

# **Pulse Drying Technology**

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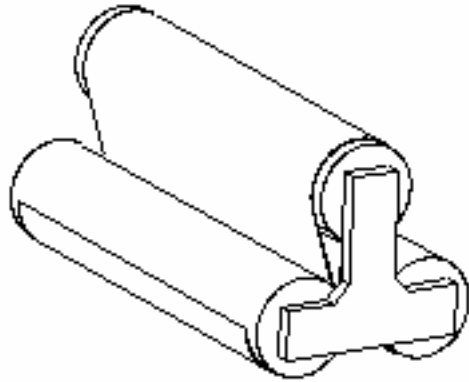
Download the 65-page DOE report:

## PULSE DRYING EXPERIMENT AND BURNER CONSTRUCTION

GOOGLE: OSTI.GOV - Office of Scientific and Technical Information

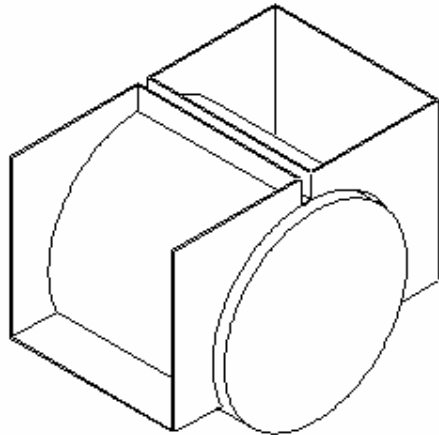
SEARCH: SEARCH ALL - PULSE DRYING

