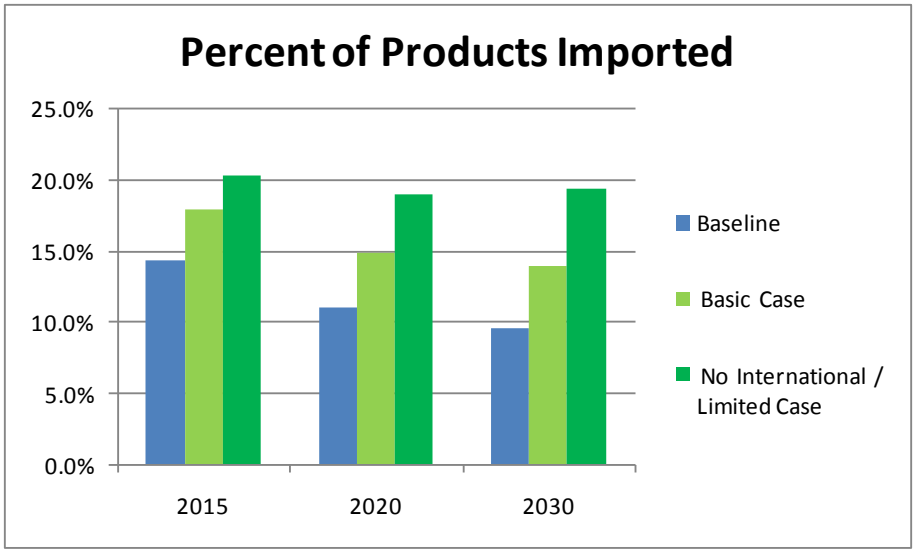
Assessment of Key Findings

- Increased reliance on product imports





- Both absolute volumes and percent

Source: EnSys *WORLD* Modeling, 2009

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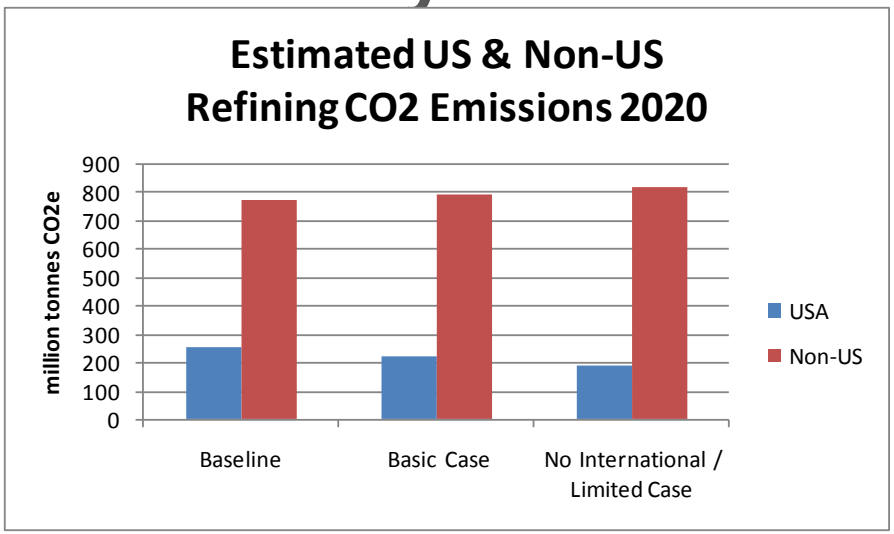
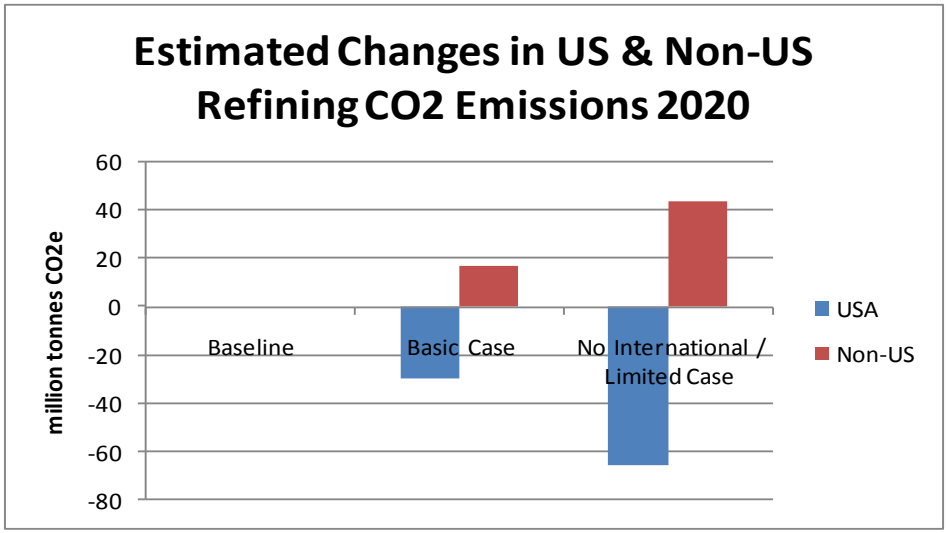
Assessment Key Findings

