

(CO2 Sequestration)

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شرکت سهامی پتروشیمی بندر امام

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CO2

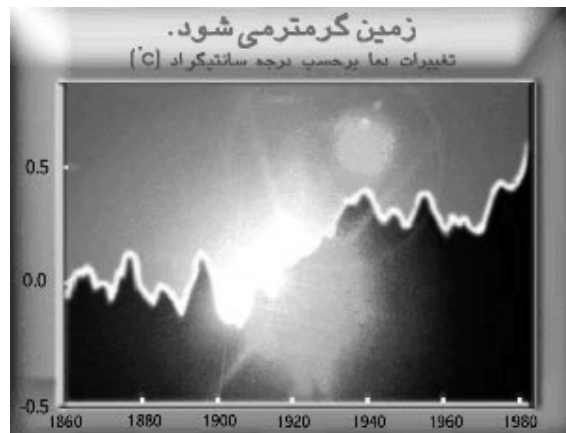
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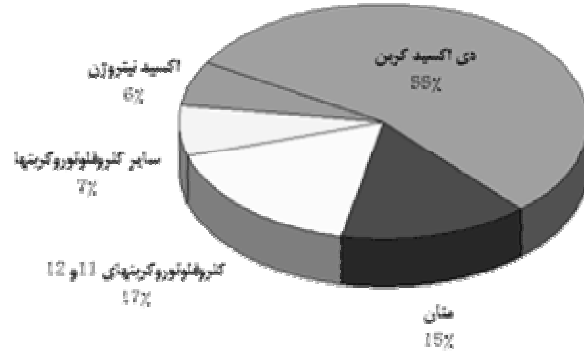
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${}^2\text{CO}_2$

CO_2



| | - | --- | | CO_2 |
|---|---|-----|-----|----------------------|
| | | | | CH_4 |
| - | | | | N_2O |
| | | | --- | O_3 |

CO₂

CO₂

*Avicenna marina*³

CO₂

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) *Avicenna marina*

. [] () *Rhizophora mangle*⁴ (

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: CO2

CO2

Carbon Sink⁵

CO2

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CO2

24 kg/y

6.5

CO2 2.3 ton

acre⁶ . 2.6 ton /acre .y

kg/y

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CO2

CO2

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| تعداد نهال | سال کاشت |
|------------|----------|
| ۴۰۰۰۰ | ۱۳۷۸ |
| ۵۰۰۰۰۰ | ۱۳۷۹ |
| ۵۰۰۰۰۰ | ۱۳۸۰ |
| ۵۰۰۰۰۰ | ۱۳۸۱ |
| ۵۲۰۰۰۰ | ۱۳۸۲ |
| ۱۰۰۰۰۰۰ | ۱۳۸۳ |
| ۱۳۰۰۰۰۰ | ۱۳۸۴ |
| ۱۰۰۰۰۰۰ | ۱۳۸۵ |
| ۶۱۰۵۰۰ | ۱۳۸۶ |
| ۸۲۰۰۱۵ | ۱۳۸۷ |
| ۶۷۹۰۵۱۵ | جمع |

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CO2

Method For Calculation CO2 Sequestration by Trees)^y

(

URBAN FORESTRY CARBON SEQUESTRATION WORKSHEET

(Calculate each reporting year on a separate worksheet; photocopy if more than one sheet is required)

Reporting year: 19__

| A. Species Characteristics <small>(Refer to Table 1)</small> | | | B. Tree Age | C. Number of Age 0 Trees Planted | D. Survival Factor <small>(Refer to Table 2)</small> | E. Number of Surviving Trees <small>(C x D)</small> | F. Annual Sequestration Rate <small>(Est./tree) <small>(Refer to Table 2)</small></small> | G. Carbon Sequestered <small>(lb) <small>(E x F)</small></small> | |
|--|---|---|-------------------|--|---|--|---|---|--|
| Name | Tree Type <small>(H or C)</small> | Growth Rate <small>(S, M, or F)</small> | | | | | | | |
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| | | | | | | | | | |
| Total Pounds of Carbon Sequestered | | | | | | | | | |
| Total Pounds of Equivalent CO ₂ Sequestered | | | | | | | X 3.67 | | |
| Equivalent CO ₂ Sequestered In Short Tons | | | | | | | | /2000 | |

