MORE THAN 45 YEARS DEDICATED WORK

PROMOTE SUSTAINABLITY OF BIO ETHANOL PRODUCTION IN INDIA

UTILIZATION OF ETHYL ALCOHOL IN INDIA

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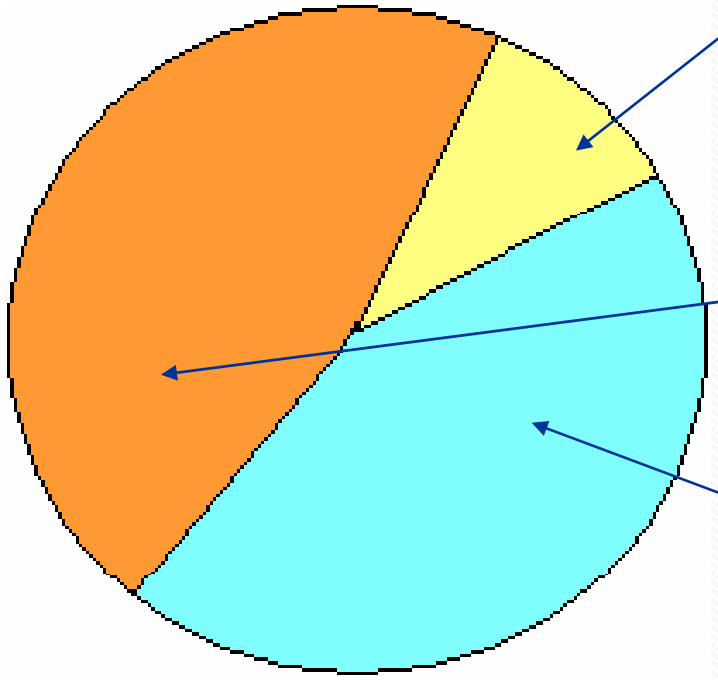