# **DRYER EFFICIENCIES**



**STEAM CYLINDER DRYER  
EVAP. EFFICIENCY**

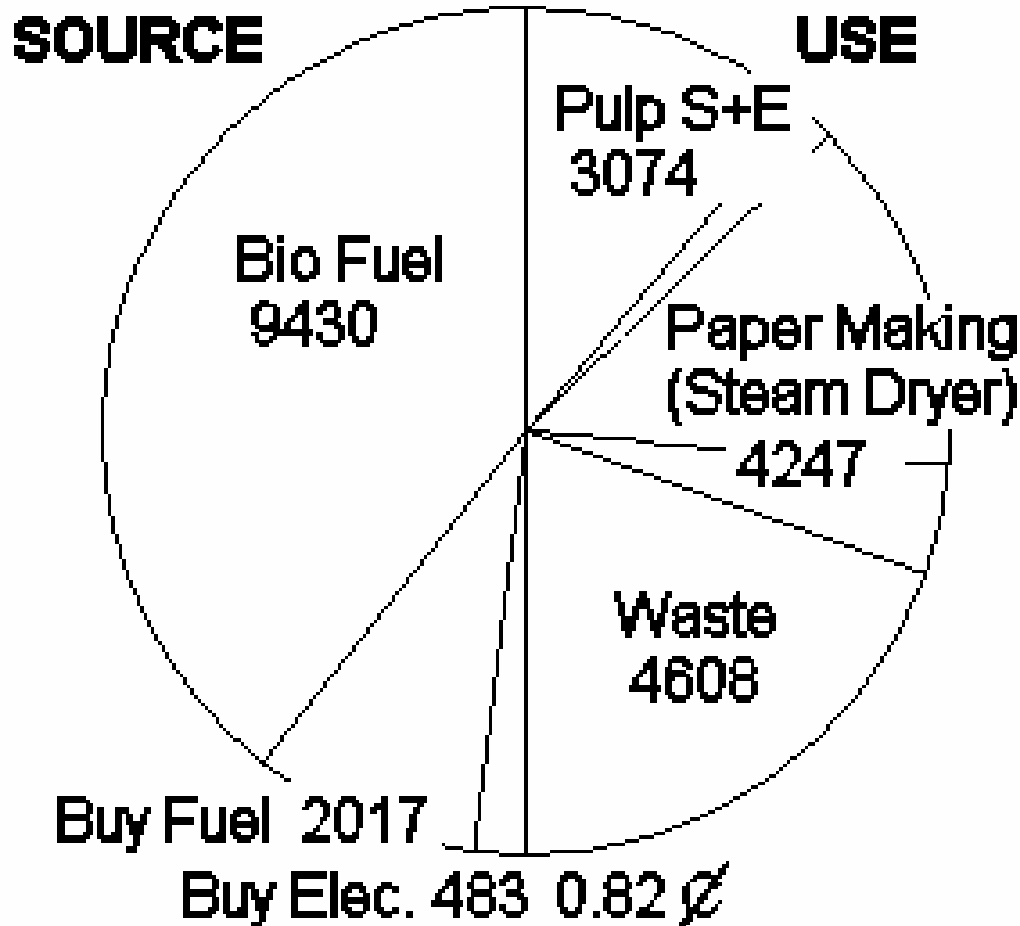
**2400 BTU/#**



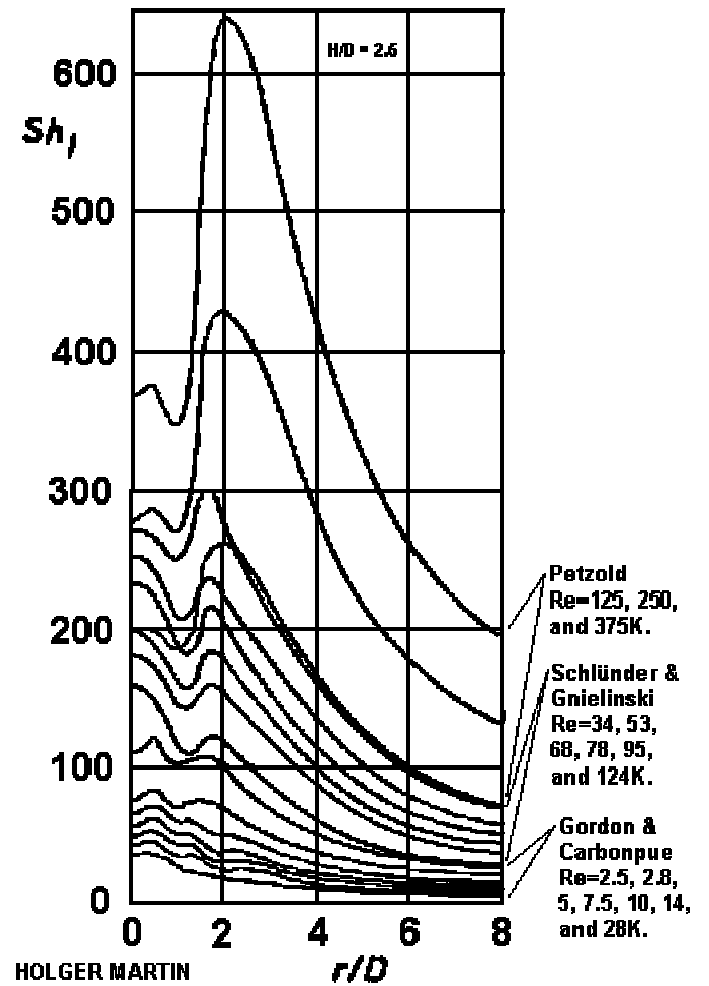
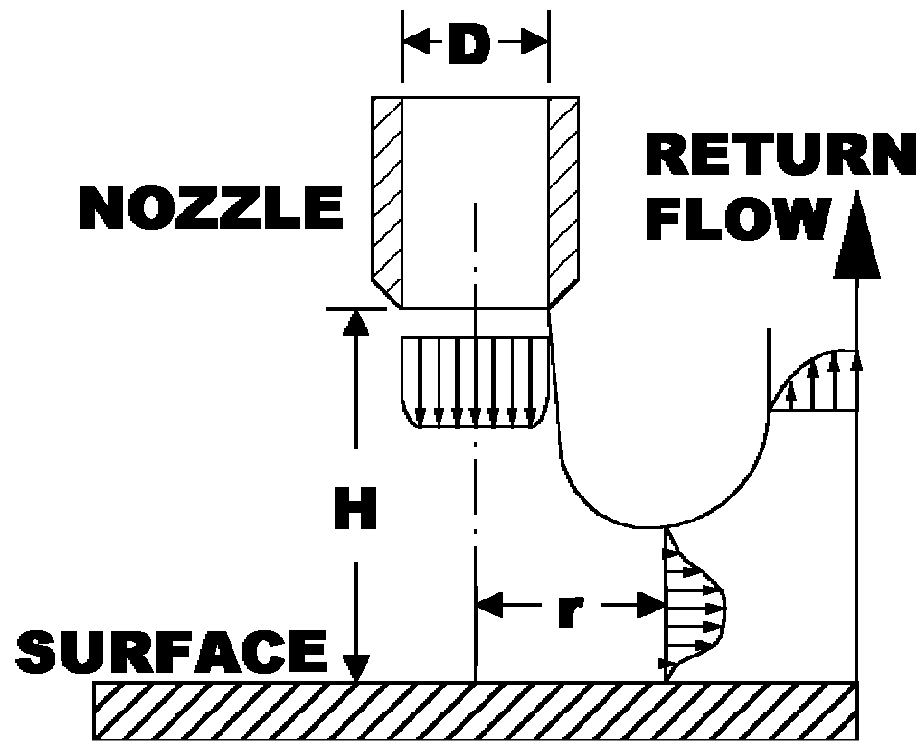
**AIR DRYER**

**4000 BTU/#**

# PAPER MILL ENERGY BALANCE [BTU/# Dry Paper]

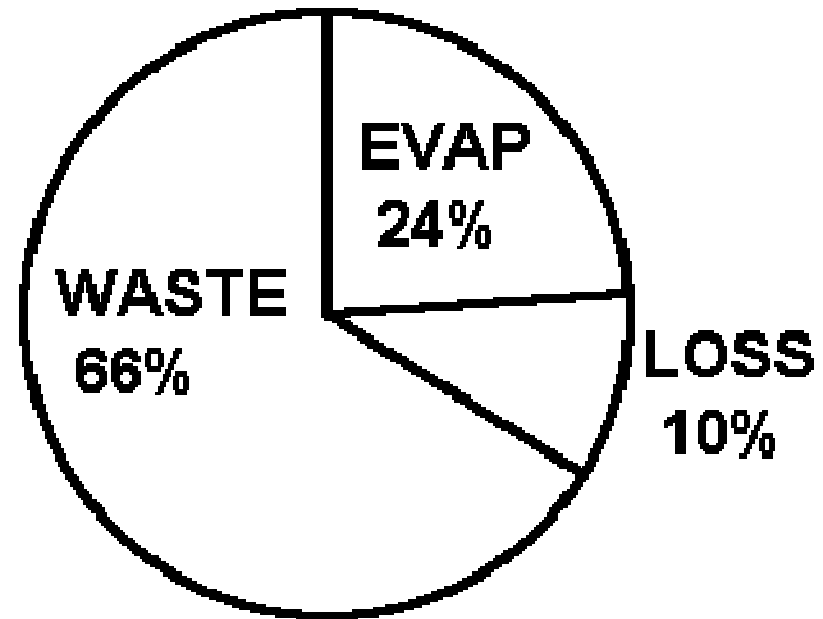
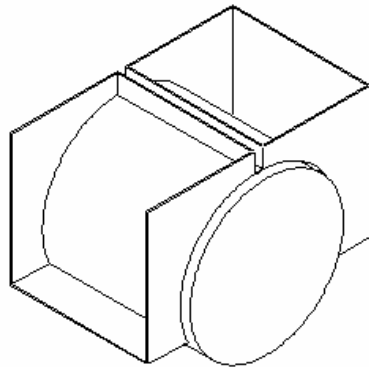


