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Deep-Draft Channel Projects Corps of Engineers Analysis– Issues

Transportation Cost Analyses

Refinery Infrastructure Considerations

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My Role with the Corps

- Corps of Engineers District Office in Galveston, Texas
- Economic Evaluation and Determination of Federal Interest in Waterway and Channel Improvements (Channel Dredging Projects).

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Organization of Corps

The US Army Corps of Engineers Headquarters is made up of made up of an Executive Office and 17 Staff Principals. The Headquarters, located in Washington, DC, creates interprets, and enforce policy and plans future direction of all the other Corps organizations.

- The workforce of the U. S. Army Corps of Engineers (USACE) consists of 98% civilian & 2% military personnel.
- The Corps is involved in civil works and military support.

Division Alignment

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Divisions and Districts

The Corps is organized geographically into 8 divisions in the US and 41 subordinate districts throughout the US, Asia and Europe. The districts oversee project offices throughout the world. Divisions and districts are defined by watershed boundaries, not by states.

Project Missions

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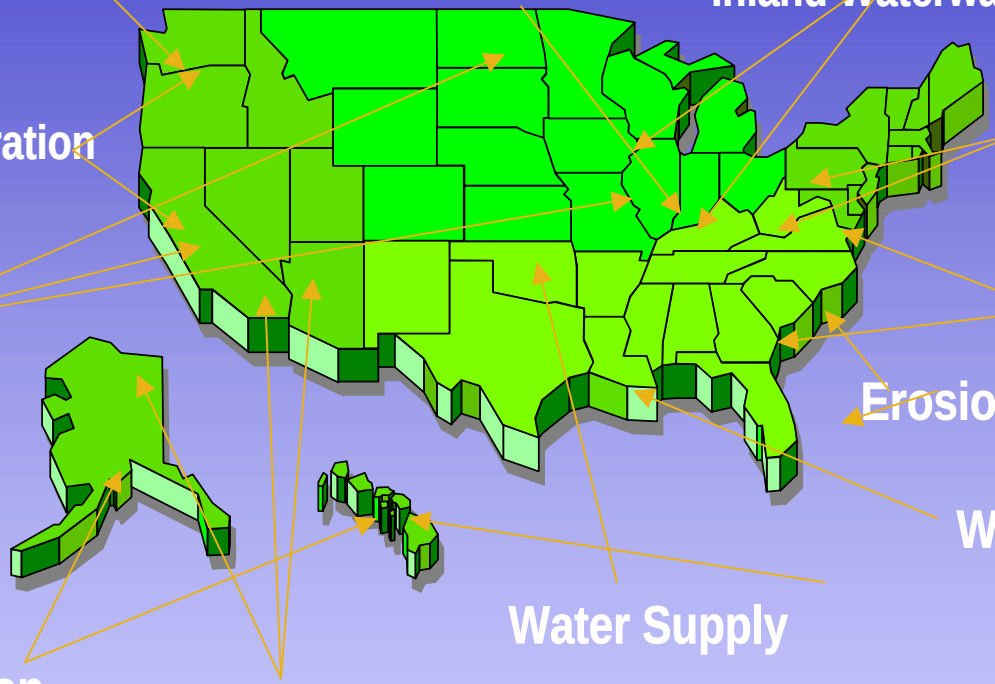

Salmon Mitigation

Lock / Dam Replacement - Inland Waterways System

Environmental Infrastructure Needs

Environ. Restoration

Flooding

Port / Harbors

Erosion/Hurricane Protection

Wetland Losses

Water Supply

Navigation

Environmental Infrastructure Needs

Letter to Corps District Office

"High Priority" Missions:

- Flood Damage Reduction
- Commercial Navigation
- Ecosystem Restoration

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Corps / Civil Works Mission

- Planning, designing, building and operating water resources and other civil works projects (Navigation, Flood Control, Environmental Protection, Disaster Response, etc.)
- Designing and managing the construction of military facilities for the Army and Air Force. (Military Construction)
- Providing design and construction management support for other Defense and federal agencies. (Interagency and International Services)

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Purpose of Presentation

- General Overview of Corps Navigation Economic Evaluation Procedures
- Outline Criterion for Determining Federal Interest in Navigation Projects

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Application to EIA

The Corps often uses or considers the Dept. of Energy (DOE/EIA) forecasts, along with site specific trend data, and other published forecasts for our project specific port and waterway studies and general channel improvement evaluations.

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Navigation Project Initiative

Port Authority through their congressional representative asks the Corps to evaluate waterway improvements.

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Examples of Waterway Improvements that the Corps is involved with

Channel deepening or widening.

Anchorages

Turning Basins

Locks and Dams

Harbors of Refuge

Protective Jetties & Breakwaters

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Examples of Project Features **NOT** in the "Federal Interest"

Not in the Federal Interest is Defined by Corps Policy and Regulations.

- Docks
- Terminal & Transfer Facilities
- Berthing Areas
- Local Access Channels

Congressional Study Resolution / Authorization

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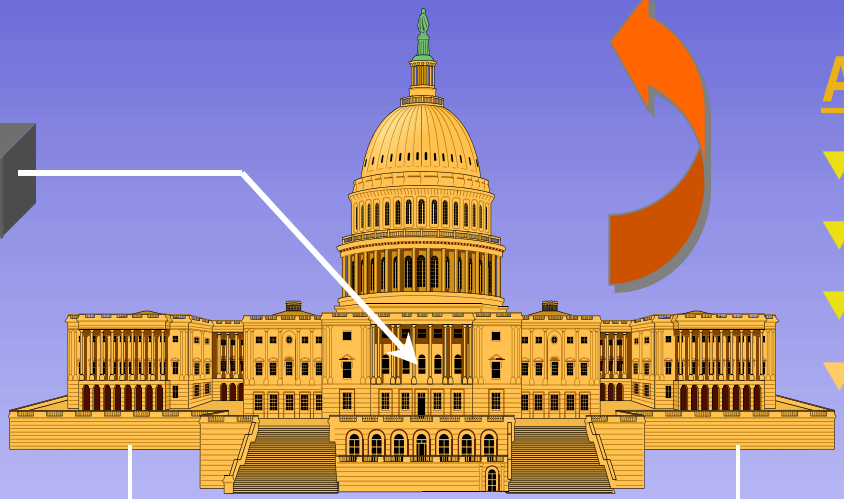
WRDA Bill

Passage ~ 2-yr. Intervals



Authority - Congress!

- Study Resolutions
- WRDA Bills
- Standing Authorities
- *Appropriations Bills*

(Step 1)

Member

Have we studied the problem before?

Environment & Public Works Committee

Senate Resolution

OR

Transportation & Infrastructure Committee

House Resolution

- Signed by President

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The economic merits of Civil works projects are primarily measured against the **Federal Objective--**

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Federal Interest in Navigation

- Commerce Clause of the Constitution, and subsequent court decisions, defined the right to regulate navigation and waterway improvements establish the Federal interest in navigation
- Navigable waters facilitate commercial transportation in support of interstate and foreign trade.

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The **Federal Objective** of water and related land resources project planning is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders & other Federal planning requirements.

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Determination of Federal Interest as it applies to Navigation

- Federal interest in a project depends on whether it provides benefits to the public by facilitating commerce.
- Determination of federal interest requires identification of public purpose and access.

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Determination of Federal Interest as it applies to Navigation (continued)

- Federal Projects must be open to public use for the project purposes.
- For navigation projects, the access required is at least one location with the vessel services needed to achieve project benefits.

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General Example of a Navigation Project Initiative or Request

Existing Channel Dimension:

40 feet deep by 400 to 500 feet wide

Sponsor (example might be a port authority) asks the Corps to evaluate channel depths up to 50 feet; along with channel widening.

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Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to the **National Economic Development** (NED) objective.

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Contributions to **National Economic Development** (NED) are increases in the net value of the national output of goods & services, expressed in monetary units.

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Principles and Guidelines (P&G)

P&G were established pursuant to the Water Resources Act of 1965 (Pub. L. 89-80), as amended (42 U.S.C. 1962a-2 and d-1).

P&G is intended to ensure proper and consistent planning by Federal agencies in the formulation and evaluation of water and related land resources implementation studies.

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Federal Water Resource Project Planning: Principles and Guidelines (P&G)

Federal Water Resource Agencies

- Corps of Engineers (Civil Works)
- Bureau of Reclamation
- Tennessee Valley Authority
- Soil Conservation Service

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Examples of Typical Vessel-Draft Constrained Commodities at U. S. Ports

- Crude Oil & Petroleum Products
- Bulk Grain
- Container / General Cargo

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Planning Constraints (may include)

- Financial / Limited Budget
- Trade Route Limitation

(Panama Canal; Channel Depths)

- Logistical Variables

(i.e. refinery capacity, infrastructure, pipeline networks, land side limitation; and other general water & land interface variables.