OTHERS

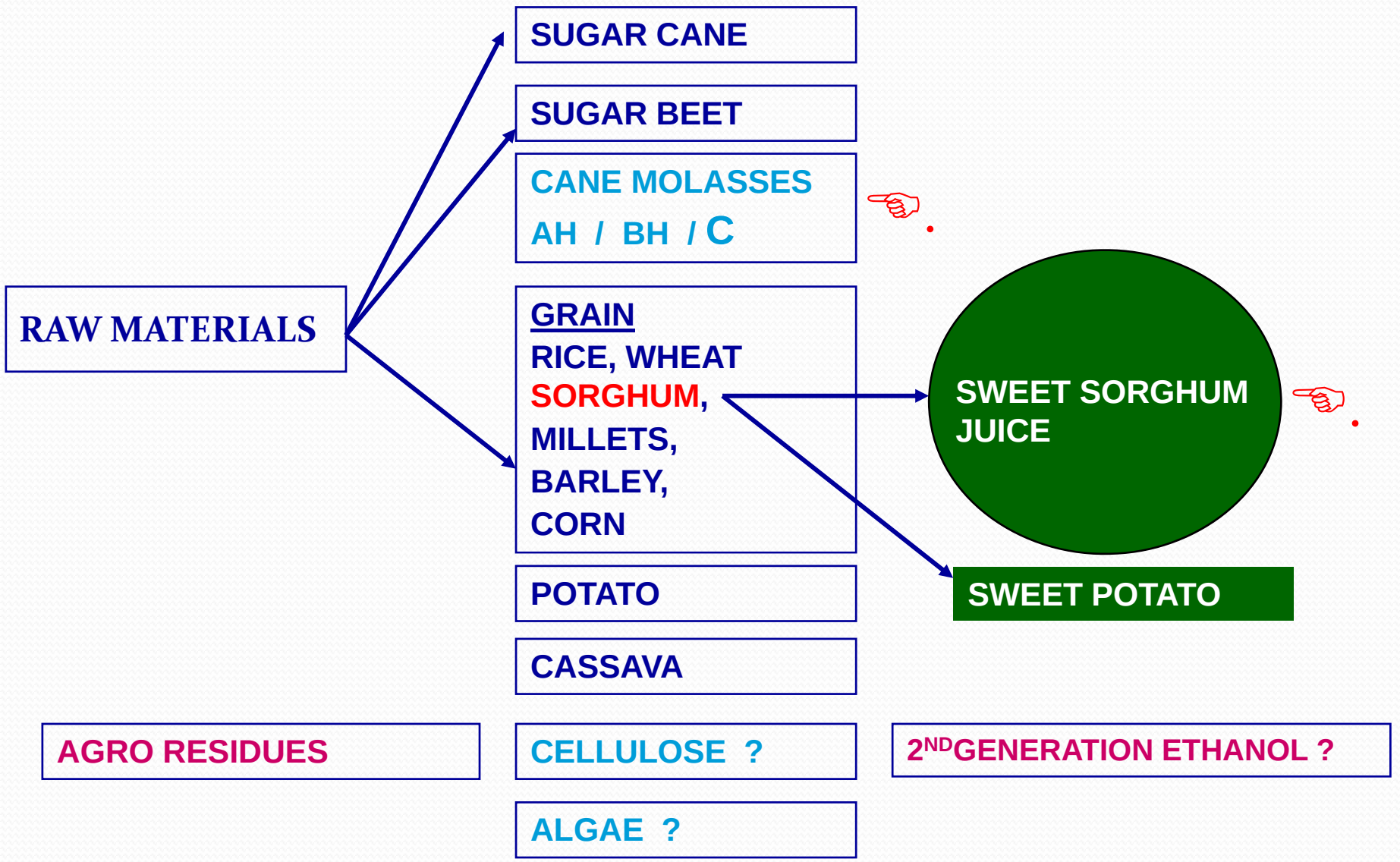
POTABLE ALCOHOL

CHEMICALS

BIO-ETHANOL
(E-5 - E-10 / E-20)

1. <u>RAW MATERIALS</u> : IS PRE REQUISITE FOR PROMOTING SUSTAINABILITY OF BIO ETHANOL PRODUCTION IN INDIA

RAW MATERIALS FOR ETHYL ALCOHOL



FEED STOCKS FOR BIO-ETHANOL PRODUCTION IN INDIA

BAGASSE , RICE / WHEAT STRAW, CORN COBE / STOVER , WOOD / BAMBOO SWITCH GRASS, MISCANTHUS , AGRO RESIDUES / OTHERS

LIMITATIONS AND CONSIDERATIONS : ????

AVAILABILITY - UN ORGANIZED SECTOR / SMALL AGRICULTURE - HOLDINGS
COLLECTION / VOLUME / FREIGHT TRANSPORT / STORAGE

PROCESSING - PREPARATION AND PRE TREATMENT TECHNO-ECONOMICAL TECHNOLOGY NEEDED – EXPENSIVE + EFFLUENT DISCHARGE ?
- ENZYME COST BARRIER

POLLUTION / ENVIRONMENT IMPACT / EFFECT :

- SOIL CONSERVATION / FERTILITY - QUESTIONABLE
- ECOLOGICAL IMPACT - UNCERTAIN

RECOVERY OF ALCOHOL FROM LIGNO CELLULOSE

RECOVERY - ETHANOL / UNIT OF RAW MATERIAL – UNCERTAIN ?

GERMAN PROCESS : 95 LITERS / MT, US PROCESS : 50 LITERS / MT
WOOD : 270 – 350 LITERS / MT, DRY STOVER : 227 LITERS / MT

CORN AND STOVER COMPOSITIONS

Corn[7]	% Dry Basis	Corn stover[8]	% Dry Basis
Starch	72.0	Cellulose	37.3
Hemicellulose/Cellulose	10.5	Galactan/Mannan	1.4
Protein	9.5	Xylan	20.6
Oil	4.5	Arabinan	2.1
Sugars	2.0	Lignin	17.5
Ash	1.5	Ash	6.1
Total	100.0	Acetate	2.0
		Extractives	13.0
		Total	100.0
% Moisture	15.0	% Moisture	15.0