Table 1. Common Urban Tree Species

| Species | Type | Growth Rate | Species | Type | Growth Rate |
|--|------|-------------|---|------|-------------|
| <i>Ailanthus, Ailanthus altissima</i> | H | F | Maple, bigleaf, <i>Acer macrophyllum</i> | H | S |
| Alder, European, <i>Alnus glutinosa</i> | H | F | Maple, Norway, <i>Acer platanoides</i> | H | M |
| Ash, green, <i>Fraxinus pennsylvanica</i> | H | F | Maple, red, <i>Acer rubrum</i> | H | M |
| Ash, mountain, American, <i>Sorbus americana</i> | H | M | Maple, silver, <i>Acer saccharinum</i> | H | M |
| Ash, white, <i>Fraxinus americana</i> | H | F | Maple, sugar, <i>Acer saccharum</i> | H | S |
| Aspen, bigtooth, <i>Populus grandidentata</i> | H | M | Mulberry, red, <i>Morus rubra</i> | H | F |
| Aspen, quaking, <i>Populus tremuloides</i> | H | F | Oak, black, <i>Quercus velutina</i> | H | M |
| Baldcypress, <i>Taxodium distichum</i> | C | F | Oak, blue, <i>Quercus douglasii</i> | H | M |
| Basswood, American, <i>Tilia americana</i> | H | F | Oak, live, <i>Quercus macrocarpa</i> | H | S |
| Beech, American, <i>Fagus grandifolia</i> | H | S | Oak, California black, <i>Quercus kelloggii</i> | H | S |
| Beech, paper (white), <i>Betula papyrifera</i> | H | M | Oak, California white, <i>Quercus lobata</i> | H | M |
| Beech, river, <i>Betula nigra</i> | H | M | Oak, canyon live, <i>Quercus chrysolepis</i> | H | S |
| Beech, yellow, <i>Betula alleghaniensis</i> | H | S | Oak, chestnut, <i>Quercus prinus</i> | H | S |
| Bocconia, <i>Acer negundo</i> | H | F | Oak, Chinquapin, <i>Quercus muhlenbergii</i> | H | M |
| Buckeye, Ohio, <i>Aesculus glabra</i> | H | S | Oak, Laurel, <i>Quercus laurifolia</i> | H | F |
| Catalpa, northern, <i>Catalpa speciosa</i> | H | F | Oak, live, <i>Quercus virginiana</i> | H | F |
| Cedar-red, eastern, <i>Juniperus virginiana</i> | C | M | Oak, northern red, <i>Quercus rubra</i> | H | F |
| Cedar-white, northern, <i>Thuja occidentalis</i> | C | M | Oak, overcup, <i>Quercus lyrata</i> | H | S |
| Cherry, black, <i>Prunus serotina</i> | H | F | Oak, pin, <i>Quercus palustris</i> | H | F |
| Cherry, pin, <i>Prunus pennsylvanica</i> | H | M | Oak, scarlet, <i>Quercus coccinea</i> | H | F |
| Cottonwood, eastern, <i>Populus deltoides</i> | H | M | Oak, swamp white, <i>Quercus bicolor</i> | H | M |
| Crabapple, <i>Malus</i> spp. | H | M | Oak, water, <i>Quercus nigra</i> | H | M |
| Cucumber tree, <i>Magnolia acuminata</i> | H | F | Oak, white, <i>Quercus alba</i> | H | S |
| Dogwood, flowering, <i>Cornus florida</i> | H | S | Oak, willow, <i>Quercus phellos</i> | H | M |