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Data Analysis Trends

Foreign imports of crude petroleum and products have replaced domestic production for both the U. S. and the Gulf Coast.

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General Evaluation Considerations

- Analysis of vessel sizes and associated loaded drafts by commodity groups
- Review commodity Origin-to-Destination Routings.
- Primary emphasis historically has been on identifying % of movements that have the potential to be shipped in vessels at deeper depths

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Evaluation Considerations

- Port Depth Constraints
- Trade Route Constraints
- Vessel Size Utilization / Limitations
- Evaluation of Offshore Lightering Costs
- Cost of Channel Improvements (channel deepening, widening, environmental mitigation cost, & channel maintenance cost) on a life-cycle basis.
- General Navigation Features.

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U. S. Crude Oil Imports Offshore Lightering

Region	Barrels	%
Arabian Gulf	352	59%
Africa	113	19%
Europe	64	11%
Americas	61	10%
Pacific	6	1%
Total	596	100%

Source: Maritime Administration

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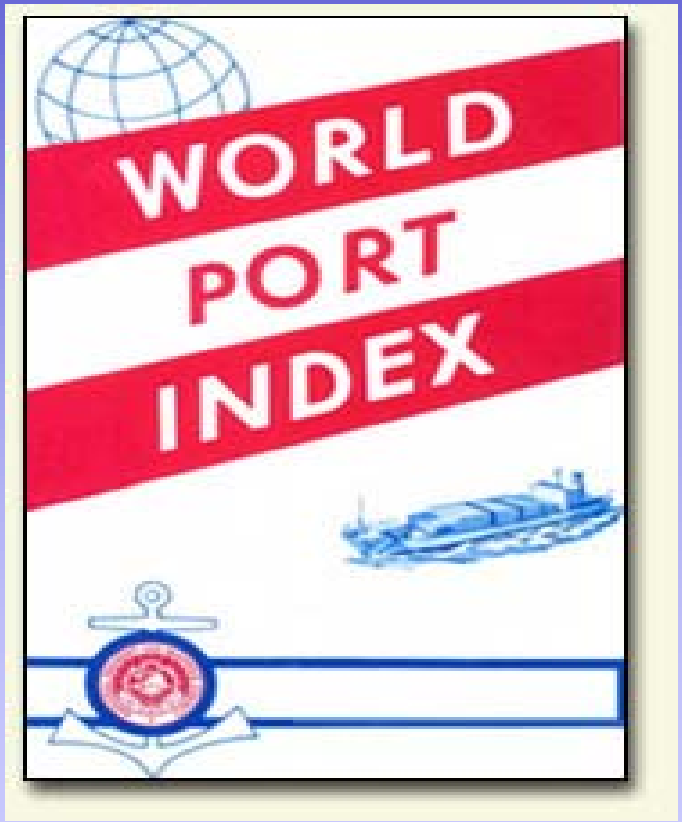
Channel Depth Constraints



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Identification of Trade Route Constraints & General Data

General Data Sources:

- Lloyds of London: Ports of the World
- Fairplay Vessel Registers
- Many internet links
- Journal of Commerce
- Waterway Journal

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Reoccurring Issue for Texas Gulf Coast Channel Improvement Projects

Refinery Capacity *

- Texas Gulf Coast petroleum refineries are operating at 93.4% of capacity for crude petroleum and products
- Louisiana Gulf Coast refineries are at 98.9%.

Source: U. S. Dept. of Energy, Petroleum Supply Annual, Volume 1, p. 49.

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Project Evaluation Considerations for Navigation Planning

- Confirm vessel operating practices and ship size choices and determine the sensitivity of the project benefits to variable changes.
- Determine the sensitivity of project benefits and project construction cost.
- Determine effects of channel widening on vessel delay occurrences and frequencies.
- Identify changes in vessel distribution & demand.

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Effect of Refinery Capacity Expansions on Corps Waterway Projects

- Determine if refinery expansion is needed to accommodate expected throughput volumes.
- Cost of Refinery Expansion may need to be included in evaluation of and may be particularly important in comparison between Corps waterway improvements.

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Data Analysis Trends

Comparison of 1980s series data with 1990/00 data slows an increasing move towards imports of not only crude petroleum but refined products

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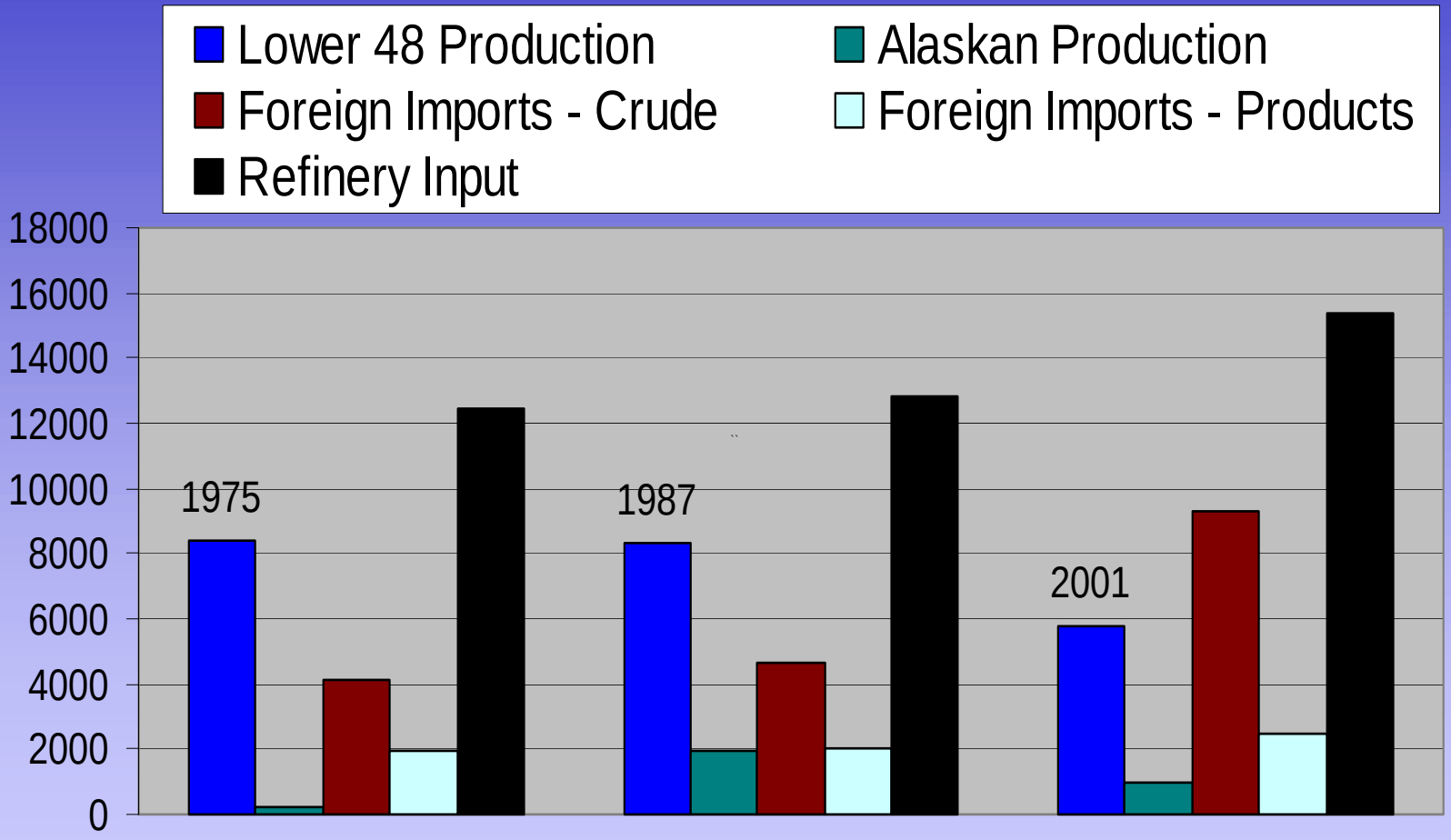
1975-2001 Petroleum Disposition barrels/day

source: EIA



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Data Analysis Trends

Since the late 1980s, receipts of domestic crude oil to the U. S. Gulf from Alaska and California has declined.

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Data Analysis Trends

Foreign imports of crude petroleum and products have replaced domestic production for both the U. S. and the Gulf Coast.