- **Reductions in US CO2 emissions are largely offset by increases from non-US refineries**





- **Same patterns apply 2015 and 2030**
- **Imposing CO2 costs on US refiners moves emissions from US to non-US regions**

Source: EnSys *WORLD* Modeling, 2009

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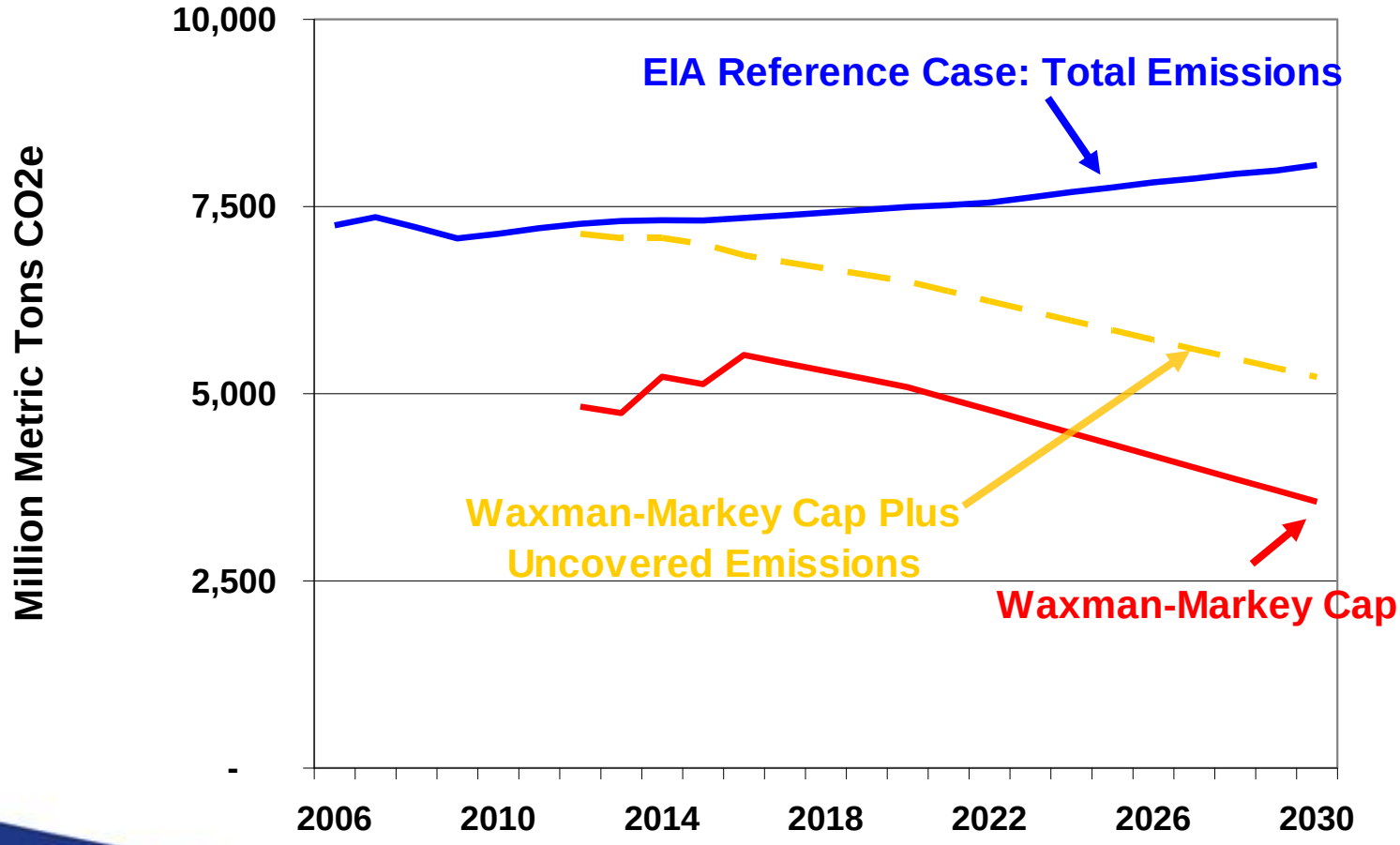
Overview of H.R. 2454 Cap & Trade