# AIR DRYING



HOLGER MARTIN  
FIGURE 4(C)

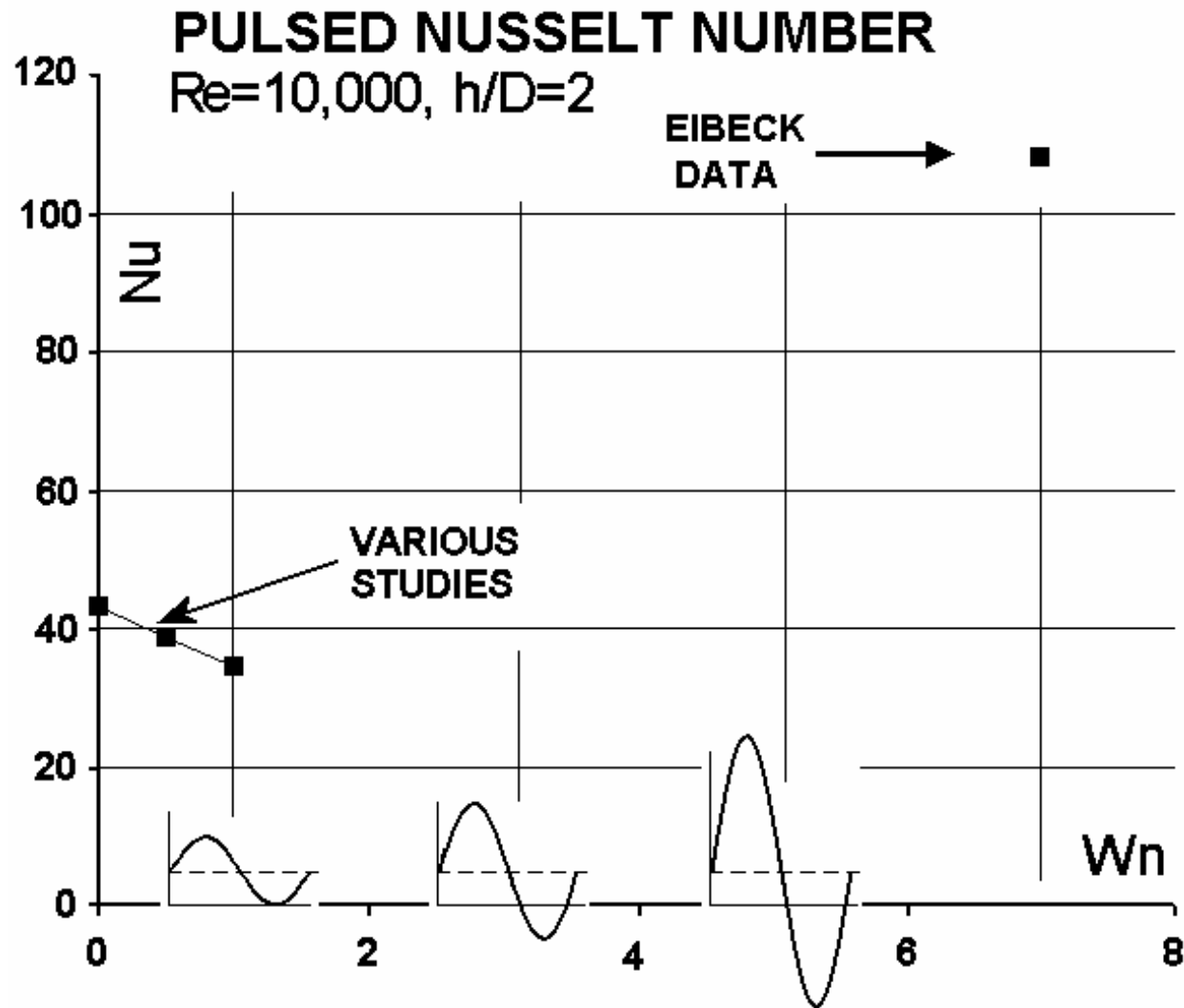
# STEADY DRYING PROCESS



```

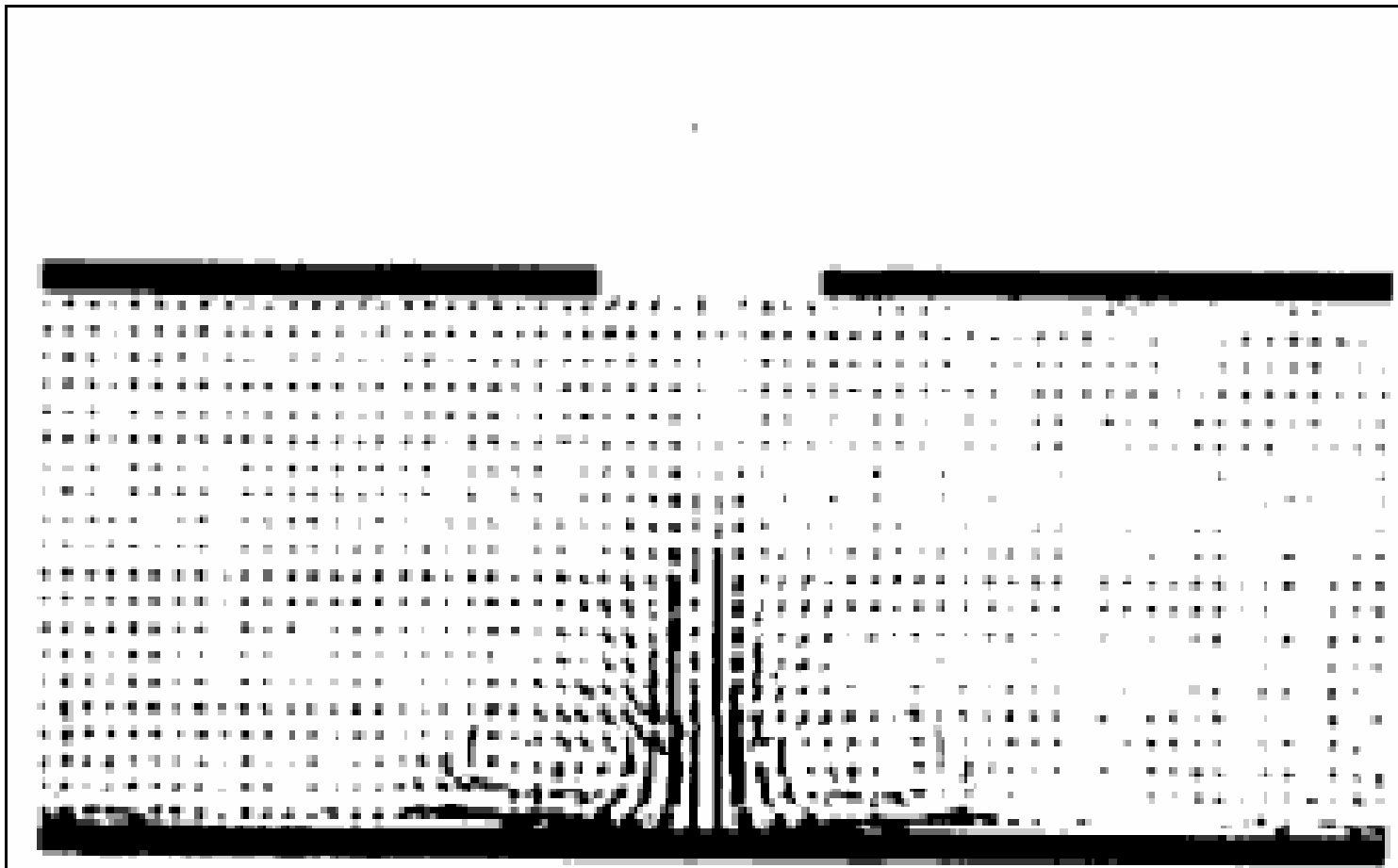
._Steady Drying Process-----[perSqFt]_
| 235KB/H==> 900F== 58#w/H==> 704F==+=====> 621F 0.91HP/f2 |
| 248SCFM      79D   57KB/H   118D  +--> 23KB/H           154KB/H |
|_heat_____in_____evap_____10%loss_____out_____waste_|
    
```