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Data Analysis Trends

During the 1970s and early 1980s

Most of the crude oil and products moved by water was associated with inland barges or coastwise movement between U. S. production/processing and consumption regions.

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Data Analysis Trends

During the 1980s, high volumes of Alaskan crude oil was shipped to U. S. Gulf Coast ports. Oil went by ship from Alaska to Panama, where it was transferred by pipeline.

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Data Analysis Trends

Comparison of decade interval data between 1981/00 and 1991/00 shows that product imports are up by over 70 percent.

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Data Analysis Trends

The U. S. Gulf Coast leads the nation in refinery capacity. The Gulf is nation's leading supplier in refined products. Products such as distillates or derivatives (gasoline, heating oil, diesel & jet fuel) are transported to the East Coast and the Midwest.

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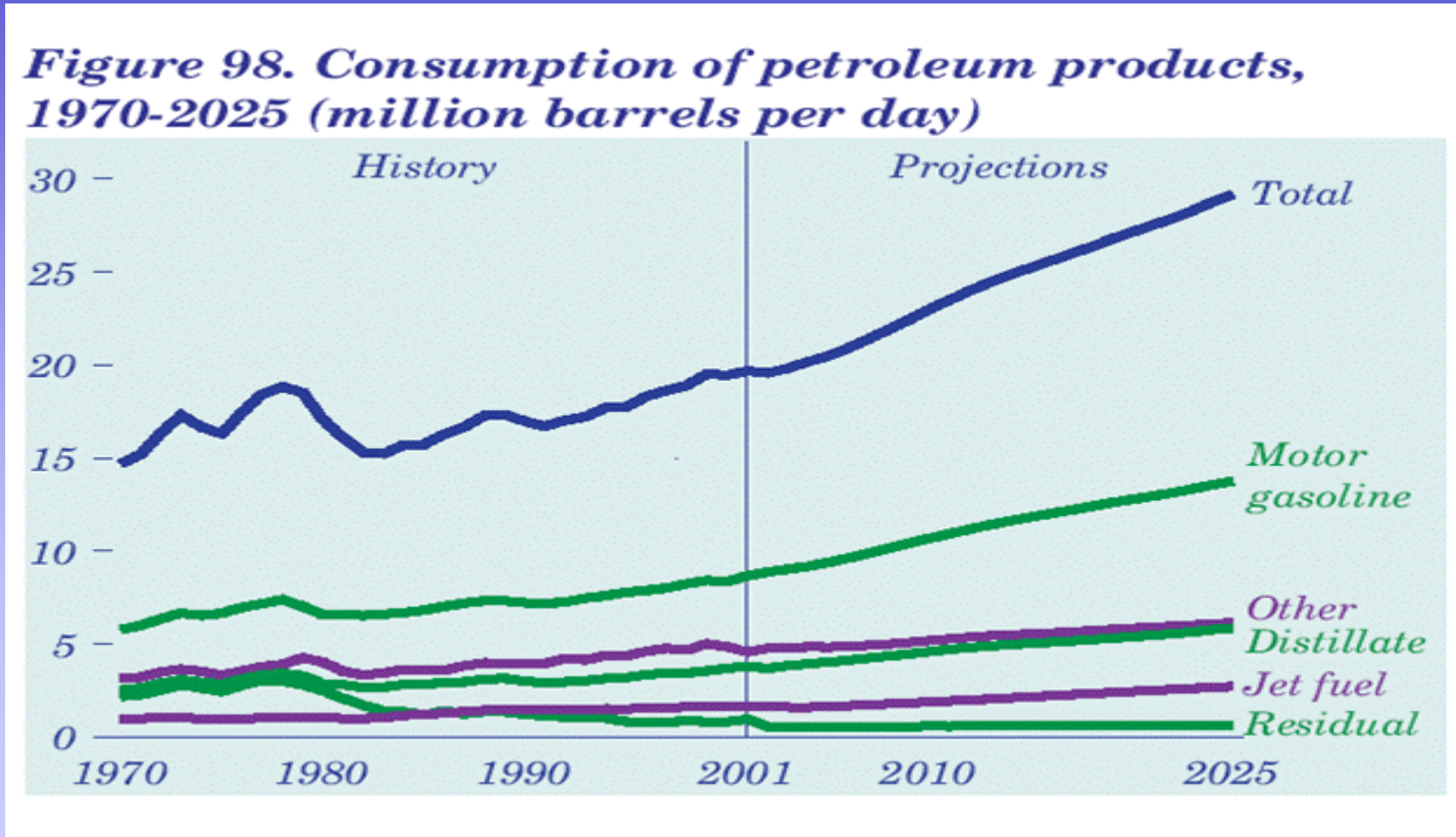
Source: DOE/EIA Jan 2003



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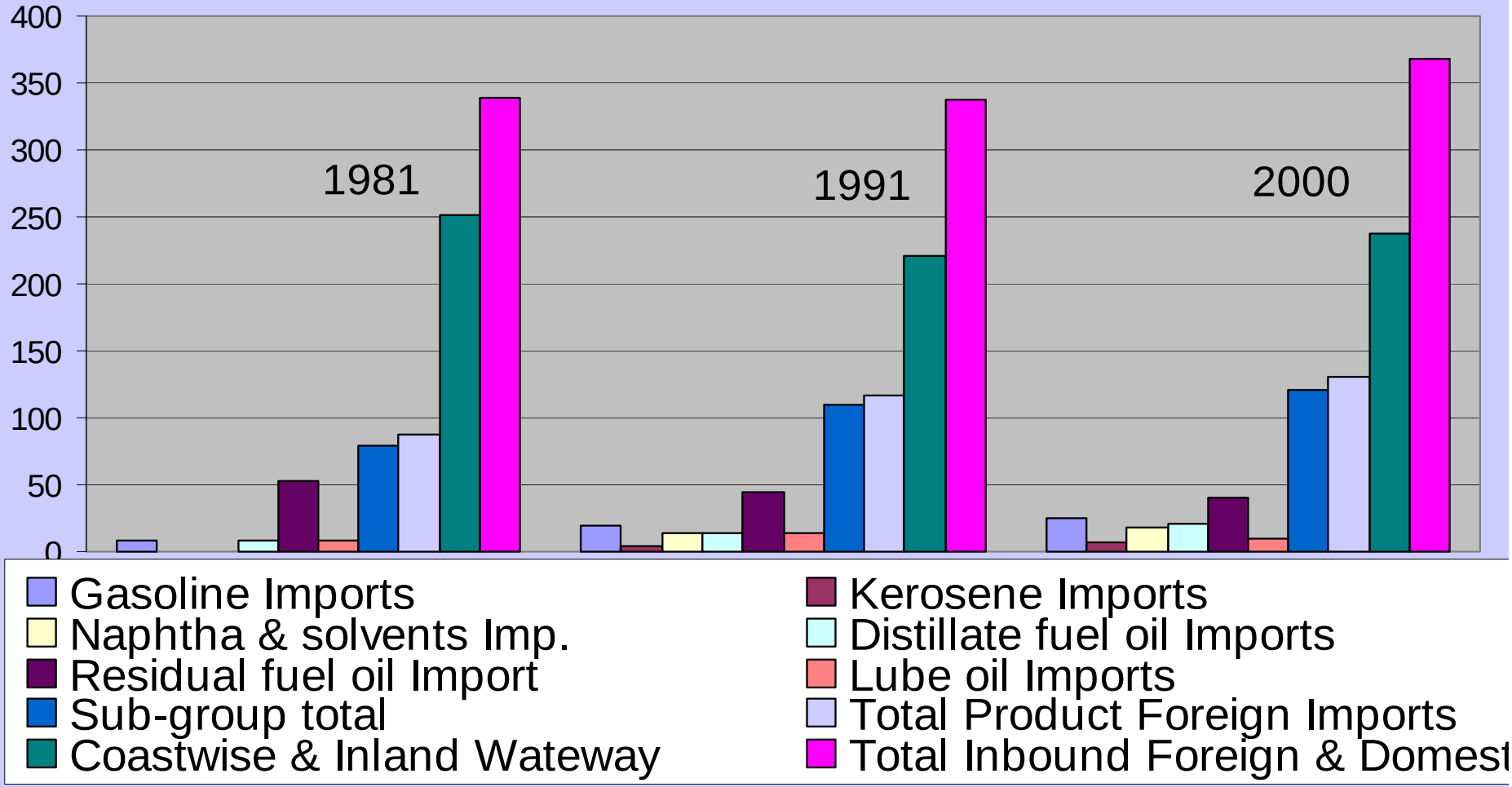
U. S. Foreign & Domestic Waterborne Commerce millions of short tons Petroleum Products