- **Puts a cap on economy-wide GHG emissions**
  - **Covers an estimated 81% of US GHG emissions by 2016**
  - **Refineries have a compliance obligation for facility direct emissions and emissions from consumer use of petroleum products produced**
  - **Refineries have a compliance obligation for about 43% of covered GHG emissions**
  - **Initially receive 2.25% of total allowances without cost, dropping to zero in 2026**

EIA Projected Emissions & Waxman-Markey Cap



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W-M 2016 Allocated Allowances versus Share of Emissions

Refiners' allocations much below covered emissions

Sector	Sector covered emissions as % of total covered emissions	Allocated % of Allowances under W-M
Refining	43%	2.25%
Electric LDCs	39%	35%
Energy Intensive Mfgs	8%	15%
Natural Gas LDCs	7%	9%
Other Covered Emissions & Other Allowances	3%	39%
Total	100%	100%

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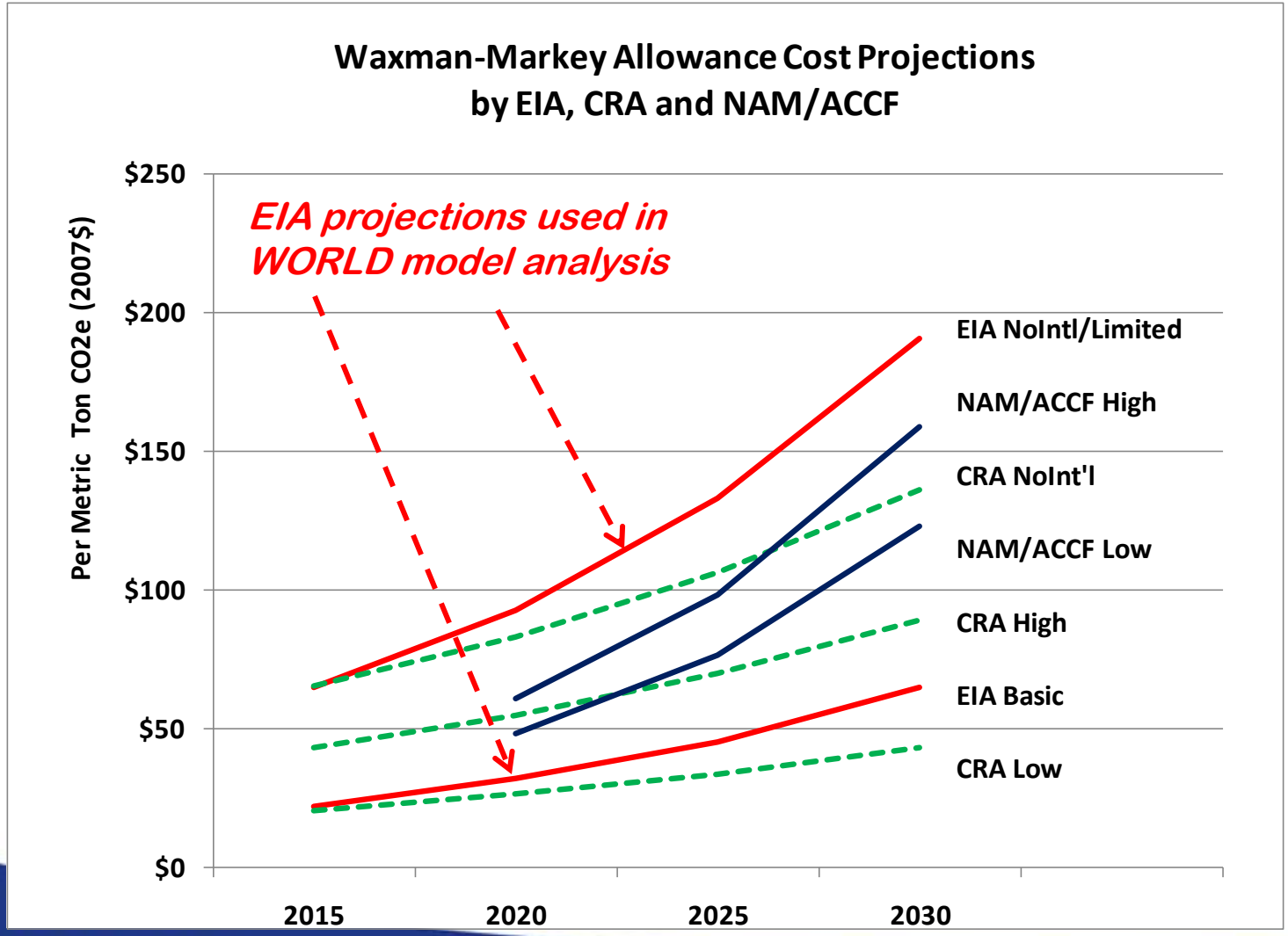
Allowance Costs Projections



