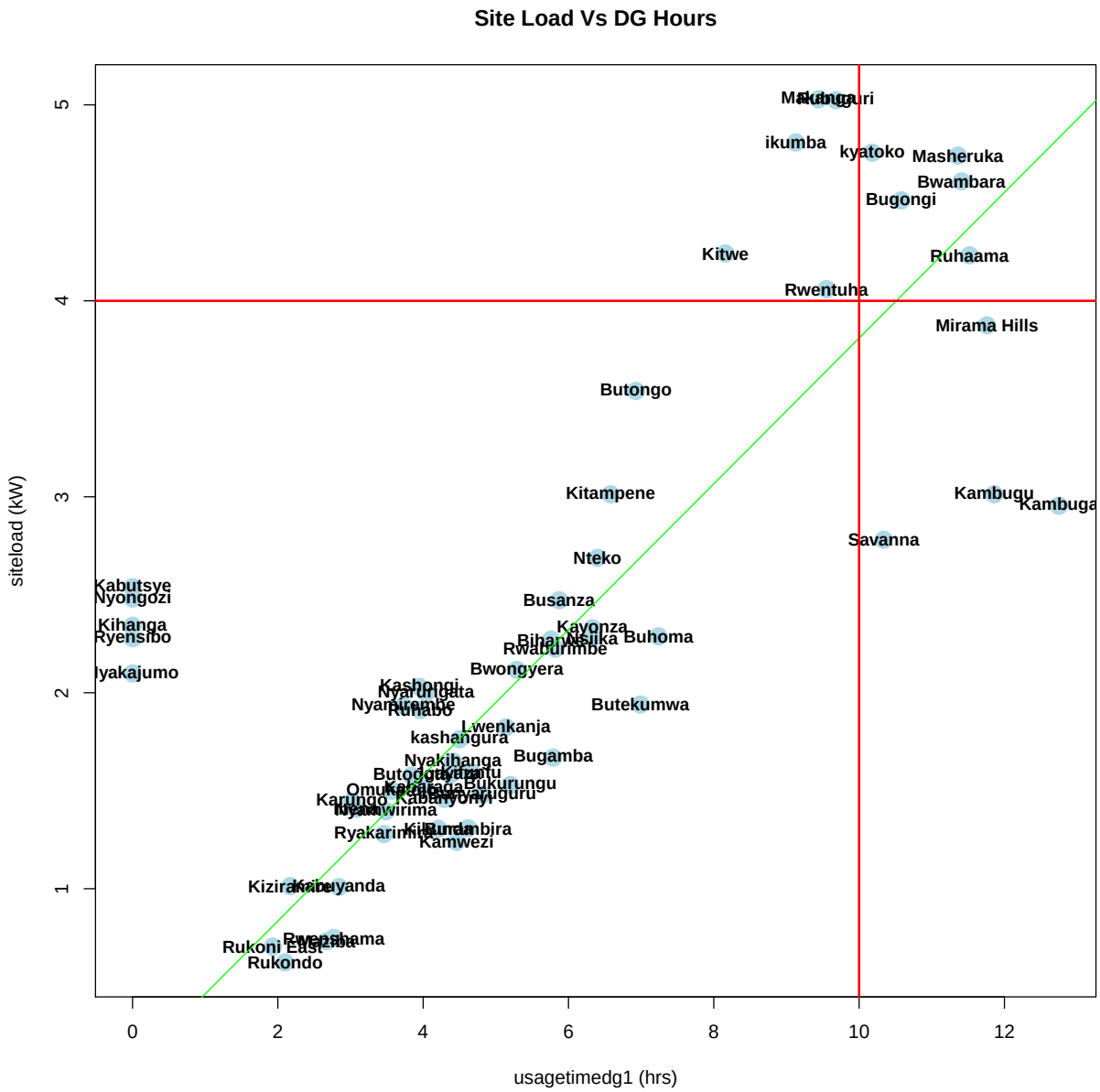
Site Load Vs DG hours

08/10/2019



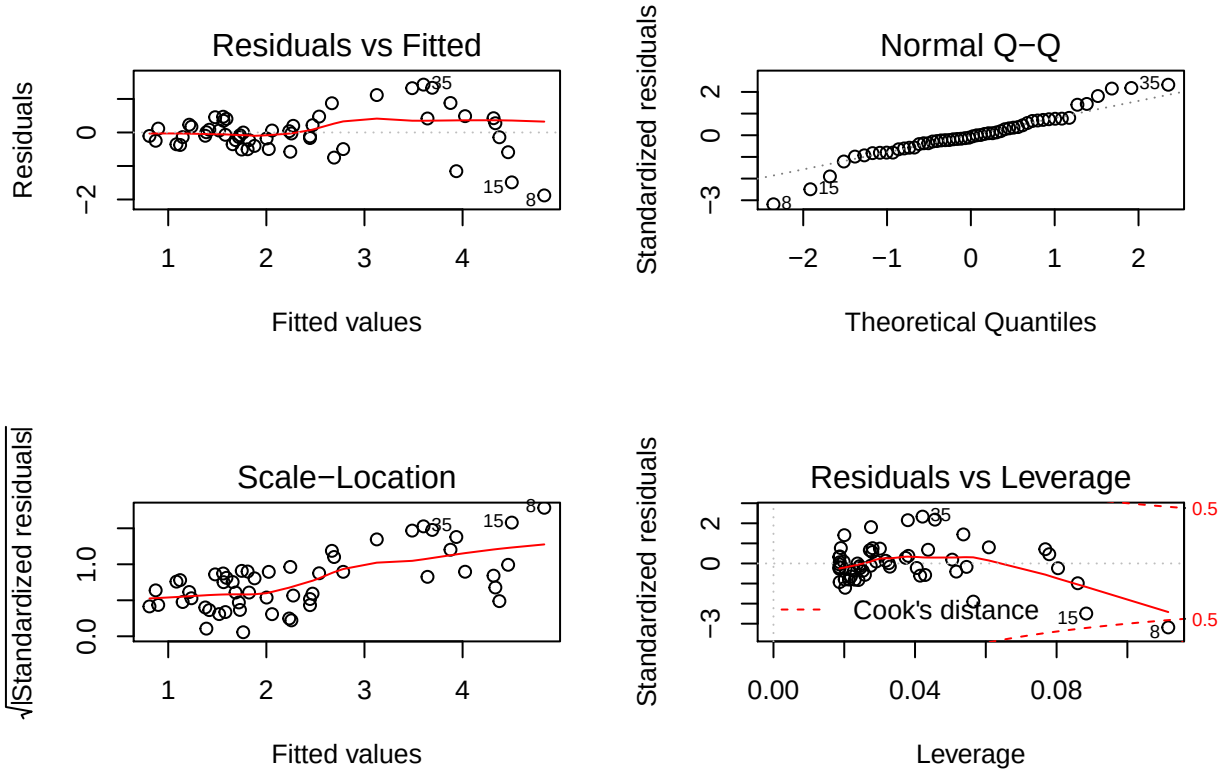

```
## Save the file allanHy
save(allanHy, file = "allanHy.Rda")

## To be load using load("allanHy.Rda") in shiny App
```

Site Loads with Average DG hours more than 10

```
##    generalinformationsitename siteload
## 1                      Savanna 2.780833
```

```
## 2                  Rwentuha 4.059167
## 3                     Kitwe 4.242083
## 4                  Bwambara 4.609583
## 5                   Kambugu 3.012500
## 6              Mirama Hills 3.875000
## 7                  Butongo 3.540000
## 8                  Makanga 5.028750
## 9                   ikumba 4.807917
## 10                 kyatoko 4.756250
## 11                Rubuguri 5.023750
## 12                 Ruhaama 4.232083
```



To be corrected - Fitted regression lines show that there is need to have optimisation for the low load sites that have been ignored. Prediction values show better savings realised for high load sites and less for low load sites. 22.7562681, -2.0563031, 0.4225344, 0.1581931, 53.8566077, -12.9986907, $2.7326474 \times 10^{-47}$, $5.7716326 \times 10^{-18}$ - Prediction for 2kW 18.6436619, 18.2267264, 19.0605973 - Prediction for 3kW 16.5873587, 13.6014909, 19.5732265 *Above to be corrected*

Benefits of adding solar to sites

- With inclusion of LiBs and rectifier systems, solar helps realise savings of between 18.06085 to 20.84824 (predicted = 19.45455)
  19.8703704, 18.9863315, 20.7544092