| Elm, American, <i>Ulmus americana</i> | H | F | Pecan, <i>Carya illinoensis</i> | H | S |
| Elm, Chinese, <i>Ulmus parvifolia</i> | H | M | Pine, European black, <i>Pinus nigra</i> | C | S |
| Elm, rock, <i>Ulmus thomasii</i> | H | S | Pine, jack, <i>Pinus banksiana</i> | C | F |
| Elm, September, <i>Ulmus serotina</i> | H | F | Pine, loblolly, <i>Pinus taeda</i> | C | F |
| Elm, Siberian, <i>Ulmus pumila</i> | H | F | Pine, longleaf, <i>Pinus palustris</i> | C | F |
| Elm, slippery, <i>Ulmus rubra</i> | H | M | Pine, ponderosa, <i>Pinus ponderosa</i> | C | F |
| Fir, balsam, <i>Abies balsamea</i> | C | S | Pine, red, <i>Pinus resinosa</i> | C | F |
| Fir, Douglas, <i>Pseudotsuga menziesii</i> | C | F | Pine, Scotch, <i>Pinus sylvestris</i> | C | S |
| Ginkgo, <i>Ginkgo biloba</i> | H | S | Pine, shortleaf, <i>Pinus echinata</i> | C | F |
| Hackberry, <i>Celtis occidentalis</i> | H | F | Pine, slash, <i>Pinus elliottii</i> | C | F |
| Hawthorne, <i>Crataegus</i> spp. | H | M | Pine, Virginia, <i>Pinus virginiana</i> | C | M |
| Hemlock, eastern, <i>Tsuga canadensis</i> | C | M | Pine, white eastern, <i>Pinus strobus</i> | C | F |
| Hickory, bitternut, <i>Carya cordiformis</i> | H | S | Poplar, yellow, <i>Liriodendron tulipifera</i> | H | F |
| Hickory, mockernut, <i>Carya tomentosa</i> | H | M | Redbud, eastern, <i>Cercis canadensis</i> | H | M |
| Hickory, shagbark, <i>Carya ovata</i> | H | S | Sassafras, <i>Sassafras albidum</i> | H | M |
| Hickory, shellbark, <i>Carya laciniata</i> | H | S | Spruce, black, <i>Picea mariana</i> | C | S |
| Hickory, pignut, <i>Carya glabra</i> | H | M | Spruce, blue, <i>Picea pungens</i> | C | M |
| Holly, American, <i>Ilex opaca</i> | H | S | Spruce, Norway, <i>Picea abies</i> | C | M |
| Honeylocust, <i>Gleditsia triacanthos</i> | H | F | Spruce, red, <i>Picea rubens</i> | C | S |
| Hophornbeam, eastern, <i>Ostrya virginiana</i> | H | S | Spruce, white, <i>Picea glauca</i> | C | M |
| Horsechestnut, common, <i>Aesculus hippocastanum</i> | H | F | Sugarberry, <i>Celtis laevigata</i> | H | F |
| Kentucky coffeetree, <i>Gymnocladia dioica</i> | C | F | Sweetgum, <i>Liquidambar styraciflua</i> | H | F |
| Linden, little-leaf, <i>Tilia cordata</i> | H | F | Sycamore, <i>Platanus occidentalis</i> | H | F |
| Locust, black, <i>Robinia pseudoacacia</i> | H | F | Tamarack, <i>Larix laricina</i> | C | F |
| London plane tree <i>Platanus X acerifolia</i> | H | F | Walnut, black, <i>Juglans nigra</i> | H | F |
| Magnolia, southern, <i>Magnolia grandifolia</i> | H | M | Willow, black, <i>Salix nigra</i> | H | F |

