CE350 LSN 22 Board Notes (Bruhl)

Thursday, March 1, 2018

EXAMPLE PROBLEM: PIZZERIA (OPERATES FROM 1000–1400 DAILY)

ITEM	POWER REQ'T (W) OPERATING	POWER REQ'T (W) STARTUP	HRS/DAY	DUTY CYCLE (%)	ENERGY REQ'D (Wh/DAY)
FRIDGE	200	1200*	24	50%	200 W x 24 hrs x 50% = 2400
AC	1500	2200*	4	100%	1500 W x 4 hrs x 100% = 6000
OVEN	10000*	—	4	100%	SPREADSHEET! = 40000
LIGHTS	480*	—	4	100%	= 1920
	Σ = 12180 W	13880 W			Σ = 50320 Wh/DAY

SIZE THE GENERATOR

* SAY 20 kW ANS

FUEL REQ'T: 50320 Wh/DAY = 50.3 kWh/DAY

DIESEL: 128500 BTU/GAL

ASSUME 30% EFFICIENCY

$$\text{ENERGY}_{\text{REQ'D}} = \frac{50.3\ \text{kWh/DAY}}{0.30} = 167.7\ \text{kWh/DAY}$$

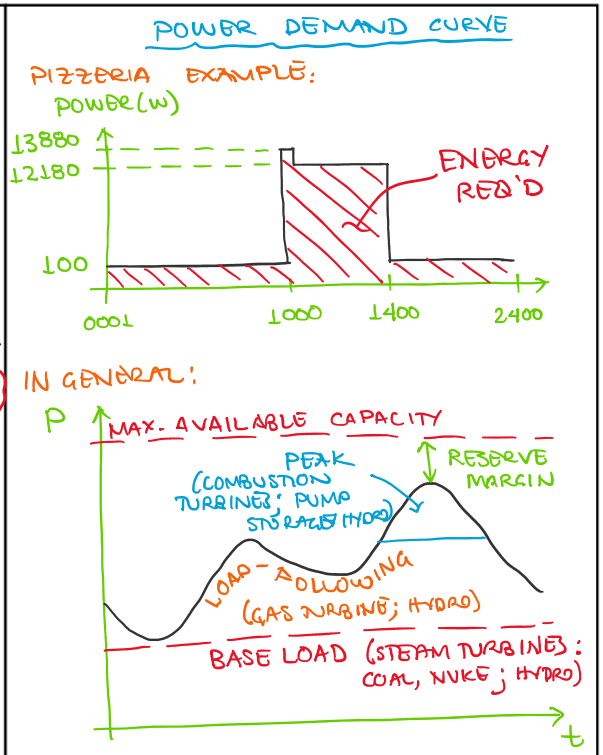
$$\text{BTU}_{\text{REQ'D}} = 167.7\ \text{kWh/DAY} \times 3412\ \text{BTU/kWh} = 572300\ \text{BTU/DAY}$$

(3412 BTU/kWh: CONVERSION)

$$\text{GAL}_{\text{REQ'D}} = \frac{572300\ \text{BTU/DAY}}{128500\ \text{BTU/gal}} = 4.45\ \text{GAL}$$

SAY 5 GAL/DAY ANS

POWER DEMAND CURVE



Notes

* REVIEW SLIDES TO START
* FAST ROD IN FOBS ...
* PROBLEM SET UP
  → LARGELY REVIEW FROM LAST LSN
* GENERALLY SIZE A GENERATOR FOR 70-80% CAPACITY

Notes

DUTY CYCLE: FRACTION OF A PERIOD THAT A SYSTEM IS ACTIVE (TYP. EXPRESSED AS %)

* MOST GENERATORS ARE 20-60% EFFICIENT

SETUP SPREADSHEET FOR THIS TYPE OF CALCULATION!

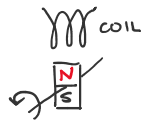
THIS PROBLEM NEEDS TO MOVE QUICKLY - DENSE LSN

Notes

* SLIDE W/ DATA FROM CA ISO
  → BUILD 2ND GRAPH AND START FROM BOTTOM (BASE LOAD)
  * SLIDES W/ EX FOR EACH TYPE OF GENERATION PLANT

GENERATING AC VOLTAGE

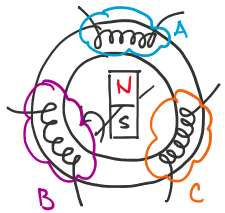
FARADAY'S LAW

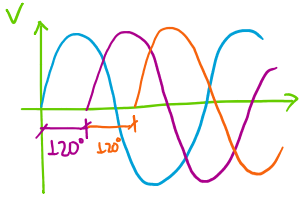


AS MAGNET ROTATES, ALTERNATING VOLTAGE IS GENERATED IN THE COIL [RE: BLUME FIG 1-7]

3 PHASE AC POWER

* 3 COILS 120° APART → STATOR
* ELECTROMAGNET ON ROTATING SHAFT → ROTOR

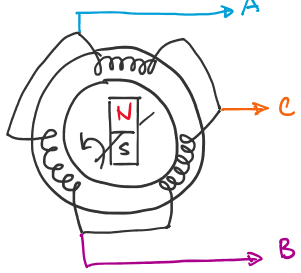




COIL CONNECTIONS (BLUME p14 ¶ 94-98)

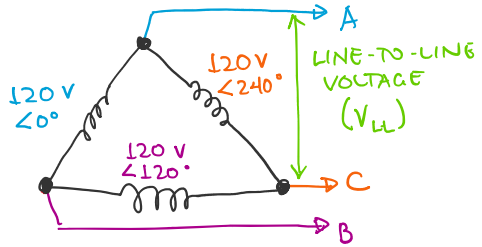
PROS & CONS

DELTA



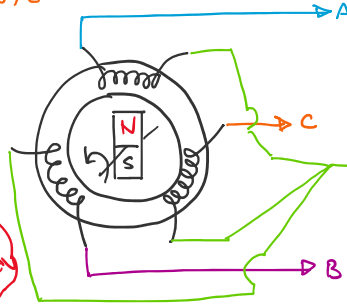
* 3 "HOTS"
* COILS (aka WINDINGS) IN SERIES
* FEWER CONDUCTORS THAN WYE

GENERATE AS OR TRANSFORM BETWEEN

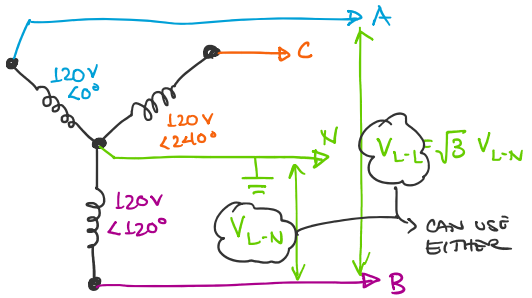


* MAY BE USED FOR TRANSMISSION

WYE



* 3 "HOTS"
* 1 "NEUTRAL"
* MORE STABLE
* MORE COMMON



* USED FOR DISTRIBUTION
* REPLACING DELTA W/ WYE

Notes	Notes	Notes
		* STABLE BECAUSE NEUTRAL (CONSISTENT REFERENCE) (BLUME p 96) * WILL TALK MORE ABOUT THESE IN LSN 24 (E-6) — DISTRIBUTION