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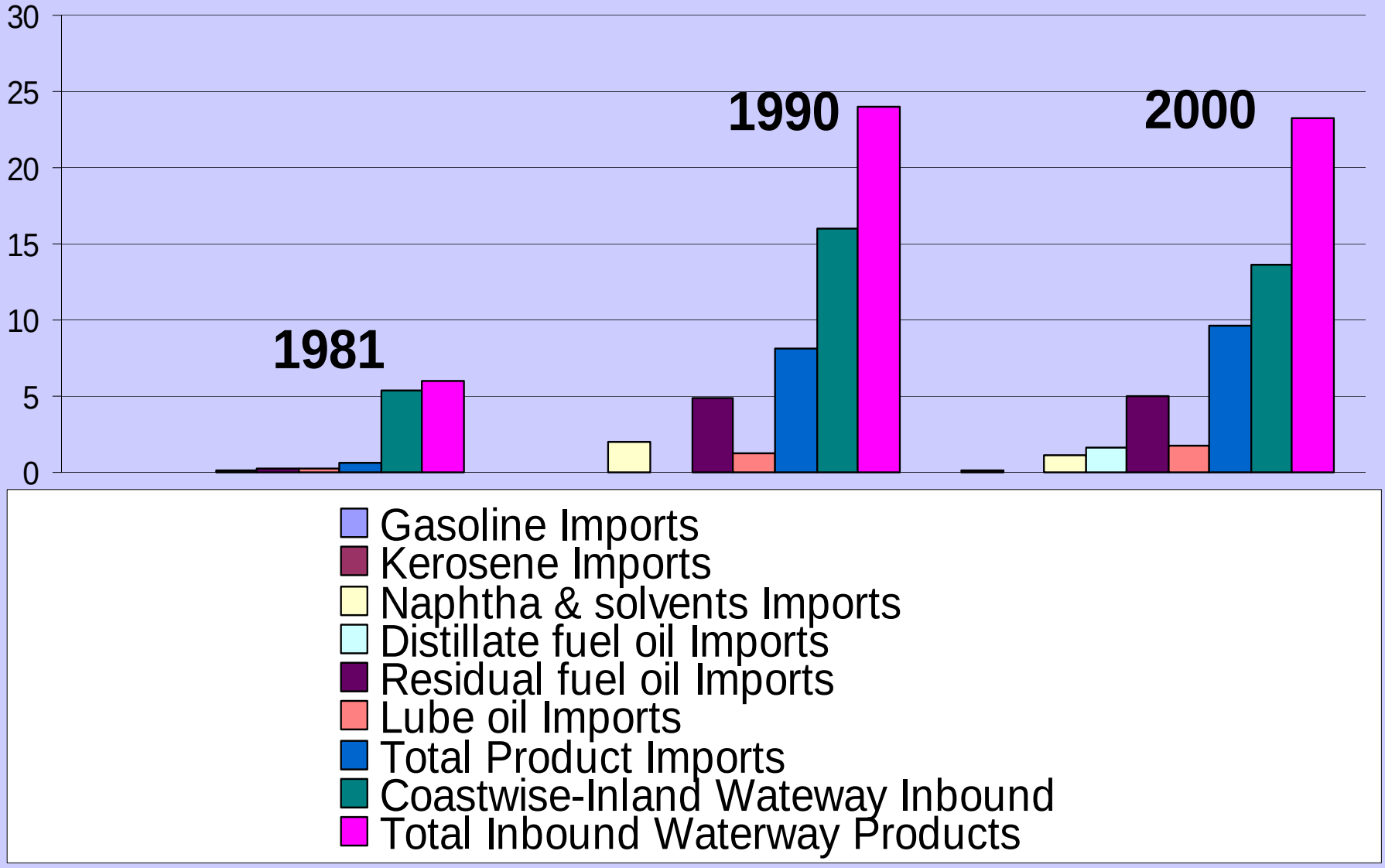
Corpus Christi, TX,
Foreign & Domestic Waterborne Commerce
millions of short tons of Petroleum Products



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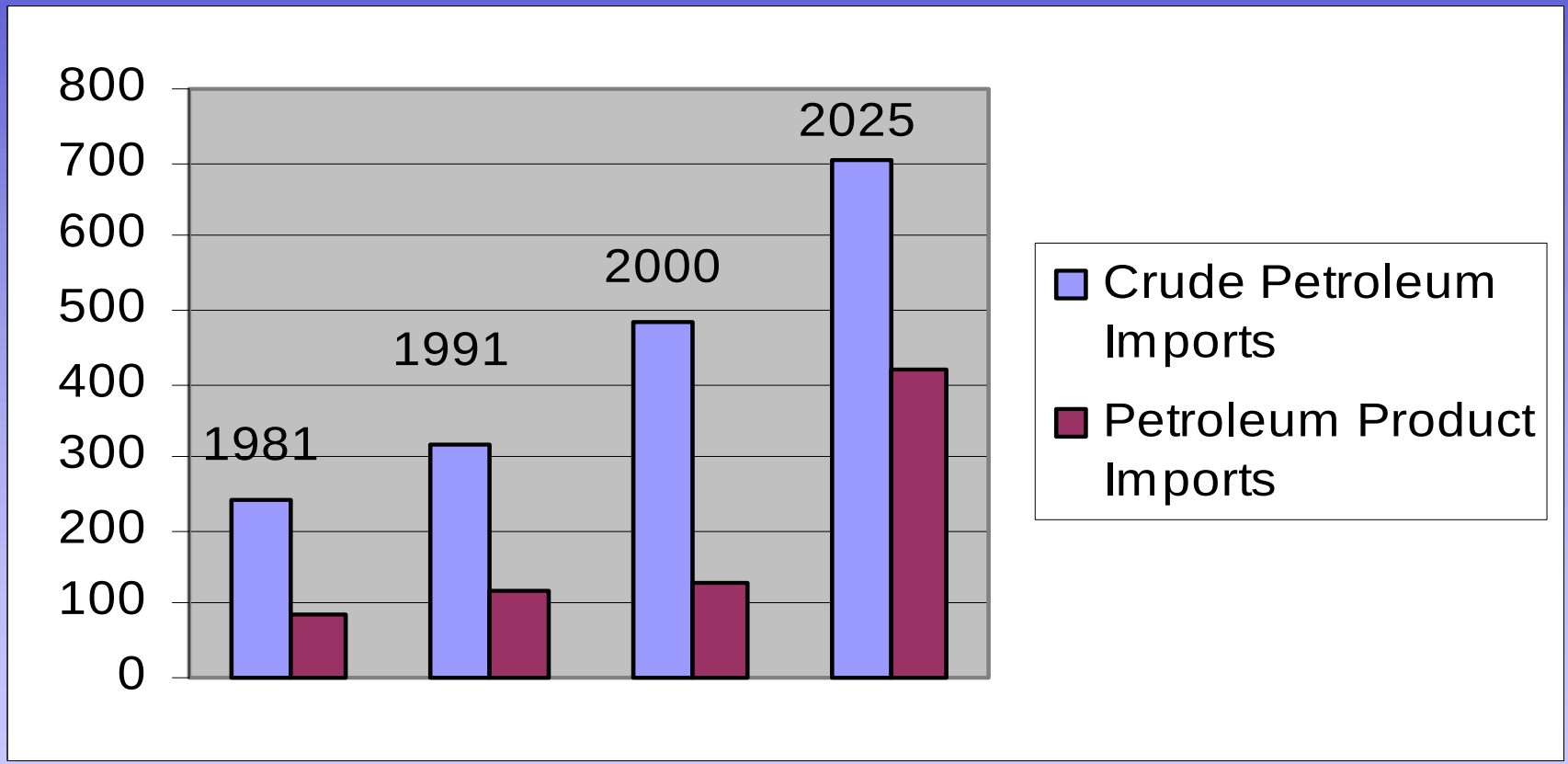
U. S. Petroleum Imports millions of short tons