# PULSE DRYING AS OF 2001



# TOROID ANIMATION

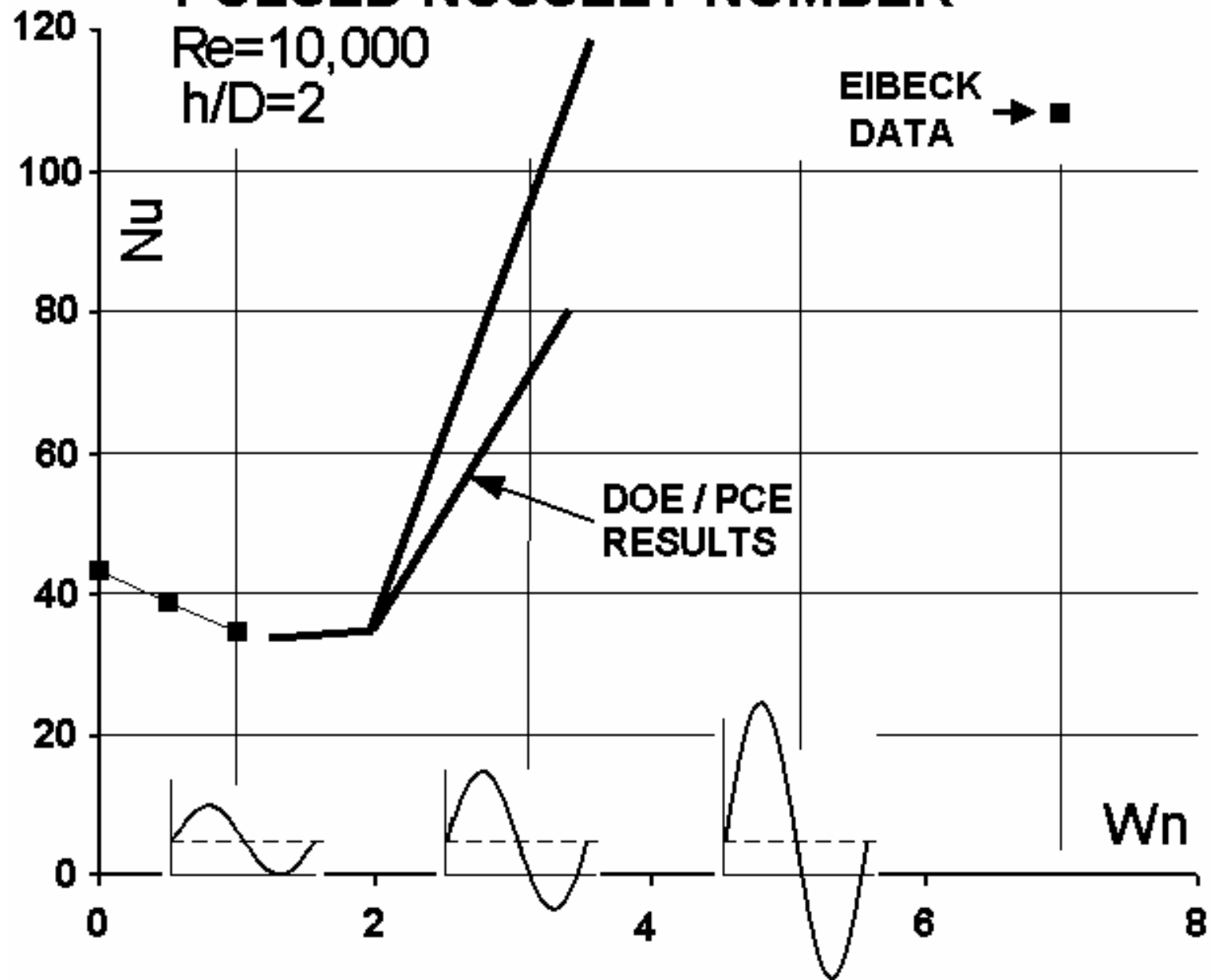
(from Eibeck publication)



