function profit=fobjco2egr (x)

%optimized variable

minj=x(1) %laju aliran massa injeksi (kg/s)

pinj=x(2) %tekanan injeksi (psia)

tinj=x(3) %temepratur injeksi (C)

%Parameter model injection well

dwell=0.127; %diameter well (m)

g=9.8; %percepatan gravitasi (m/s2)

gc=1; %faktor gravitasi (kg m/N s2)

depth=1700; %kedalaman sumur (m) % DIGANTI

thick=0.0053848; %ketebalan dinding (m)

rough=0.0000675; %kekasaran dinding (m)

trev=38.889; %temperatur reservoir (C) % DIGANTI

tling=31; %temperatur lingkungan (C)

%INJECTION WELL

mjci= 750.159157983176-15.4538661097692\*tinj+0.294070293859911\*pinj; %massa jenis co2 injection well (kg/m3)

volci= minj/mjci; %Volume flowrate co2 (m3/s)

viscoci= 0.000074101376759184+2.44308946085363E-08\*pinj+-1.22646600912301E-06\*tinj; %viscositas co2 injection well (kg/ms)

vlci= volci/(3.14\*((dwell^2)/4)); %velocity co2 injection well (m/s)

Gammai=0.07275\*(1-0.002\*((tinj+273)-291)); % Surface Tension

LVNi=vlci\*(mjci/(g\*Gammai)^0.25);%Liquid Velocity Number CO2

NFRi=(vlci^2)/(g\*dwell); %Froude Number Co2 Injection

% Mentukan Pola Aliran

lambdai=1;

Eksi=log(lambdai);

L1i=exp(-4.62-(3.757\*Eksi)-(0.481\*Eksi^2)-(0.0207\*Eksi^3));

L2i=exp(1.061-(4.602\*Eksi)-(1.609\*Eksi^2)-(0.179\*Eksi^3)+(0.635\*(10^-3)\*Eksi^5));

if ((NFRi<L1i)) || ((NFRi<L2i))

pola = 1; %1=segregated

elseif ((NFRi>L1i) &&(NFRi>L2i))

pola = 2;%2=distributed

else

pola=3; %3=intermittent

end

Hlsci=(0.98\*(lambdai^0.4846)/(NFRi^0.0868));

Hlici=(0.84\*(lambdai^0.5351)/(NFRi^0.0173));

Hldci=(1.06\*(lambdai^0.5824)/(NFRi^0.0609));

%Nilai C Aliran

Csi=(1-lambdai)\*log((4.7\*LVNi^0.0868)/((lambdai^0.3692)\*(NFRi^0.5056)));

Cii=(1-lambdai)\*log((4.7\*LVNi^0.1244)/((lambdai^0.3692)\*(NFRi^0.5056)));

Cdi=(1-lambdai)\*log((4.7\*LVNi^0.1244)/((lambdai^0.3692)\*(NFRi^0.5056)));

if pola == 1

HLI = Hlsci;

Ci = Csi;

elseif pola == 2

HLI = Hldci;

Ci = Cdi;

else HLI = Hlici;

Ci = Cii;

end

PSIi=1+Ci\*(sin(1.8\*-90)-((1/3)\*sin(-90)^3));

HLItetha = HLI \* PSIi;

yi = lambdai/(HLItetha^2);

Si = (log(yi))/(-0.0523+3.812\*log(yi)-0.8725\*(log(yi)^2)+0.01853\*(log(yi)^4));

NREi = mjci\*vlci\*dwell/viscoci;

fnsi = (2\*log10(NREi/(((4.5223\*log10(NREi))-3.8215))))^(-2);

ftpi = exp(Si)\*fnsi;

%Pressure Drop

pdfi = (ftpi\*minj\*vlci^2)/(2\*gc\*dwell)

pdei = (g\*mjci)/gc;

pdtoti = (pdfi+pdei)\*0.0000442075\*depth\*3.28084;

%heat transfer co2 injection well

Kci=-8.62245548121198E-06\*pinj+(0.00165497333443547\*tinj)-0.00120940124857462; %Konduktivitas Thermal CO2 injection well (W/mK)

Cpci= (22.9307000677034+-0.100097810122466\*tinj+-0.00261700285458468\*pinj)\*1000;%Heat capacity CO2 injection well (kJ/kgK)

NPrci=Cpci\*viscoci/Kci;%Prandlt Number CO2 injection well

NNuci=0.023\*(NREi^0.8)\*(NPrci^0.3);%Nuselt Number CO2 injection well

hci=NNuci\*Kci/dwell;%heat transfer coefficient CO2 injection well (W/m2K)

Rci=thick/(Kci\*(3.14 \*(dwell^2)/4));%Resistansi konduktivitas thermal CO2 injection well (K/W) 0.005-wallthicknes

Uci=hci+(1/(Rci\*3.14\*dwell^2))%All Heat transfer coefficient CO2 injection well (W/m2K)

Qci=minj\*Cpci\*(tinj-trev)\*35%energy panas CO2 injection well (watt)

dtci=Qci/(Uci\*3.14\*dwell\*depth\*2) %Delta T CO2 injection well (C)