❋ PRODUCTION COST : VERY HIGH BASED ON LIGNO CELLULOSIC RAW MATERIALS

SEVERAL EFC PROCESSES ARE TECHNICALLY FEASIBLE BUT COST EFFECTIVE PROCESSES HAVE BEEN DIFFECULT

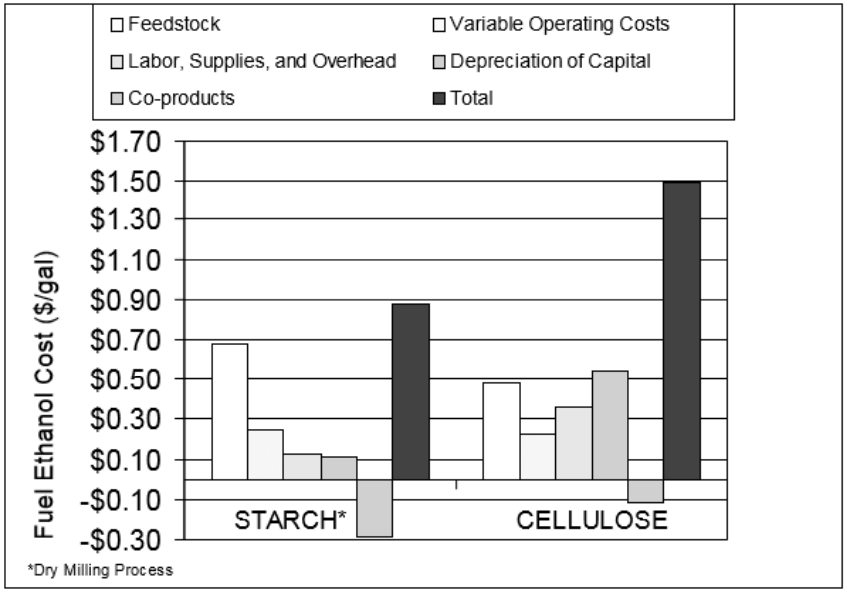
CELLULOSIC ETHANOL : 1.90 - 2.25 US$ / GALLON

CORN STARCH ETHANOL : 1.20 – 1.50 US$ / GALLON

CURRENTLY WITH AVAILABLE RAW MATERIALS CORN / MOLASSES IS EASIER AND LESS EXPENSIVE TO PROCESS ETHANOL IN COMPARISON TO CELLULOSIC ETHANOL ACCORDING TO DEPARTMENT OF ENERGY , USA

❋ CAPITAL INVESTMENT : VERY HIGH BASED ON LIGNO CELLULOSIC RAW MATERIALS

PRODUCTION COSTS IN DOLLARS PER GALLON OF FUEL ETHANOL



http://www.nrel.gov/docs/fy01osti/28893.pdf

The Institute for Local Self-Reliance estimates the cost of cellulosic ethanol from the first generation of commercial plants will be in the $1.90–$2.25 per gallon range, excluding incentives. This compares to the current cost of $1.20–$1.50 per gallon for ethanol from corn and the current retail price of over $4.00 per gallon for regular gasoline (which is subsidized and taxed).[

MOST TECHNO-ECONOMICAL RAW MATERIALS TO PROMOTE BIO ETHANOL PRODUCTION IN INDIA

CANE MOLASSES : BIO ETHANOL & CHEMICALS

CANE MOLASSES : PURITY TO BE NOT LESS THAN 30-35 %

SWEET SORGHUM : VALUABLE ALTERNATE CROP
INCENTIVIES /SECURITY TO FARMERS

STARCH – GRAIN : POTABLE ALCOHOL
(COARSE GRAIN /
BROKEN RICE)