Eibeck1

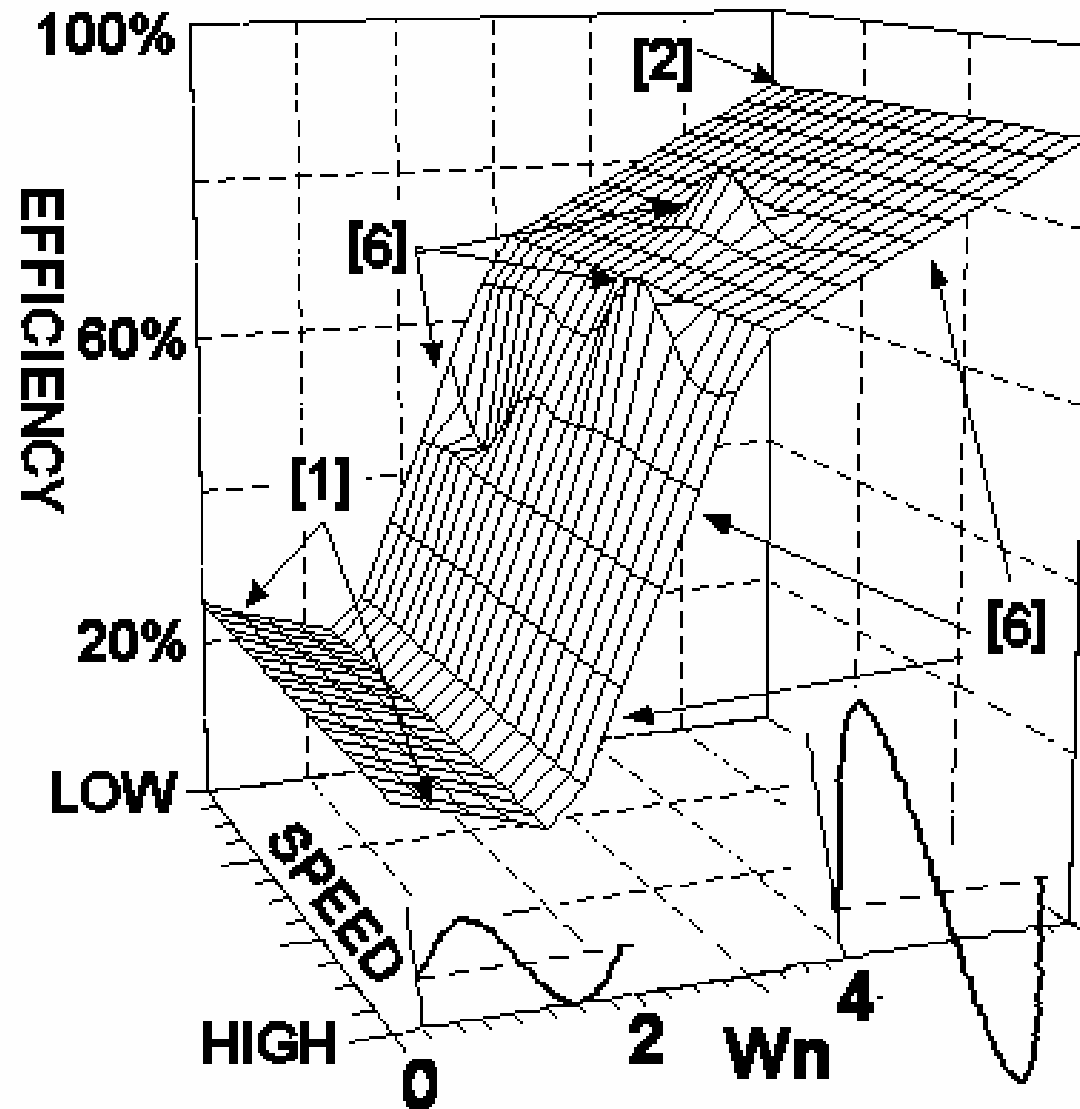
# PULSED NUSSELT NUMBER

$Re=10,000$   
 $h/D=2$



# PULSE VARIABLE SPACE 2007

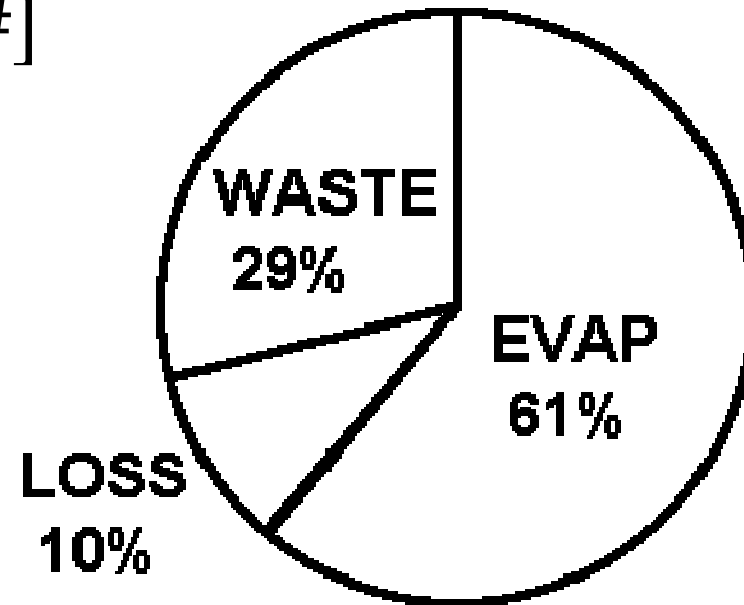
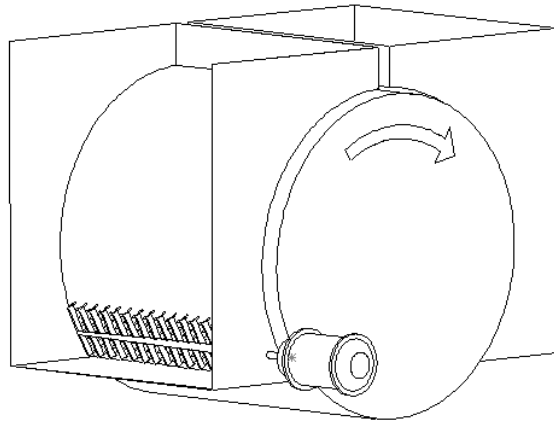
## PULSE DRYING BEHAVIOR



## PULSED AIR DRYING

Efficiency=1200 [BTU/#]

Required fan pressure  