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EIA Allowance Costs Used

Allowance Costs $/tonne CO2e (basis)			
	Baseline	**Basic Case**	**No International / Limited Case**
2015	$0.00	$22.22	$65.30
2020	$0.00	$31.75	$93.30
2030	$0.00	$64.83	$190.52

Allowances at No Cost million tonnes CO2e / year			
	National Allowance Cap	**Percentage to Refiners**	**Refiners' No Cost Allowances**
2015	5003	2.25%	113
2020	5056	2.25%	114
2030	3533	0.0%	0

Source: EnSys *WORLD* Modeling, 2009

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Impacts of Concern

- **GHG Allowance Requirements Could:**
  - **Effectively relocate some future refinery operations overseas, resulting in:**
    - **Reduced US investment**
    - **Imports shifted from crude oil to refined products**
    - **Lost jobs**
    - **Relocated emissions**
  - **US refinery allowance costs for facility and consumer emissions would be substantial**

Modeling Used to Assess Potential Waxman Markey Impacts

- Ensys *WORLD* model:
  - Integrated model of the global refining and liquids supply industry
  - Merges "top down" scenarios (from EIA in this study) with "bottom up" detail
  - US is part of the global refining/supply system – so interactions with non US regions, crude oil and product trading patterns captured
  - US results reported by PADD
  - EnSys *WORLD* model used industry wide: DOE, EPA, World Bank, OPEC, International Maritime Organization, Bloomberg, major and specialty oil companies

Modeling of Refining Operations / Allowance Costs

- Estimated refining costs increase for "own" emissions, and purchased electricity, including
  - H2 plant, refinery fuel, FCC coke, sulfur plant tail gas, and flaring
  - EU and Canada also assumed to have allowance costs
- Emissions from domestic and imported refined products treated the same – i.e., allowances needed for consumer emissions

Model Cases

- **Base Case:**
  - Based on latest EIA Reference Case projection of future liquid fuels supply/demand without climate legislation
- **Basic Case:**
  - Uses EIA's Waxman Markey "Basic Case" allowance costs and other market impacts
- **No International/Limited Case:**
  - Uses EIA's Waxman Markey "No International / Limited Case" allowance costs and other market impacts

Modeling Analysis Estimated US Impacts in Global Context

- EnSys *WORLD* model analysis projects:
  - Reductions in US refining investments, throughputs & utilizations, largely offset by gains at non-US refineries
    - PADD3 (Gulf Coast) most heavily impacted but also PADDs 1 and 5 (East and West Coasts)
  - Increased US refining costs, hence decreased competitiveness versus non-US refineries
  - Increased reliance on product imports / supply sources
  - Reductions in US refinery CO2 emissions largely offset by increases in non-US emissions

Estimated Total Refinery Allowance Costs Under Waxman-Markey

	Facility (1) Emissions Costs	Consumer Emissions Costs	Total
	Billion 2007$		
	Basic Case		
2015	2.5	40.3	42.8
2020	3.4	58.2	61.6
2030	14.8	120.5	135.3
	No International / Limited Case		
2015	5.7	112.8	118.4
2020	6.7	157.5	164.2
2030	32.0	304.0	335.9

(1) 2015, 2020 facility emissions costs are net of no-cost allowances

Source: EnSys *WORLD* Modeling, 2009

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Estimated Impacts on US Refining Nationwide

	Baseline	Basic Case	No International / Limited Case
		Investments (billion 2007$)	
2015	36.5	25.1	13.1
2020	69.4	47.5	13.0
2030	101.9	47.1	12.2
		Throughput (million B/d)	
2015	14.8	13.8	12.8
2020	14.9	13.7	12.4
2030	16.4	14.9	12.0
		% Utilization	
2015	77.5%	72.9%	67.3%
2020	78.0%	72.1%	65.6%
2030	83.3%	78.1%	63.4%