*** BY PRODUCT OBTAINED VERY VALUABLE FOR ANIMAL FEED / SAVING FOOD GRAIN**

SWEET SORGHUM JUICE BASED ETHANOL

SWEET SORGHUM IN INDIA

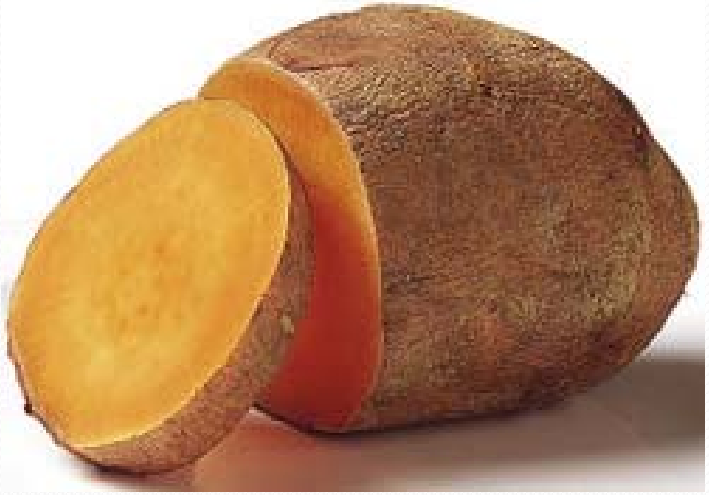
SWEET SORGHUM IN FLORIDA

SWEET SORGHUM IN R. DOMINICANA

SWEET SORGHUM IN INDONESIA

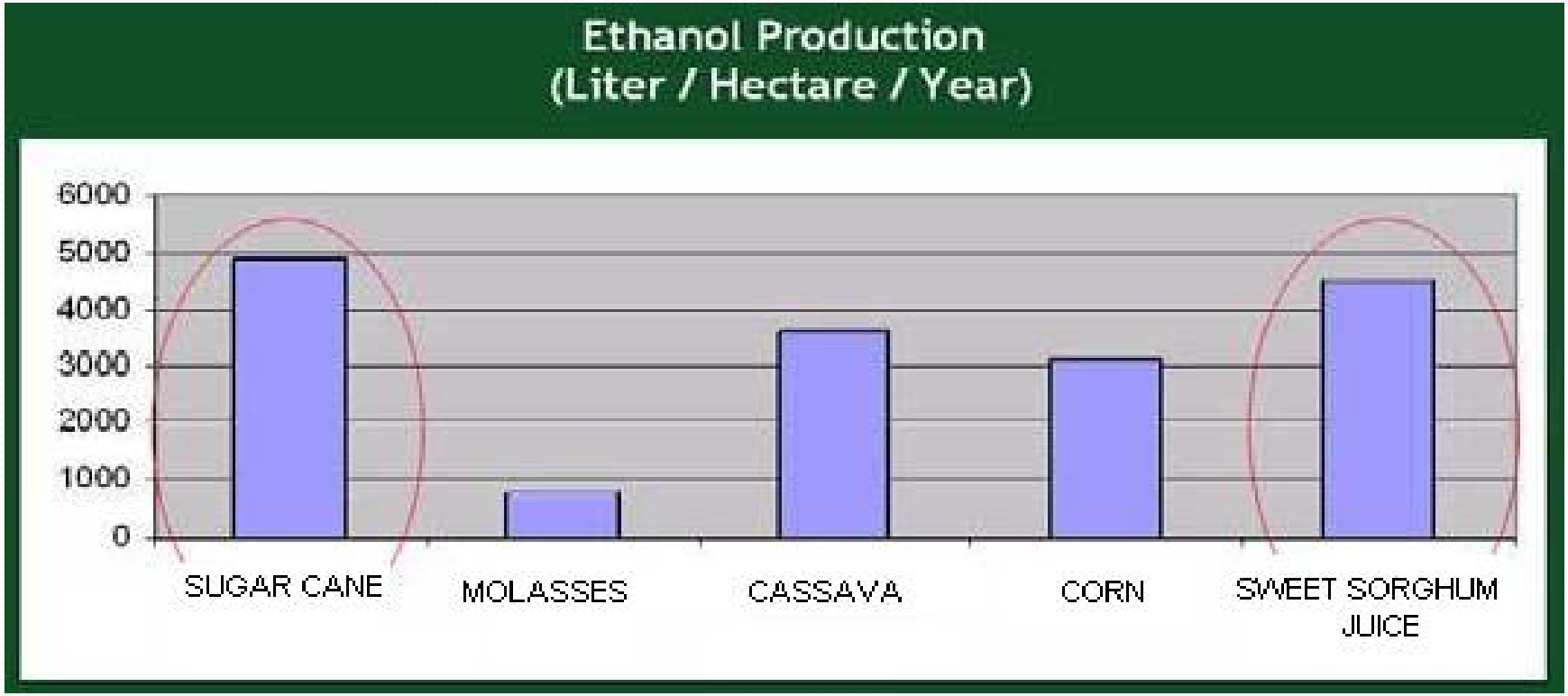
SWEET POTATO - YAM

HIGH IN CARBOHYDRATE CONTENT AS INTER CROPPING



COMPARISON : RAW MATERIALS

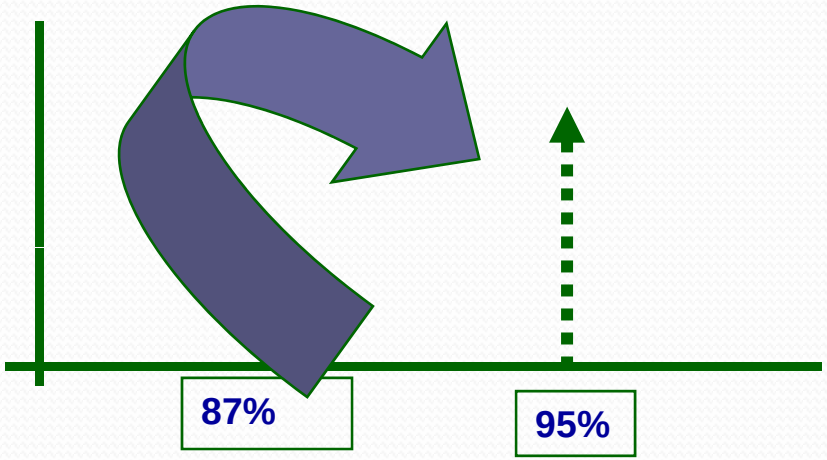
SUGARCANE, MOLASSES, CASSAVA, CORN & SWEET SORGHUM FOR BIO ETHANOL



In terms of feedstock, sweet sorghum is an important alternate raw material for bio ethanol production.