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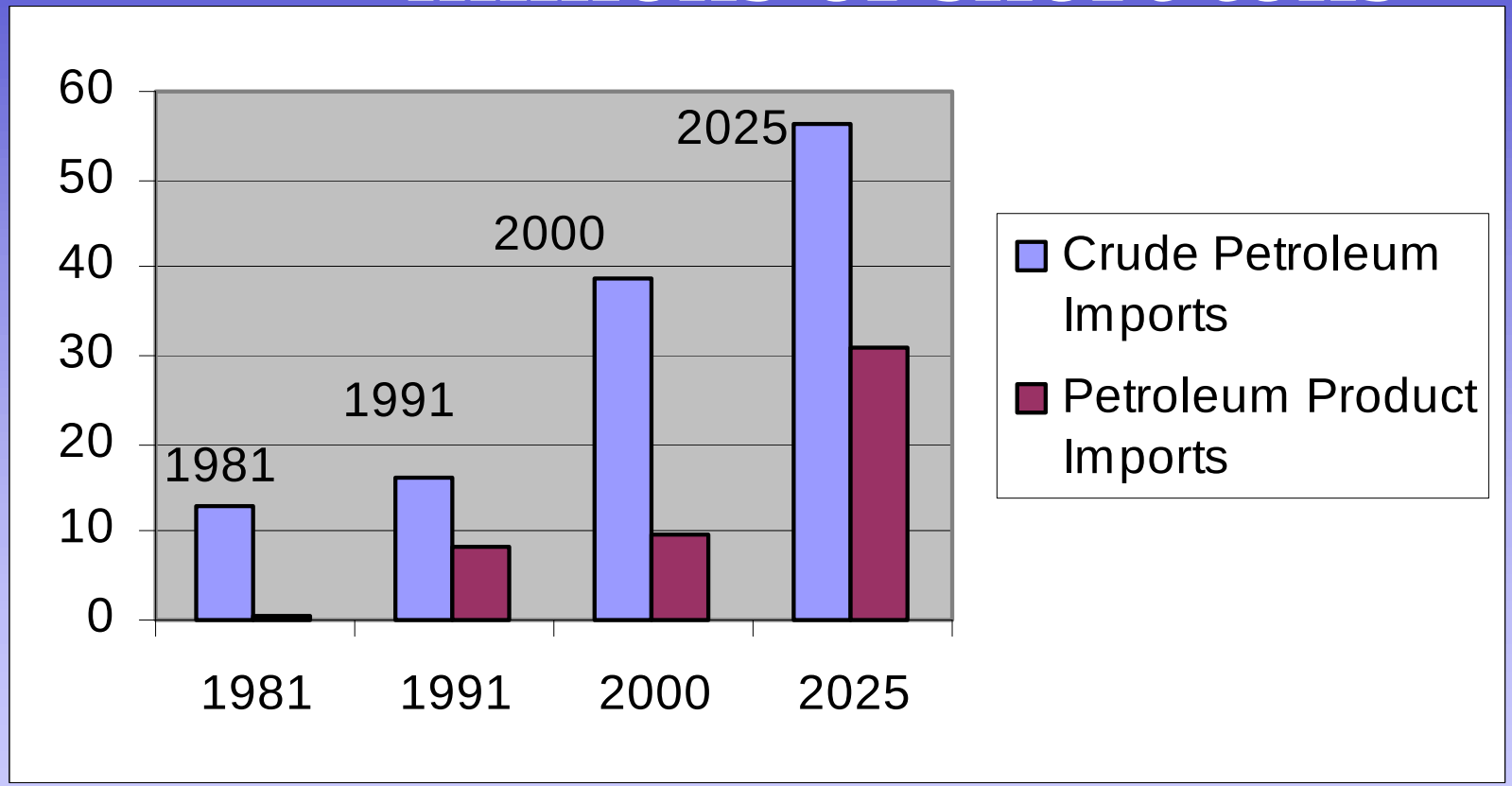
Corpus Christi, TX Petroleum Imports millions of short tons



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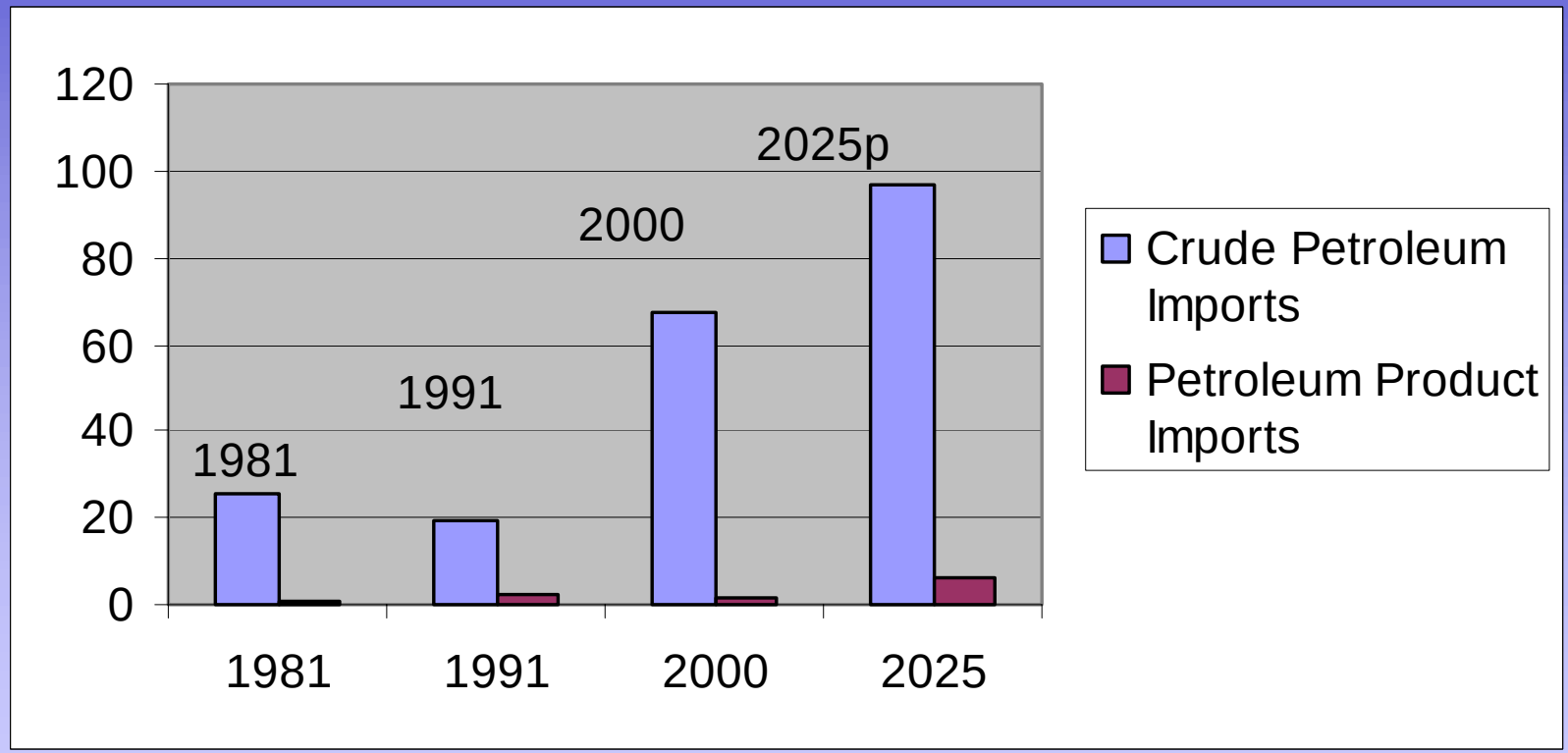
Beaumont-Pt. Arthur, TX Petroleum Imports millions of short tons



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Atmospheric Crude Oil Distillation 1000's of barrels, 1991-01

Geographic Area	Input	Capacity	Rate
1991 Texas Gulf Coast	2883	3350	86.1%
2001 Texas Gulf Coast	3529	3777	93.4%
1991 PAD III	6055	7234	83.7%
2001 PAD III	7271	7672	94.8%
1991 U. S. Total	13507	15707	86.0%
2001 U. S. Total	15352	16582	92.6%
	2001	2001	