Type: H = Hardwood, C = Conifer Growth Rate: S = Slow, M = Moderate, F = Fast

Table 2: Survival Factors and Annual Carbon Sequestration Rates for Common Urban Trees

| Tree Age (yrs) | Survival Factors by Growth Rate | | | Annual Sequestration Rates by Tree Type and Growth Rate (lbs. carbon/tree/year) | | | | | |
|----------------|---------------------------------|----------|-------|---|----------|------|---------|----------|------|
| | | | | Hardwood | | | Conifer | | |
| | Slow | Moderate | Fast | Slow | Moderate | Fast | Slow | Moderate | Fast |
| 0 | 0.873 | 0.873 | 0.873 | 1.3 | 1.9 | 2.7 | 0.7 | 1.0 | 1.4 |
| 1 | 0.798 | 0.798 | 0.798 | 1.6 | 2.7 | 4.0 | 0.9 | 1.5 | 2.2 |
| 2 | 0.736 | 0.736 | 0.736 | 2.0 | 3.5 | 5.4 | 1.1 | 2.0 | 3.1 |
| 3 | 0.706 | 0.706 | 0.706 | 2.4 | 4.3 | 6.9 | 1.4 | 2.5 | 4.1 |
| 4 | 0.678 | 0.678 | 0.678 | 2.8 | 5.2 | 8.5 | 1.6 | 3.1 | 5.2 |
| 5 | 0.658 | 0.658 | 0.658 | 3.2 | 6.1 | 10.1 | 1.9 | 3.7 | 6.4 |
| 6 | 0.639 | 0.639 | 0.644 | 3.7 | 7.1 | 11.8 | 2.2 | 4.4 | 7.6 |
| 7 | 0.621 | 0.621 | 0.630 | 4.1 | 8.1 | 13.6 | 2.5 | 5.1 | 8.9 |
| 8 | 0.603 | 0.603 | 0.616 | 4.6 | 9.1 | 15.5 | 2.8 | 5.8 | 10.2 |
| 9 | 0.585 | 0.589 | 0.602 | 5.0 | 10.2 | 17.4 | 3.1 | 6.6 | 11.7 |
| 10 | 0.568 | 0.576 | 0.589 | 5.5 | 11.2 | 19.3 | 3.5 | 7.4 | 13.2 |
| 11 | 0.552 | 0.564 | 0.576 | 6.0 | 12.3 | 21.3 | 3.8 | 8.2 | 14.7 |
| 12 | 0.536 | 0.551 | 0.563 | 6.5 | 13.5 | 23.3 | 4.2 | 9.1 | 16.3 |
| 13 | 0.524 | 0.539 | 0.551 | 7.0 | 14.6 | 25.4 | 4.6 | 9.9 | 17.9 |
| 14 | 0.512 | 0.527 | 0.539 | 7.5 | 15.8 | 27.5 | 4.9 | 10.8 | 19.6 |
| 15 | 0.501 | 0.516 | 0.527 | 8.1 | 16.9 | 29.7 | 5.3 | 11.8 | 21.4 |
| 16 | 0.490 | 0.504 | 0.516 | 8.6 | 18.1 | 31.9 | 5.7 | 12.7 | 23.2 |
| 17 | 0.479 | 0.493 | 0.505 | 9.1 | 19.4 | 34.1 | 6.1 | 13.7 | 25.0 |
| 18 | 0.469 | 0.483 | 0.495 | 9.7 | 20.6 | 36.3 | 6.6 | 14.7 | 26.9 |
| 19 | 0.459 | 0.472 | 0.484 | 10.2 | 21.9 | 38.6 | 7.0 | 15.7 | 28.8 |
| 20 | 0.448 | 0.462 | 0.474 | 10.8 | 23.2 | 41.0 | 7.4 | 16.7 | 30.8 |
| 21 | 0.439 | 0.452 | 0.464 | 11.4 | 24.4 | 43.3 | 7.9 | 17.8 | 32.8 |
| 22 | 0.429 | 0.442 | 0.454 | 12.0 | 25.8 | 45.7 | 8.3 | 18.9 | 34.9 |
| 23 | 0.419 | 0.433 | 0.445 | 12.5 | 27.1 | 48.1 | 8.8 | 20.0 | 37.0 |
| 24 | 0.410 | 0.424 | 0.435 | 13.1 | 28.4 | 50.6 | 9.2 | 21.1 | 39.1 |
| 25 | 0.401 | 0.415 | 0.426 | 13.7 | 29.8 | 53.1 | 9.7 | 22.2 | 41.3 |
| 26 | 0.392 | 0.406 | 0.417 | 14.3 | 31.2 | 55.6 | 10.2 | 23.4 | 43.5 |
| 27 | 0.384 | 0.398 | 0.409 | 15.0 | 32.5 | 58.1 | 10.7 | 24.6 | 45.7 |
| 28 | 0.375 | 0.389 | 0.400 | 15.6 | 33.9 | 60.7 | 11.2 | 25.8 | 48.0 |
| 29 | 0.367 | 0.381 | 0.392 | 16.2 | 35.3 | 63.3 | 11.7 | 27.0 | 50.3 |
| 30 | 0.359 | 0.373 | 0.383 | 16.8 | 36.8 | 65.9 | 12.2 | 28.2 | 52.7 |
| 31 | 0.352 | 0.365 | 0.375 | 17.5 | 38.2 | 68.5 | 12.7 | 29.5 | 55.1 |
| 32 | 0.344 | 0.358 | 0.367 | 18.1 | 39.7 | 71.2 | 13.3 | 30.7 | 57.5 |
| 33 | 0.337 | 0.350 | 0.360 | 18.7 | 41.1 | 73.8 | 13.8 | 32.0 | 59.9 |
| 34 | 0.330 | 0.343 | 0.349 | 19.4 | 42.6 | 76.5 | 14.3 | 33.3 | 62.4 |
| 35 | 0.323 | 0.336 | 0.339 | 20.0 | 44.1 | 79.3 | 14.9 | 34.7 | 64.9 |