2. TECHNOLOGY UP-GRADATION IN INDIA

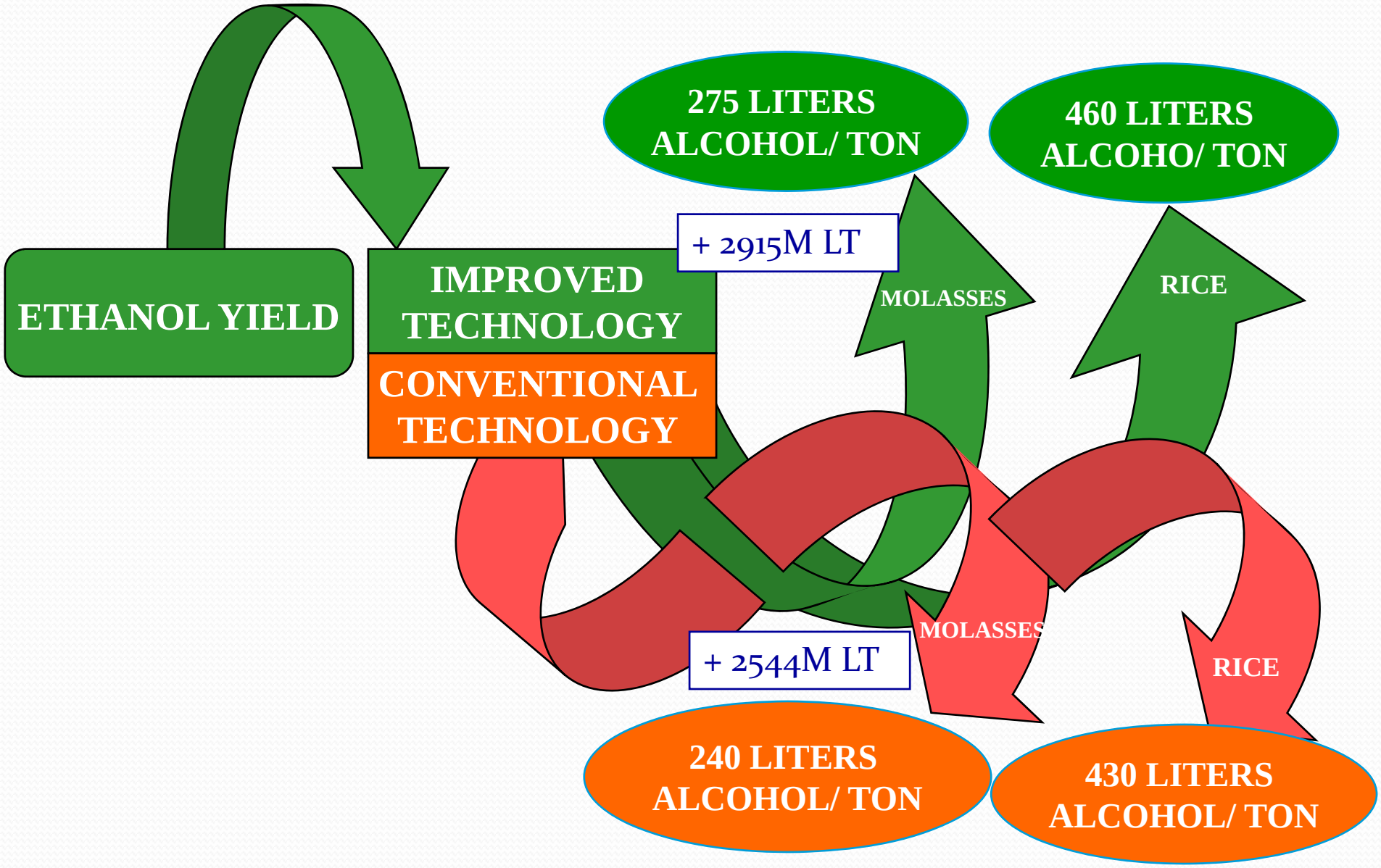
❋ IMPROVING FERMENTATION EFFICIENCY



❋ ZELD & BY PRODUCTS RECOVERY : BOILER FUEL, ANIMAL FEED, FERTILIZER

☞ ❋ 95% HYDROUS ALCOHOL USE AS E5/E10 DOPPING IN PETROL

CREST INTEGRATED TECHNOLOGY : INCREASE IN ETHYL ALCOHOL YIELD



3. HUMAN RESOURCE DEVELOPMENT & R & D CENTER

- 4 YEARS INTEGRATED DEGREE COURSE FOR ALCOHOL TECHOLGOY BY NSI/DSI / PRIVATE / PUBLIC INSTITUTES
- 1 YEAR INTENSIVE SKILL DEVELOPMENT PROGRAM FOR DISTILLERY OPERATORS (10 + 2 PASS).
- SET UP R & D CENTER BY AIDA
- PRIVATE R & D CENTERS TO BE ENCOURAGED

4. DEVELOPMENT FUND FOR BIO ETHANOL

- TECHNICAL DEVELOPMENT FUND (TDF) TO BE PROVIDED EXECLUSIVELY TO DISTILLERY INDUSTRY FOR BIO ETHANAL PRODUCTION

- REMUNERATIVE PRICE FOR BIO ETHANOL WITH INCENTIVES.

- PRAGMATIC AND + IVE APPROACH BY OIL COMPANIES

5. POLLUTION / ENVIRONMENT NORMS

POLLUTION : ***DISTILLERY INDUSTRY TO BE TAKEN OUT FROM RED CATEGORY DISTILLERY INDUSTRY TO BE ALLOWED TO OPERATE AROUND THE YEAR.***

DISTILLERY INDUSTRY TO BE PROVIDED WITH SOFT LOAN FOR ADOPTING ZELD AND RECOVERY OF VALUABLE BY PRODUCTS

PCB / MCB : ***PRAGMATIC + IVE APPROACH (CLOSURE IS DISASTER)***


THANKS

COMMERCIAL CELLULOSIC ETHANOL PLANTS IN THE U.S. (OPERATIONAL OR UNDER CONSTRUCTION)