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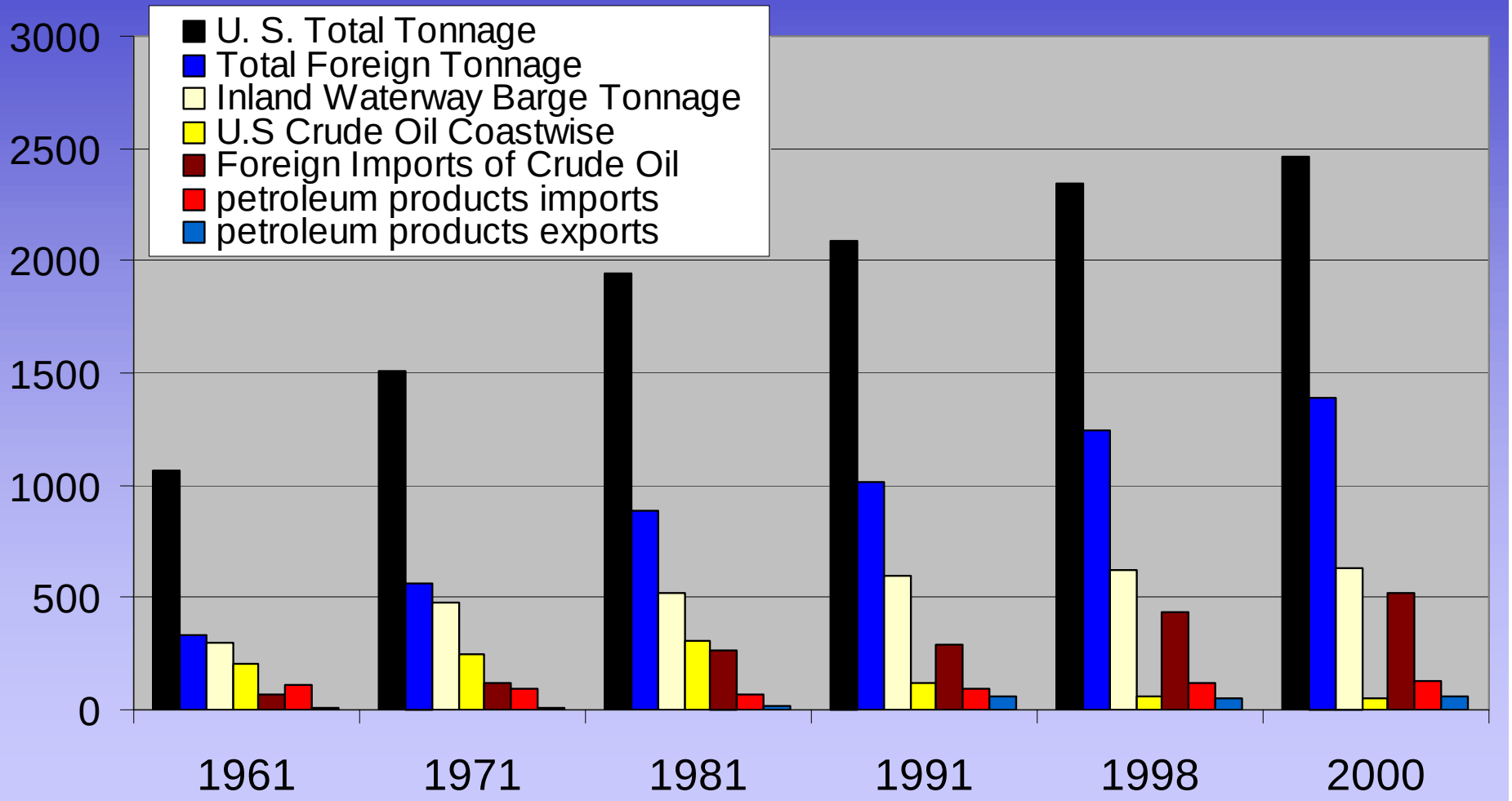
Waterborne Commerce 1961-2000 million of short Tons



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U.S. Waterborne Commerce 1961-2000 & Average Annual Growth Rate

	1961	2000	AAG
U. S. Total	1,062	2,462	2%
Total Foreign	329	1,392	4%
Inland Waterways	294	628	2%
Crude Oil Coastwise	207	48	-4%
Crude Oil Imports	65	522	5%

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MARAD: U. S. Foreign Waterborne Trade (million of short tons)

Port	1998	1999	2000	2001
Houston	98	95	109	118
S. Louisiana	60	71	77	75
New York	56	58	63	72
New Orleans	79	70	67	65
Corpus Christi	54	56	55	49
Los Angeles	30	33	40	42
% of Total	35%	35%	36%	36%
All Ports Tons	1075	1096	1158	1161

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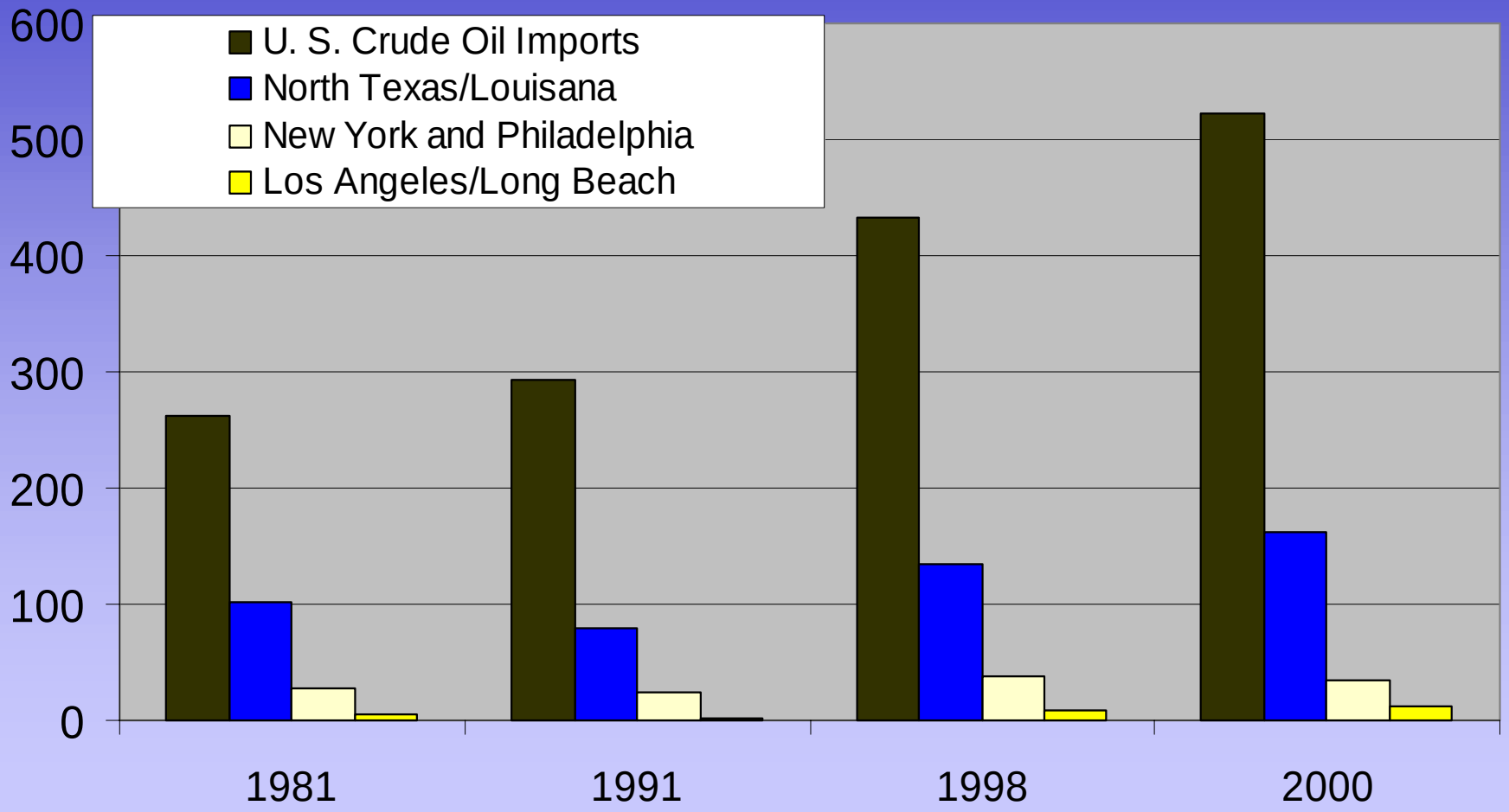
U. S. Crude Oil Imports millions of short tons