Source: EnSys *WORLD* Modeling, 2009

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Estimated US Regional Impacts - 2015

	Baseline	Basic Case	No International / Limited Case
	Throughput in 2015 (million B/d)		
PADD-1+PADD-6 (1)	1.7	1.6	1.3
PADD-2 (Midwest)	2.7	2.6	2.6
PADD-3 (Gulf Coast)	7.2	6.7	6.0
PADD-4 (Rocky Mountains)	0.5	0.5	0.5
PADD-5 (West Coast)	2.6	2.4	2.4
USA-Total	**14.8**	**13.8**	**12.8**
Rest of World	58.1	58.9	59.9
Global Total	72.8	72.7	72.7

1. PADD-1 is East Coast, PADD-6 U.S. Virgin Islands and Puerto Rico

Largest impacts: PADD3 (Gulf Coast) & PADD1 (East Coast)

Source: EnSys *WORLD* Modeling, 2009

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Estimated US Regional Impacts - 2020

	Baseline	Basic Case	No International / Limited Case
	Throughput in 2020 (million B/d)		
PADD-1+PADD-6 (1)	1.4	1.3	1.2
PADD-2 (Midwest)	3.2	3.0	2.9
PADD-3 (Gulf Coast)	7.1	6.4	5.6
PADD-4 (Rocky Mountains)	0.5	0.5	0.4
PADD-5 (West Coast)	2.7	2.5	2.3
USA-Total	**14.9**	**13.7**	**12.4**
Rest of World	60.0	60.7	61.9
Global Total	74.9	74.4	74.3

1. PADD-1 is East Coast, PADD-6 U.S. Virgin Islands and Puerto Rico

Largest impacts: PADD3 (Gulf Coast) & PADD5 (West Coast)

Source: EnSys *WORLD* Modeling, 2009

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Estimated US Regional Impacts - 2030

	Baseline	Basic Case	No International / Limited Case
	Throughput in 2030 (million B/d)		
PADD-1+PADD-6 (1)	1.4	1.4	1.2
PADD-2 (Midwest)	3.7	3.6	3.2
PADD-3 (Gulf Coast)	7.7	6.8	5.1
PADD-4 (Rocky Mountains)	0.5	0.6	0.4
PADD-5 (West Coast)	3.1	2.5	2.1
USA-Total	**16.4**	**14.9**	**12.0**
Rest of World	66.0	66.9	69.3
Global Total	82.4	81.7	81.3

1. PADD-1 is East Coast, PADD-6 U.S. Virgin Islands and Puerto Rico

Largest impacts: PADD3 (Gulf Coast) & PADD5 (West Coast)

Source: EnSys *WORLD* Modeling, 2009

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Estimated Impacts on US & Global Refining GHG Emissions

Refining GHG Emissions (million Mt CO2e)					
	Baseline	Basic Case		No International / Limited Case	
USA					
2015	236	224	(-5.2%)	200	(-15.4%)
2020	251	221	(-11.9%)	185	(-26.1%)
2030	286	228	(-20.1%)	168	(-41.2%)
Non-US					
2015	736	745	(1.2%)	769	(4.4%)
2020	771	788	(2.2%)	814	(5.6%)
2030	957	980	(2.5%)	1036	(8.3%)
World					
2015	972	969	(-0.4%)	968	(-0.4%)
2020	1022	1009	(-1.3%)	1000	(-2.2%)
2030	1242	1209	(-2.7%)	1203	(-3.1%)

Stated GHG emissions figures rounded for reporting

Source: EnSys *WORLD* Modeling, 2009

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Estimated Impacts on Sources of US Petroleum Product Supply

Products Supplied (million B/d)			
	Baseline	Basic Case	No International / Limited Case
US Domestic Sources			
2015	16.5	15.6	15.1
2020	17.1	15.9	14.9
2030	18.3	16.6	15.0
Non-US Sources			
2015	2.8	3.4	3.9
2020	2.1	2.8	3.5
2030	1.9	2.7	3.6
Percent of Products Imported			
2015	14.4%	18.0%	20.4%
2020	11.0%	14.8%	19.0%
2030	9.6%	14.0%	19.4%

Products supplied figures rounded to one decimal place for reporting

Source: EnSys *WORLD* Modeling, 2009

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