%RESERVOIR

tcr=tinj-dtci %temperature co2+oil pada reservoir C

pcr=(pinj+pdtoti)\*1.1 %pressure Co2+oil pada reservoir psi

%parameter model

frac=0.5582; %fraksi liquid awal

resthick=12.192; %reservoir thickness (m) % DIGANTI

reslength=100; %reservoir length (m)% DIGANTI

Krock=0.02630; %thermal conductivity (W/mK) % DIGANTI

permeabil= 8.48734E-14; %permeability (m2)% DIGANTI

permeabilv= 8.48734E-15; %permeability vertikal (m2) % DIGANTI

poros= 0.089; %porosity batuan % DIGANTI

Lling = 116.6862; % 3316.625; %Luas Lingkaran % DIGANTI

%pressure drop

mjcr= 46.8300924806693-1.3210030053444\*tcr+0.0865162316754536\*pcr%massa jenis phase liquid co2+Oil reservoir (kg/m3)

volcr= minj/mjcr;%Volume flowrate co2+Oil reservoir (m3/s)

vlcr=volcr/(3.14\*((resthick^2)/4)); %velocity co2+oil reservoir (m/s)

viscocr =9.82074864020945E-06+tcr\*-5.57764956509715E-08+pcr\*6.21051761785609E-09;%viscositas phase liquid co2+Oil reservoir (kg/ms)

NRecr=mjcr\*vlcr\*resthick/viscocr; %reynold number co2+oil reservoir

pdcr= -((viscocr\*volcr\*reslength)/(permeabil\*3.14\*resthick\*reslength)\*0.000145038);%pressure drop co2 reservoir psi. thicknes 35.052m

%heat transfer

Cpcr=2.37305418766803+tcr\*-0.0109693863865791+0.000240054091308146\*pcr; %Heat capacity CO2+oil di reservoir (J/kgK)

Kcr=0.0174865883625187+-0.000124017589052688\*tcr+0.0000167603402817045\*pcr; %Thermal conductivity co2+oil di reservoir (W/mK)

NPrcr=Cpcr\*viscocr/Kcr; %PRandlt Number CO2+oil di reservoir 1.73-thermal conductivity batuan

NNucr=0.023\*(NRecr^0.8)\*(NPrcr^0.3);%Nuselt Number CO2+oil di reservoir

Lpcr=(3.14\*0.25\*(resthick^2)\*reslength)^(1/3); %length characteristic di reservoir

hcr=NNucr\*Krock/Lpcr ;%heat transfer coefficient di reservoir 5.678263 W/mK=Kthermal batuan

Rkvcr=1/(hcr\*(3.14\*0.25\*(resthick^2)));%tahanan konveksi perpindahan panas di rservoir

Rkdcr=Lpcr/(Krock\*3.14\*0.25\*(resthick^2));%tahanan konduksi perpindahan panas di reservoir

Qcr=((tcr-48.33)/(Rkvcr+Rkdcr))\*100;%energy panas co2+oil yg terbuang di reservoir (J)

dtcr=Qcr/((Rkvcr+Rkdcr)\*Cpcr); %Delta T Co2+oil di rservoir (C)

%PRODUCTION WELL

tcp=tcr-dtcr %temperature co2+oil production well (C)

pcp=pcr+pdcr%pressure co2+oil production well psi

mjcp= 52.8443199090267-1.35123899611828\*tcp+0.0844646786671024\*pcp; %massa jenis co2 injection well (kg/m3)

volcp= minj/mjcp; %Volume flowrate co2 (m3/s)

viscocp= 9.93335855782682E-06+tcp\*-6.23116671510213E-08+pcp\*6.27709117124863E-09; %viscositas co2 injection well (kg/ms)

vlcp= volcp/(3.14\*((dwell^2)/4)); %velocity co2 injection well (m/s)

Gammap=0.07275\*(1-0.002\*((tinj+273)-291)); % Surface Tension

LVNp=vlcp\*(mjcp/(g\*Gammap)^0.25);%Liquid Velocity Number CO2

NFRp=(vlcp^2)/(g\*dwell); %Froude Number Co2 Injection

% Mentukan Pola Aliran

lambdap=1;

Eksp=log(lambdap);

L1p=exp(-4.62-(3.757\*Eksp)-(0.481\*Eksp^2)-(0.0207\*Eksp^3));

L2p=exp(1.061-(4.602\*Eksp)-(1.609\*Eksp^2)-(0.179\*Eksp^3)+(0.635\*(10^-3)\*Eksp^5));

if ((NFRp<L1p)) || ((NFRp<L2p))

polap = 1; %1=segregated

elseif ((NFRi>L1p) &&(NFRi>L2p))

polap = 2;%2=distributed

else

polap=3; %3=intermittent

end

Hlscp=(0.98\*(lambdap^0.4846)/(NFRp^0.0868));

Hlicp=(0.84\*(lambdap^0.5351)/(NFRp^0.0173));

Hldcp=(1.06\*(lambdap^0.5824)/(NFRp^0.0609));