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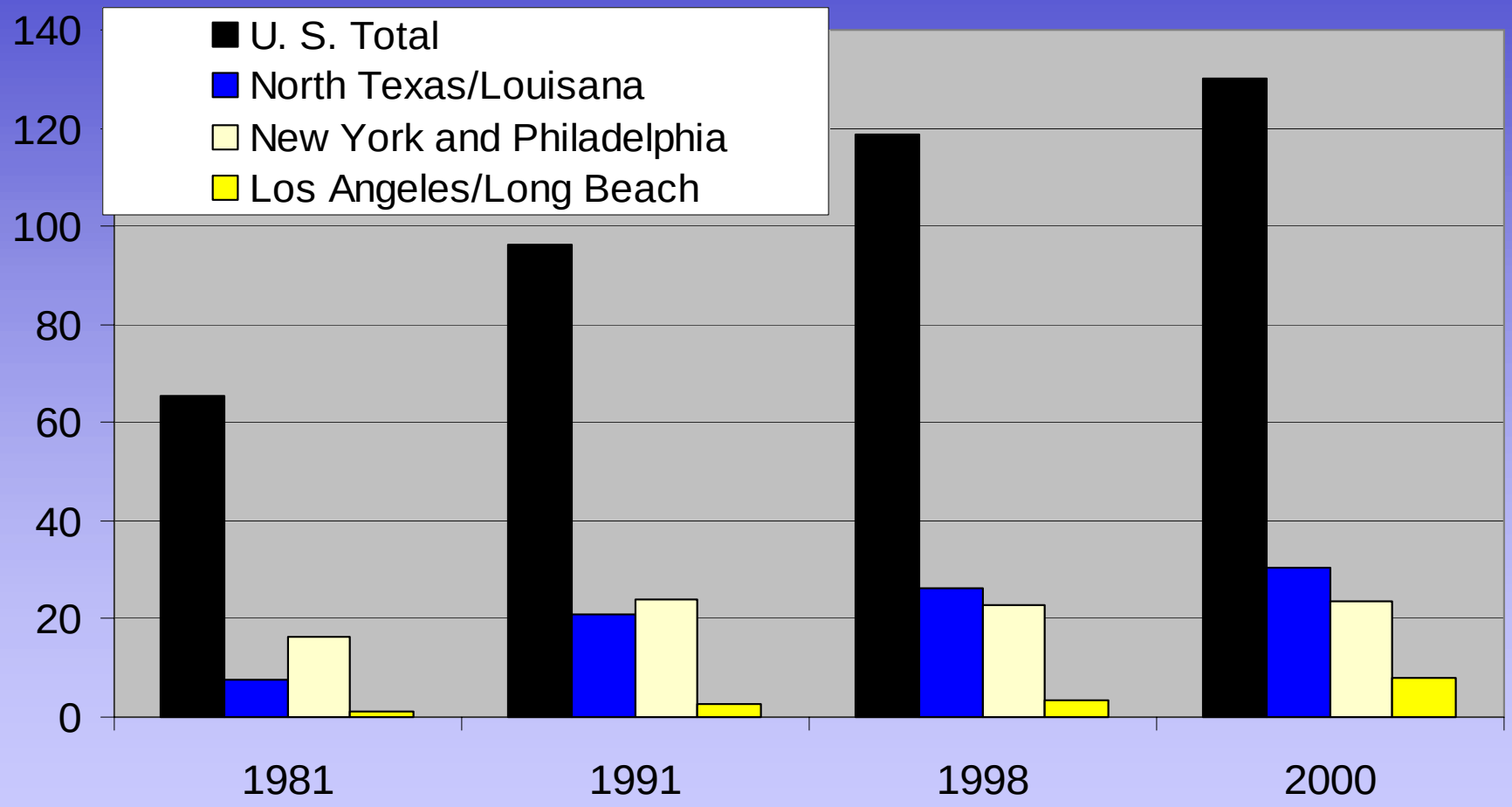
U. S. Product Imports millions of short tons



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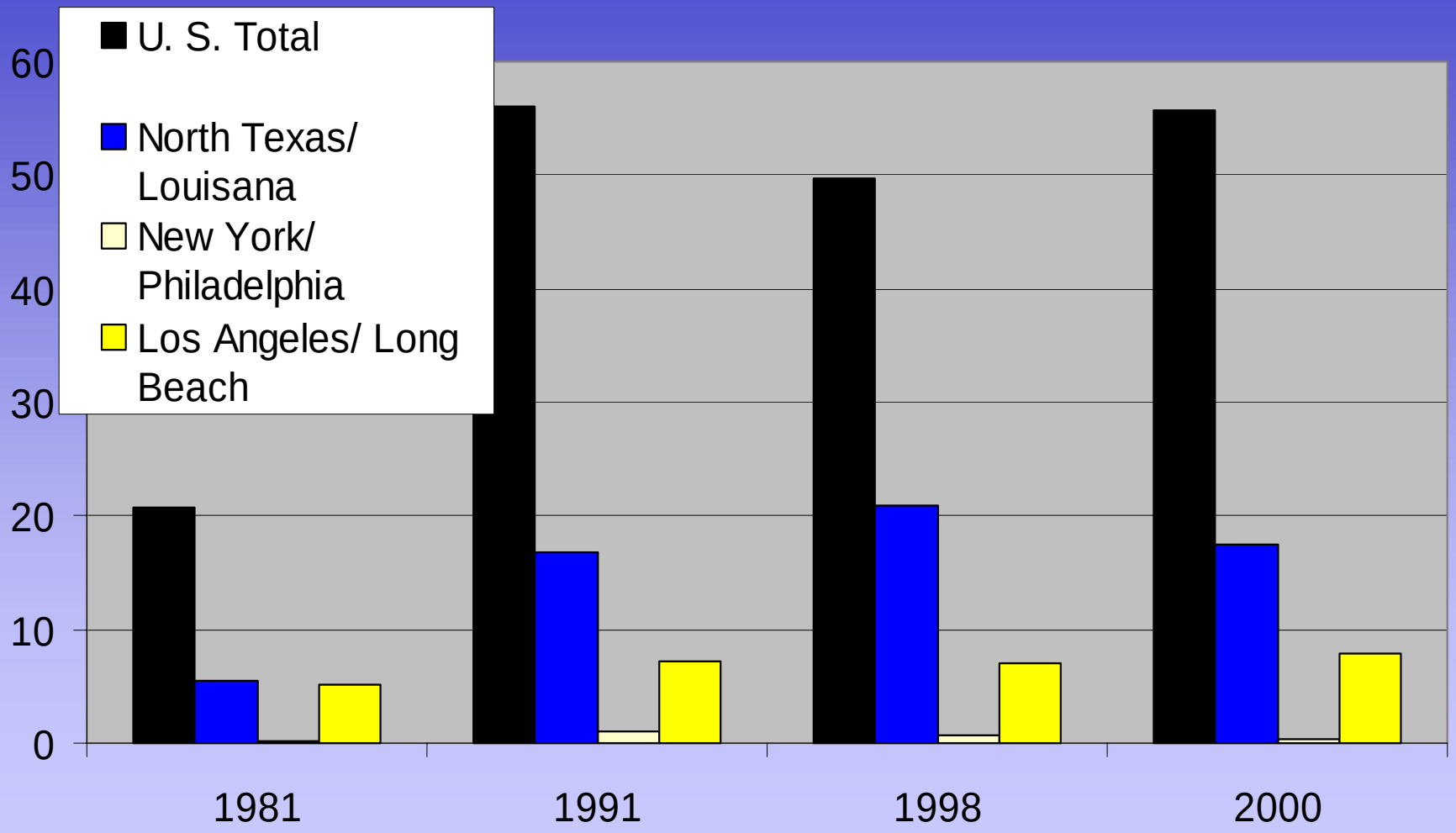
U. S. Product Exports millions of short tons



