POWER CONVERSION FOR LIQUID WALL CONCEPT (LWC)

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ENERGY AND MASS BALANCE

Percentage of thermal power radiated to the first wall	20%
Assumed first wall coolant thickness	2 cm
Percentage of thermal power deposited within the 1st wall coolant	12%
Total power deposited in the first wall coolant	32%
Power deposited in the blanket	68%
First wall coolant inlet temperature	300°C
First wall coolant exit temperature	320°C
Blanket coolant inlet temperature*	320°C
Blanket coolant exit temperature	600°C

*Part of the first wall coolant temperature will pass through the blanket to be heated up to 600°C.

FRACTION OF THE FIRST WALL COOLANT WILL GO TO BLANKET

$Q=MC_p\Delta T$

in which:

Q is the thermal power
M is the mass flow rate
Cp is the specific heat
ΔT is the coolant temperature rise

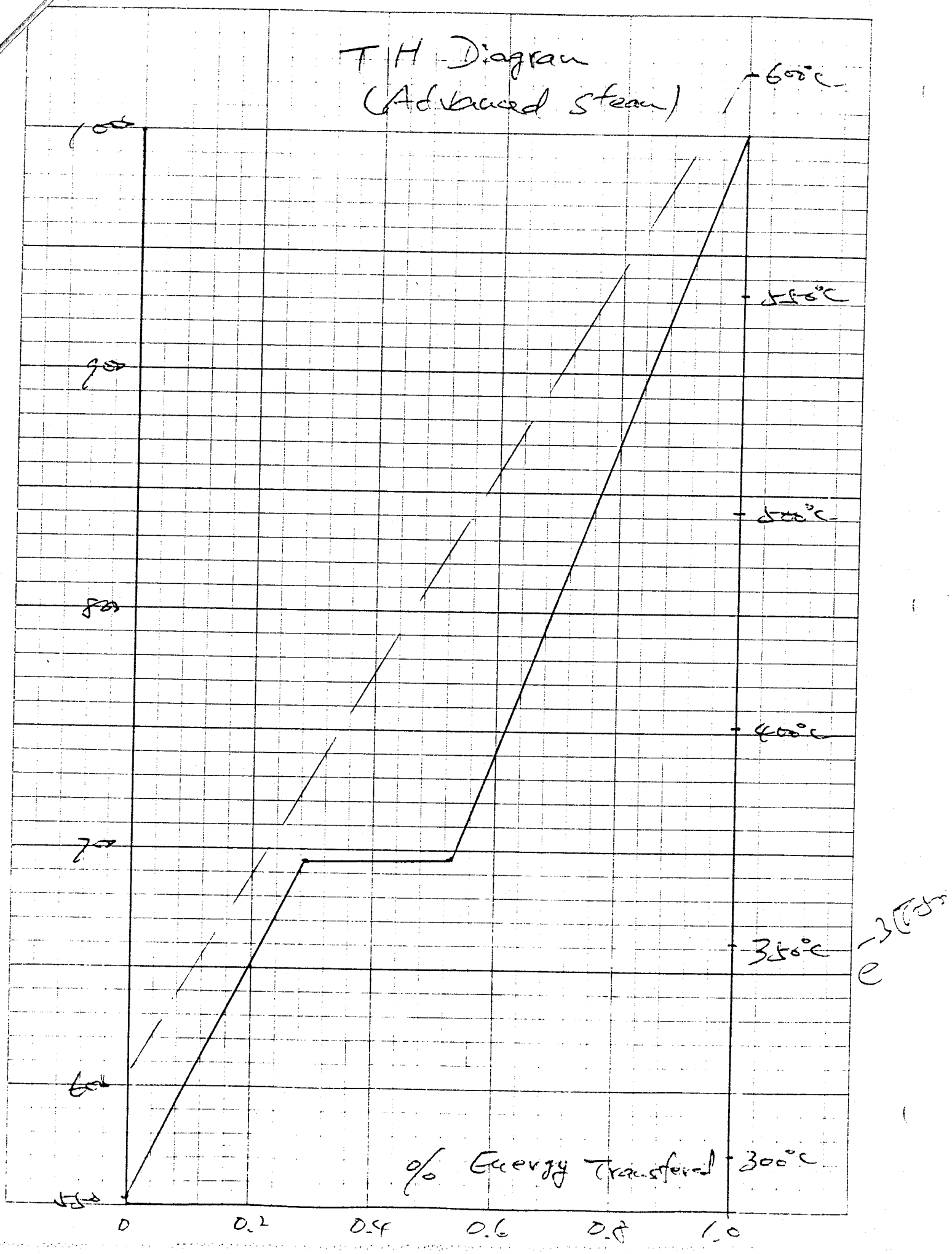
	First Wall	Blanket
Q	0.32	0.68
ΔT	20	280
M	6.6	1

or, only 15% of the first wall coolant can go to the blanket and be heated up to 600°C.

POWER CONVERSION

	85% of the first wall coolant	Blanket coolant
Q	680 MW	1820 MW
Tin	300°C	300°C*
Tout	320°C	600°C
Conversion system	PWR	Advanced steam
Cycle efficiency	35%	44%
Power out put	238 MW	800 MW
Gross power	1038 MW	
Cycle efficiency	41.5%	

*It will be very useful if the Tin is 315°C, instead of 300°C.


T H Diagram
(Advanced Steam)
600°C
350°C
400°C
350°C
300°C
% Energy Transferred
0
0.2
0.4
0.6
0.8
1.0

CONCLUSION

- **Only a very small fraction of the first wall coolant can be heated up by the blanket to 600°C.**

- **This limitation is controlled by mass and energy balance, and can not be changed after the temperature requirements are set.**

- **For the LWC design, the best way to use the thermal energy is to have two steam cycle.**

- **The inlet temperature for the advanced steam cycle need to be increased to 315°C.**