= 5.7 [PSI]

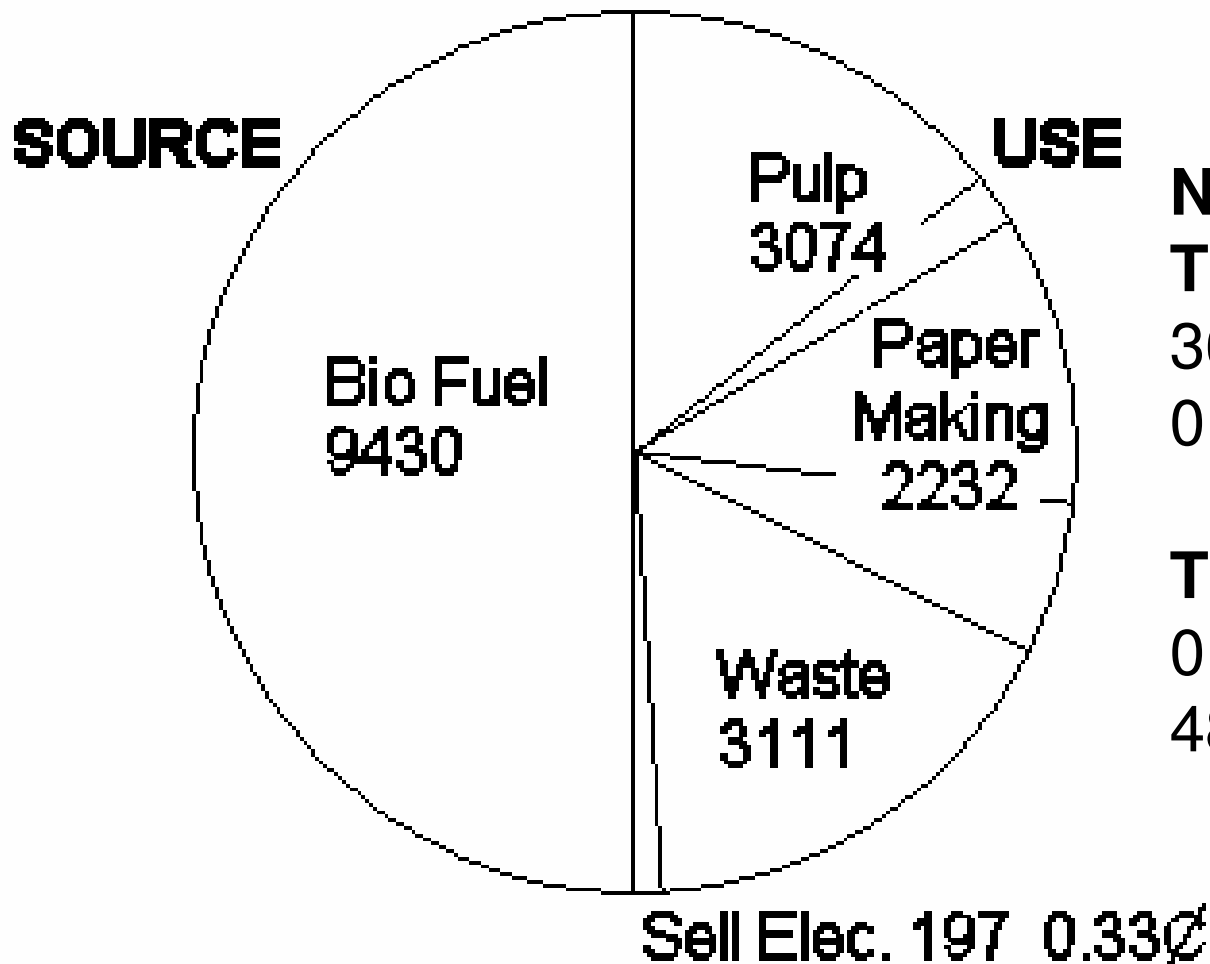


```

. 2.5X Pulse Process ----- [perSqFt] .
| 235KB/H==> 900F==145#w/H==> 402F==+=====> 319F 0.91HP/f2 |
| 248SCFM      79D  143KB/H    143D  +-> 23KB/H           68KB/H |
| heat      in      evap      10%loss      out      waste |
    
```