Company	Location	Feedstock
Abengoa Bioenergy	Hugoton, KS	Wheat straw
BlueFire Ethanol	Irvine, CA	Multiple sources
Colusa Biomass Energy Corporation	Sacramento, CA	Waste rice straw
Coskata	Warrenville, IL	Biomass, Agricultural and Municipal wastes
DuPont	Vonore, TN	Corn cobs, switchgrass
DuPont	Nevada, IA	Corn stover
Fulcrum BioEnergy	Reno, NV	Municipal solid waste
Gulf Coast Energy	Mossy Head, FL	Wood waste
KL Energy Corp.	Upton, WY	Wood
Mascoma	Lansing, MI	Wood
POET-DSM Advanced Biofuels	Emmetsburg, IA	Corn cobs, husks, and stover[98]
Range Fuels[99]	Treutlen County, GA	Wood waste
SunOpta	Little Falls, MN	Wood chips
SweetWater Energy	Rochester, NY	Multiple Sources
US Envirofuels	Highlands County, FL	Sweet sorghum
Xethanol	Auburndale, FL	Citrus peels

CELLULOSIC ETHANOL COMMERCIALIZATION IN WORLD

UNITED STATES
Plants totaling 12 million liters (3.17 million gal) per year were operational, and an additional 80 million liters (21.1 million gal.) per year of capacity - in 26 new plants - are under construction.

CANADA
Capacity of 6 million liters per year are operational.

EUROPE
Several plants are operational

GERMANY, SPAIN, and **SWEDEN**,
Capacity of 10 million liters per year is under construction.

ITALY
Mossi & Ghisolfi Group broke ground for its 13 MMgy cellulosic ethanol.