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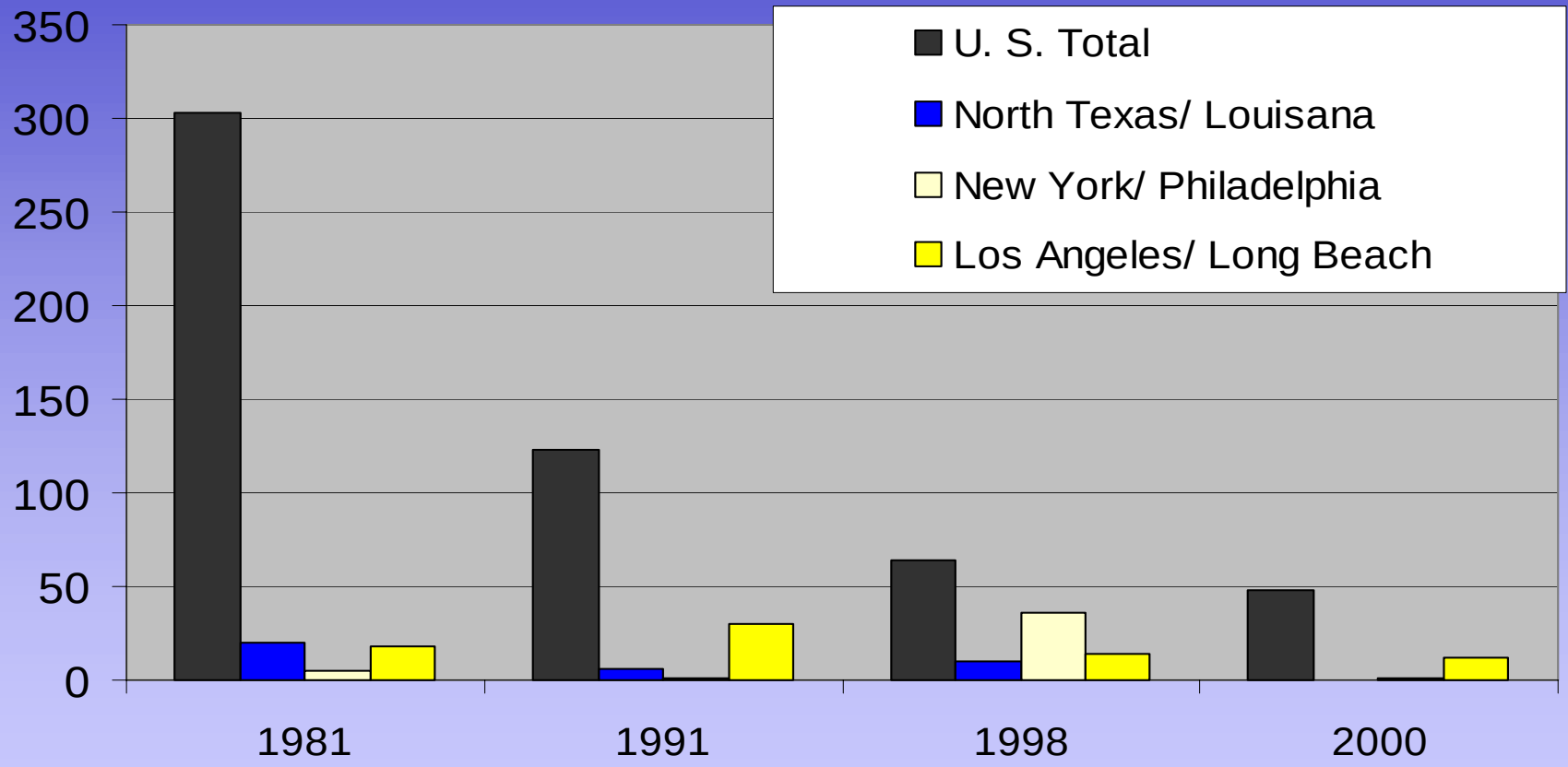
U. S. Coastwise Movements millions of short tons



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Identification of Traffic Problems (general steps)

- Talk with Vessel Pilots, Sponsor, Port & Industry Representatives.
- Determine the number of vessels and % of tonnage presently light-loaded (I.e. transported in vessels with design drafts greater than the channel depth.
- Talk with vessel operators and harbor pilots.

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Identification of Traffic Problems (general steps)

- Identify other sources of traffic problems (may include vessel meeting constraints due to channel width or unsafe bends)
- Determine trade route constraints
- Talk with sponsor, waterway users and vessel pilots, project engineers, environmental managers, obtain public input.

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Identification of Traffic Problems (general steps)

- Historic trends are assessed for the purpose of determining the commodity groups limited by the constraints of channel dimensions.
- Within the context of this framework, channel constraints are defined to exist when some % of the tonnage currently or anticipated to be transported in vessels that cannot be fully loaded.

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U. S. Gulf Coast Example Trips by Vessel DWT, Length and Beam (ft)

Vessel DWT	% Trips	LOA	Beam
<4000	1%	253	47
4000 to 19999	6%	436	65
20000 to 39999	23%	602	90
40000 to 80000	17%	677	104
80000 to 99999	46%	795	136
100000 to 160000	8%	831	140
Total	100%		

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Evaluation Criteria Identification of Traffic Problems

Identify range of potential solutions along with constraints

Common constraints include:

constraints are driven by costs, environmental impacts & associated cost

shipping constraints / logistical constraints

Implementability / engineering feasibility

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Identify Vessel Traffic Problems

Review recent historical traffic data

Tonnage Volumes

Vessel Sizes

- Identify tonnage shipped in draft limited vessels
- Identify trade routes associated with draft limited tonnage and shipping methods.
- Traffic density, intensity, and congestion.
- Identify channel depths at trading ports.

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US Gulf Coast Crude Oil Imports World Fleet Forecast Group Projections

source: 1998 McGraw-Hill/DRI data extraction

DWT (1000's)	Avg. Draft	1998	2006	2016	2026
<25k	34 ft	1%	1%	1%	1%
40-60k	36 ft	4%	4%	5%	5%
60-80k	41 ft	2%	2%	3%	3%
80-100k	44 ft	26%	27%	30%	32%
100-160k	52 ft	24%	25%	28%	30%
160-250k	63 ft	1%	1%	1%	1%
>250k	69 ft	42%	39%	32%	28%
total		100%	100%	100%	100%

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Planning Guidance

The overall procedures used by the Corps for navigation planning project formulation and evaluation are contained in Engineering Regulation (ER) 1105-2-100.

The ER outlines the requirements for conducting planning studies within the Corps of Engineers Civil Works Program.

http://www.usace.army.mil/inet/usace-docs/eng-regs/er1105-2-100/toc.htm

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Crude Oil Cost/Ton by Channel Depth Venezuela to Beaumont, Texas

sample calculation for presentation

Round Trip Mileage	4206		
Vessel DWT	120000		
Loading/Unload Rate	5250 tons/hour		
Hrly Cost at Sea	$1,124		
Hrly Cost in Port	$872		
Channel Depth	40-ft	45-ft	50-ft
Loaded Tons/ Channel	69,540	84,360	99,180
Voyage Cost/Ton	$4.53	$2.87	$2.41
Cost / Ton	$0.35	$0.35	$0.35
Total Cost/Ton	$3.71	$3.22	$2.77

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Cargo Capacity by Vessel Size & Channel Depth

(abbreviated example)

Vessel DWT	50,000	90,000	120,000
Immersion Factor	141	206	247
Maximum Draft (ft)	40	47	52
Fully Loaded Cargo	46,000	85,500	114,000
Number of ft. Light Loaded based on Channel Depth			
@ 40-ft channel	3	10	15
@ 45-ft channel	0	4	9
@ 50-ft channel	0	0	5

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Immersion Factor Application to Estimate Loaded Tonnage based on Vessel DWT, Design Draft and Channel Depth

Immersion Factor *	Design Draft (ft)	DWT	Loaded Cargo By Channel Depth		
			40	45	50
113	35	35,000	32,200	32,200	32,200
141	40	50,000	46,000	46,000	46,000
206	47	90,000	60,780	73,140	85,500
247	52	120,000	69,540	84,360	99,180
285	55	150,000	83,940	101,040	118,140

* Measures long tons per design draft. It is used to estimated tonnage by dwt and depth.

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Cargo Capacity by Vessel Size & Channel Depth

(abbreviated example)

Vessel DWT	**50,000**	**90,000**	**120,000**
Maximum Draft (ft)	40	47	52
Channel Depth	Cargo Capacity (tons of cargo)		
40-feet	40,924	60,780	69,540
45-feet	46,000	73,140	87,324
50-feet	46,000	85,500	99,180

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Number of Shuttles Offshore Lightering Mother Vessel: 325,000 dwt.

(abbreviated example)

	Vessel DWT			
Channel	50000	70000	90000	120000
Depth	Number of Vessels Needed			
40-feet	7	6	5	4
45-feet	7	5	5	4
50-feet	7	5	4	3

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Texas Gulf Coast Port % Crude Oil Imports by Trade Route 1998-2020 (compiled from Corps of Engineers & U.S. Dept. Commerce databases)

Trade Route	1998	2010	2020
Mexico and S America	43%	38%	36%
Europe, Africa, Med	1%	24%	24%
Mideast	55%	33%	34%
Far East	0%	4%	6%
Total	100%	100%	100%

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Evaluation Process

- The focus of the economic analysis is now to confirm vessel operating practices and ship size choices and determine the sensitivity of the project benefits.

-Determine the performance of selective channel widening and calculate the reduction in expected delays.

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Conclusions

Refinery Capacity and Expansion Issues are important to the Corps in terms of comparison of channel improvement projects.

The Corps needs to be aware of when improvements are needed and, when necessary, factor the additional cost of refinery expansion, as well as other logistical variables, into the evaluation.

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Conclusions

Petroleum Import Growth and Demand data suggests that refinery expansions are likely needed.

48% of U. S. Crude Oil Refinery Input &

46% of operating capacity is concentrated in along the Texas and Louisiana Coast.

General concerns about comparative analysis and the importance of multiport comparative evaluations.

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Questions and Comments