# PAPER MILL ENERGY BALANCE [BTU/#] Pulse Drying



**NET CONTRIBUTION  
TO POWER GRID**

36 B-KwHr/Yr

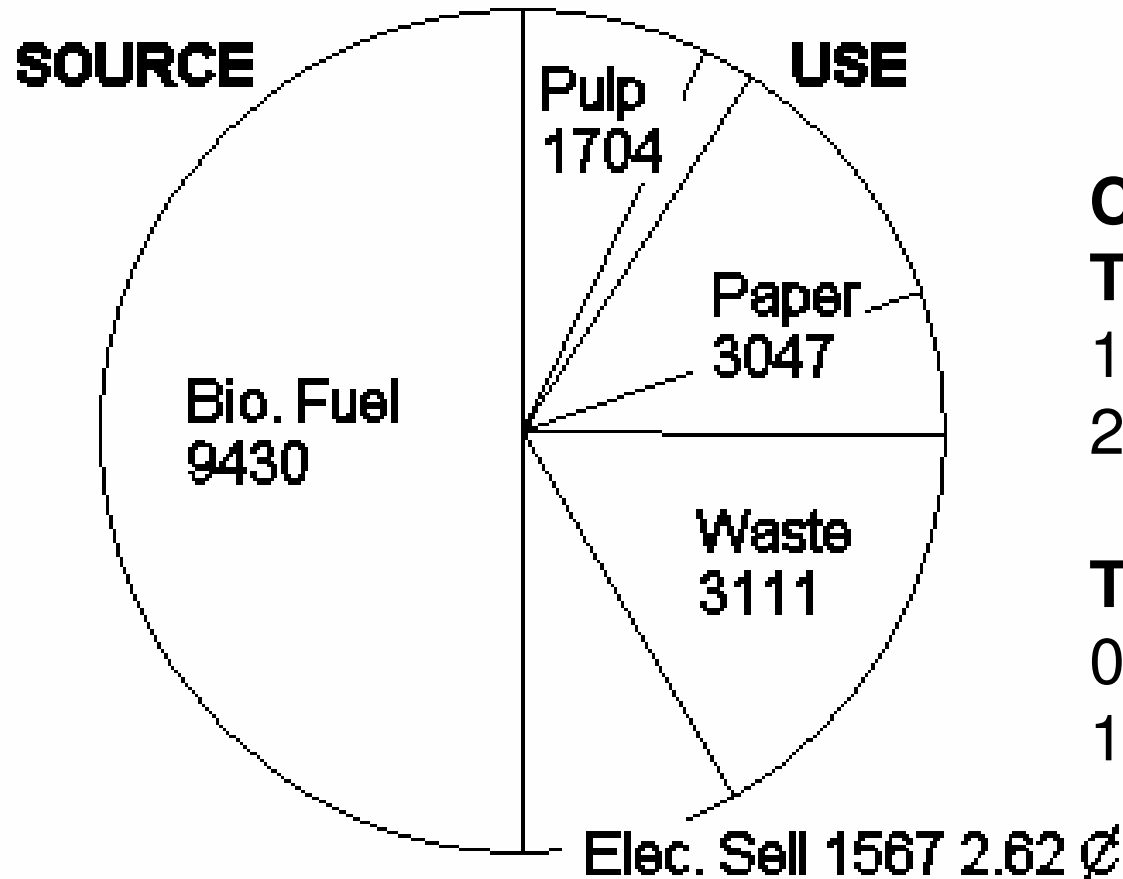
0.96% of US Grid

**TOTAL SAVINGS**

0.012 \$/#

48 M-Tons-CO<sub>2</sub>/Yr

# PAPER MILL ENERGY BALANCE Pulse Drying & Pulse Pulping



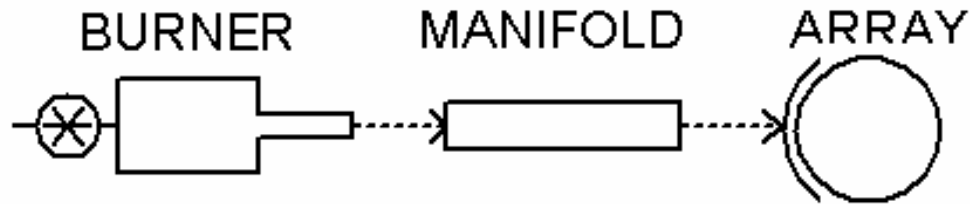
## CONTRIBUTION TO GRID

105 B-KwHr/Yr  
2.77% of US Grid

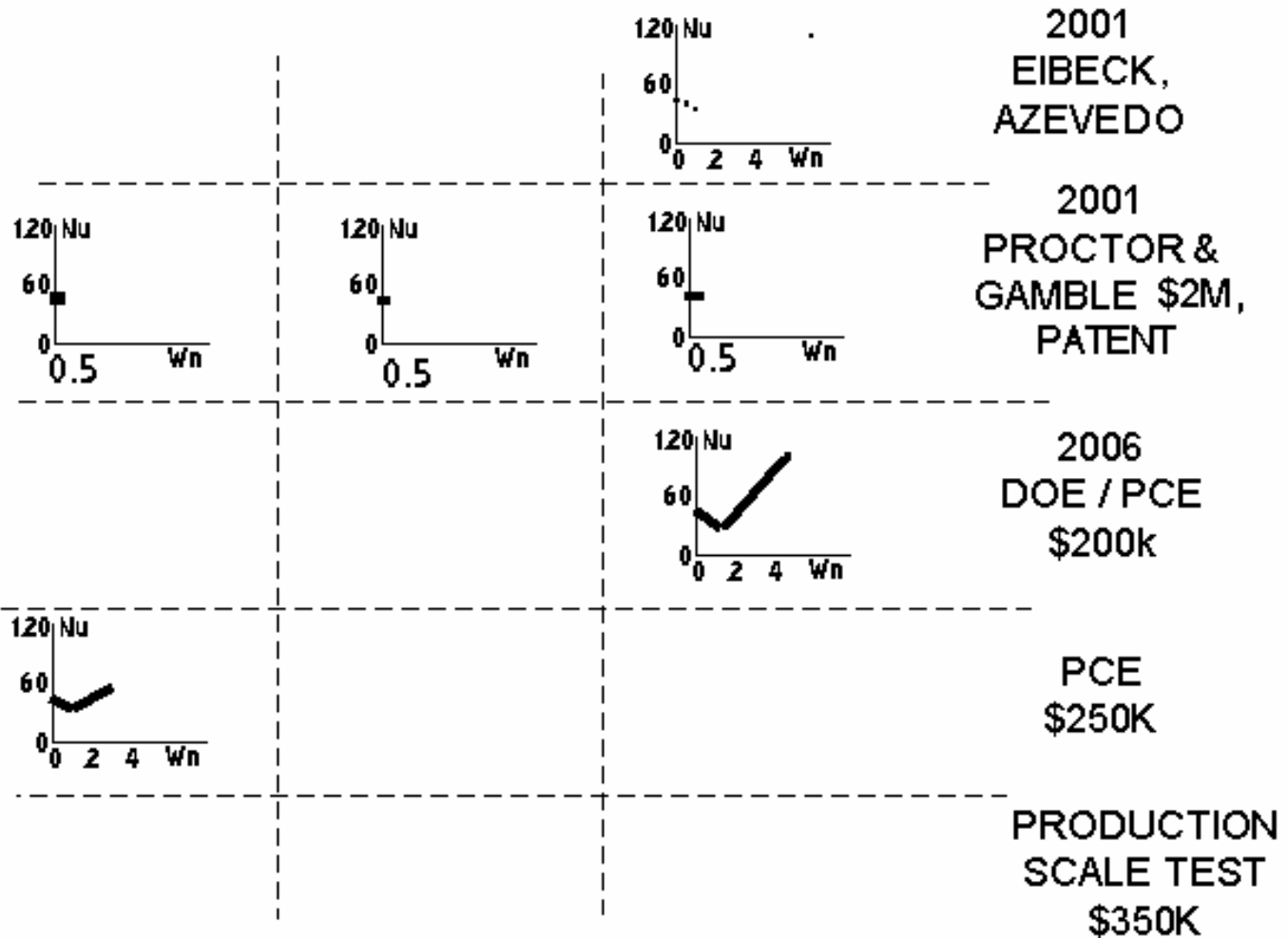
## TOTAL SAVINGS

0.0365 \$/# (13.7% Rev.)  
140 M-Tons-CO<sub>2</sub>/Yr