CO2

(Conifer)

(HARDWOOD)

" 3.67 "

در جدول زیر کل محاسبات انجام شده به شکل خلاصه دیده می شود:

| | | | | | | | lb/tree) (| (lb) | CO2 (lb) |
|------------------------|---|---|----|-------------|-------|------------|---------------|-------------|--|
| Avicen na Marina | H | M | 10 | 40000 | 0.576 | 23040 | 11.2 | 258048 | 947036 |
| | | | 9 | 500000 | 0.589 | 29450 0 | 10.2 | 300390 0 | 11024313 |
| | | | 8 | 500000 | 0.603 | 30150 0 | 9.1 | 274365 0 | 10069195 |
| | | | 7 | 500000 | 0.621 | 31050 0 | 8.1 | 251505 0 | 9230233 |
| | | | 6 | 520000 | 0.639 | 33228 0 | 7.1 | 235918 8 | 8658219 |
| | | | 5 | 100000 0 | 0.658 | 65800 0 | 6.1 | 401380 0 | 14730646 |
| | | | 4 | 130000 0 | 0.675 | 88140 0 | 5.2 | 458328 0 | 16820637 |
| | | | 3 | 100000 0 | 0.706 | 70600 0 | 4.3 | 303580 0 | 11141386 |
| | | | 2 | 610500 | 0.736 | 44932 8 | 3.5 | 157264 8 | 5771618 |
| | | | 1 | 820015 | 0.798 | 65437 2 | 2.7 | 176680 4 | 6484170 |
| | | | | | | | | | 79738879 lb= 43126.114 tonCO2/y |

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|--|----------------------------------|
| ۲۶ هکتار آکاسیا و اکالیپتوس با میانگین سنی ۲/۵ سال در هر سال 907.845 ton CO ₂ /y را جذب می کند. | |
| مجموع CO ₂ جذب شده سالیانه توسط جنگل های حرا و فضای سبز مجتمع | 44033.959 ton CO ₂ /Y |

44033.959

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CO2 Sequestration

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Abstract

Carbon dioxide plays a great role in the Global Warming and, on the other hand, huge part of GHGs, Green House Gases, is human made. This leads to necessity of establishing more control methods. Bandar Imam Petrochemical Co. , according to the its mission , have been planted Mangrove Forests, in the Mahshahr swamps, due to declining global warming effects of CO2. During a period of 10 years, B.I.P.C has been planted about 6790515 Mangroves. The results show that about 44033 ton CO2/year has been sequestered.

Key words: CO2, Mangrove, Bandar Imam Petrochemical Co., swamp