- Without solar, we are realising savings of about 16.15153 hrs to 18.19335 hrs (predicted = 17.17244)
  15.9681481, 15.0841093, 16.852187

Below is summary of improvement predictions with and without solar installation

```
PrWithsolar <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 1), interval = "confidence"
PrWithoutsolar <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 0), interval = "confiden
PrWithsolar - PrWithoutsolar
```

```
##        fit      lwr      upr
## 1 3.902222 3.902222 3.902222
```

Below is summary of improvement predictions with and without solar installation for different loads

1.5kW

```
PrWithSolarLoad <- predict(fitsolarLoad, newdata = data.frame(siteload = 1.5), interval = "confidence")
PrWithoutSolarLoad <- predict(fithybridLoad, newdata = data.frame( siteload = 1.5), interval = "confide
PrWithSolarLoad - PrWithoutSolarLoad
```

```
##         fit      lwr        upr
## 1 0.8423788 1.789256 -0.1044984
```

2kW

```
PrWithSolarLoad <- predict(fitsolarLoad, newdata = data.frame(siteload = 2), interval = "prediction")
PrWithoutSolarLoad <- predict(fithybridLoad, newdata = data.frame( siteload = 2), interval = "predictio
PrWithSolarLoad - PrWithoutSolarLoad
```

```
##         fit      lwr       upr
## 1 0.6995478 3.006065 -1.606969
```

2.5kW

```
PrWithSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 1, siteload = 2.5), int
PrWithoutSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 0, siteload = 2.5),
PrWithSolarLoad - PrWithoutSolarLoad
```

```
##        fit      lwr      upr
## 1 3.902222 3.902222 3.902222
```