# REMAINING DEVELOPMENT



**NOW**



# OTHER DEVELOPMENT TASKS

ELECTRICITY PRODUCTION CAPITAL COST

STEADY VS FALLING RATE DRYING ZONES  
NO FELTS - DIRECT CONTACT DRYING

NOZZLE VS ARRAY PERFORMANCE

MANIFOLD (PRODUCTION SCALE)

NO<sub>x</sub> CONTROL IN BURNER

SELF PUMPING BURNER CHAR.

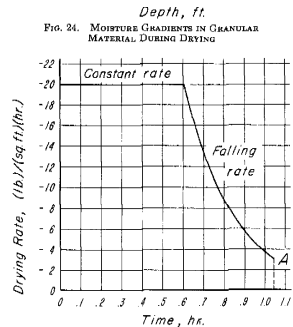
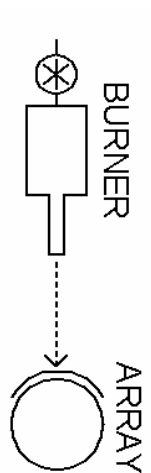
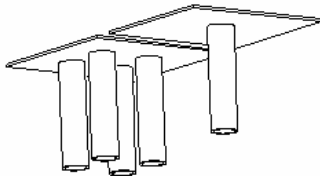


FIG. 25. TYPICAL CHANGE IN DRYING RATE OF

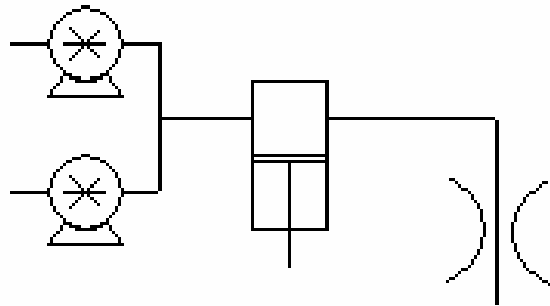


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PID of demonstration unit.