%Nilai C Aliran

Csp=(1-lambdap)\*log((4.7\*LVNp^0.0868)/((lambdap^0.3692)\*(NFRi^0.5056)));

Cip=(1-lambdap)\*log((4.7\*LVNp^0.1244)/((lambdap^0.3692)\*(NFRi^0.5056)));

Cdp=(1-lambdap)\*log((4.7\*LVNp^0.1244)/((lambdap^0.3692)\*(NFRi^0.5056)));

if polap == 1

HLP = Hlscp;

Cp = Csp;

elseif polap == 2

HLP = Hldcp;

Cp = Cdp;

else HLP = Hlicp;

Cp = Cip;

end

PSIp=1+Cp\*(sin(1.8\*90)-((1/3)\*sin(90)^3));

HLPtetha = HLP \* PSIp;

yp = lambdap/(HLPtetha^2);

Sp = (log(yp))/(-0.0523+3.812\*log(yp)-0.8725\*(log(yp)^2)+0.01853\*(log(yp)^4));

NREp = mjcp\*vlcp\*dwell/viscocp;

fnsp = (2\*log10(NREp/(((4.5223\*log10(NREp))-3.8215))))^(-2);

ftpp = exp(Sp)\*fnsp;

%Pressure Drop

pdfp = (ftpp\*minj\*vlcp^2)/(2\*gc\*dwell);

pdep = (g\*mjcp)/gc;

pdtotp = (pdfp+pdep)\*0.0000442075\*depth\*3.28084;

pco = pcp+pdtotp;

%heat transfer co2 injection well

Kcp=0.0174865883625187+-0.000124017589052688\*tcp+0.0000167603402817045\*pcp; %Konduktivitas Thermal CO2 injection well (W/mK)

Cpcp= (12.44045889320179+tcp\*-0.0105800396299696+0.000240054091308146\*pcp)\*1000;%Heat capacity CO2 injection well (kJ/kgK)

NPrcp=Cpcp\*viscocp/Kcp;%Prandlt Number CO2 injection well

NNucp=0.023\*(NREp^0.8)\*(NPrcp^0.3);%Nuselt Number CO2 injection well

hcp=NNucp\*Kcp/dwell;%heat transfer coefficient CO2 injection well (W/m2K)

Rcp=thick/(Kcp\*(3.14 \*(dwell^2)/4));%Resistansi konduktivitas thermal CO2 injection well (K/W) 0.005-wallthicknes

Ucp=hcp+(1/(Rcp\*3.14\*dwell^2));%All Heat transfer coefficient CO2 injection well (W/m2K)

Qcp=minj\*Cpcp\*(tcp-tling);%energy panas CO2 injection well (watt)

dtcp=Qcp/(Ucp\*3.14\*dwell\*depth\*2\*minj) %Delta T CO2 injection well (C)

%GAS RECOVERY

mjng=35.34614832+-0.672856976292827\*tcr+0.049907089\*pcr; %Massa jenis natural gas (kg/m3)

viscong=0.000010055+-1.33802257199713E-08\*tcr+3.48620620536712E-09\*pcr; %viskositas natural gas (kg/ms)

Cpng=2.921948336+-0.006217212\*tcr+0.00019548\*pcr;

kng=0.028944032+-0.00000363428\*tcr+0.0000111577\*pcr;

Lpres=3.14\*resthick\*reslength;

z = 0.86;

ppz=2260.668973;

pipzi=47867.359;

Bg=2.8793\*z\*48.33/1960;

M=(viscong/viscocr);

fg=(1/(1+M));

Sg=-0.0000005\*(fg^5) + 0.00004\*(fg^4) - 0.001\*(fg^3) + 0.0071\*(fg^2) + 0.0521\*fg+ 0.2623;

G = (Lling\*reslength\*poros\*Sg)/Bg;

Gp = G\*(1-(ppz/pipzi))

mco2inj=minj\*3600\*24;

VCO2inj=mco2inj/mjci;

tinj=G/VCO2inj;

CNGR=0.6829\*Gp;

CNGRpd=CNGR/tinj;

CCGR=(1-0.6829)\*Gp;

CCGRpd=CCGR/tinj;

Rng=CNGRpd/28.263682\*2.7;

Rcg=CCGRpd\*6.289814\*0.935\*68.096;

Rtot=Rng+Rcg;

co2price= 20.220; % 15.5432; %harga co2/ton

%biaya pembelian co2 per day % DIGANTI

bc=mco2inj\*co2price/1000; %USD/day

listrik=0.06; %harga listrik industri di Ohio,USA per Mei 2020 % DIGANTI

%biaya operasional pompa injeksi co2 per day

kpci= (pco-pinj)\*volci;%kinerja pompa co2 perjam 0.8efficiencypompa watt

bopc= (kpci)\*3600\*listrik; %USD/day 0.06 harga listrik CA,USA per Mei 2020 % DIGANTI

%biaya recycling co2

brc= CCGRpd\*20;%USD/day % DIGANTI

profit=(Rtot-bc-brc-bopc)

end