3kW

```
PrWithSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 1, siteload = 3), inter
PrWithoutSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 0, siteload = 3), in
PrWithSolarLoad - PrWithoutSolarLoad
```

```
##        fit      lwr      upr
## 1 3.902222 3.902222 3.902222
```

3.5kW

```
PrWithSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 1, siteload = 3.5), int
PrWithoutSolarLoad <- predict(fitsolarhybridDGS, newdata = data.frame(solaryesno = 1, siteload = 3), in
PrWithSolarLoad - PrWithoutSolarLoad
```

```
##   fit lwr upr
## 1   0   0   0
```

```
fitsolarhybridS <- lm(savings ~ I(factor(solaryesno)), data = hybridSolarYesNo)
## Regression for solar and hybrids compared: DG and siteload + solar
```

```
fitsolarhybridSL <- lm(savings ~ I(factor(solaryesno)) + siteload, data = hybridSolarYesNo)
## Regression for solar and hybrids compared: siteload only
fitsolarhybridL <- lm(savings ~ siteload, data = hybridSolarYesNo)
## Load and solar interrellation
fitsolarhybridSLInter <- lm(savings ~ I(factor(solaryesno)) + siteload + siteload*I(factor(solaryesno))

## Regression of savings with solar
summary(fitsolarhybridS)$coef
```

```
##                          Estimate Std. Error   t value     Pr(>|t|)
## (Intercept)            15.968148  0.4405553 36.245503 1.401229e-38
## I(factor(solaryesno))1  3.902222  0.6230393  6.263204 7.375820e-08
```

```
## Regression of savings with Load
summary(fitsolarhybridL)$coef
```

```
##              Estimate Std. Error   t value     Pr(>|t|)
## (Intercept) 22.756268  0.4225344  53.85661 2.732647e-47
## siteload    -2.056303  0.1581931 -12.99869 5.771633e-18
```

```
## Regression of savings with solar and load
summary(fitsolarhybridSL)$coef
```

```
##                           Estimate Std. Error   t value     Pr(>|t|)
## (Intercept)            21.8815389  0.7266293 30.113760 3.780364e-34
## I(factor(solaryesno))1  0.7813921  0.5310177  1.471499 1.473002e-01
## siteload               -1.8505316  0.2098362 -8.818935 7.811876e-12
```

```
## Regression of savings with solar and load interrelation
summary(fitsolarhybridSLInter)$coef
```

```
##                                    Estimate Std. Error   t value
## (Intercept)                     21.7708837  0.7742621 28.118234
## I(factor(solaryesno))1           1.2708719  1.2327047  1.030962
## siteload                        -1.8159032  0.2256308 -8.048116
## I(factor(solaryesno))1:siteload -0.2856621  0.6480507 -0.440802
##                                     Pr(>|t|)
## (Intercept)                     2.643233e-32
## I(factor(solaryesno))1          3.075199e-01
## siteload                        1.401556e-10
## I(factor(solaryesno))1:siteload 6.612564e-01
```

```
head(hybridSolarYesNo)
```

```
##   generalinformationsiteid generalinformationsitename
## 1                   605833                 Kiziramire
## 2                   606058                    Savanna
## 3                   605652                   Rwentuha
## 4                   605771                      Kitwe
## 5                   605835                  Masheruka
## 6                   606155                 Nyamwirima
##   generalinformationsitestatus  startdate    enddate
## 1                     Out-Door 07.10.2019 07.10.2019
## 2                     Out-Door 07.10.2019 07.10.2019
## 3                     Out-Door 07.10.2019 07.10.2019
## 4                     Out-Door 07.10.2019 07.10.2019
## 5                     Out-Door 07.10.2019 07.10.2019
```

```
## 6                     Out-Door 07.10.2019 07.10.2019
##                          sitelayout generalinformationhybridstatus
## 1 TL_UG_OUTDOOR_OFFGRID_HYBRID_SOLAR                             YES
## 2       TL_UG_OUTDOOR_OFFGRID_HYBRID                             YES
## 3       TL_UG_OUTDOOR_OFFGRID_HYBRID                             YES
## 4       TL_UG_OUTDOOR_OFFGRID_HYBRID                             YES
## 5       TL_UG_OUTDOOR_OFFGRID_HYBRID                             YES
## 6 TL_UG_OUTDOOR_OFFGRID_HYBRID_SOLAR                             YES
##   usagetimegrid usagetimedg1 usagetimedg2 usagetimebattery usagetimesolar
## 1             0         2.17            0            16.00           5.82
## 2             0        10.34            0            13.66           0.00
## 3             0         9.55            0            14.45           0.00
## 4             0         8.16            0            15.81           0.00
## 5             0        11.36            0            12.62           0.00
## 6             0         3.49            0            15.01           5.50
##   usagetimeunknown                     model extrafield8 dg1ignitioncount
## 1             0.00         Perkins # 20 kva   liblgchem                1
## 2             0.00 Lister Petter # 17.5 kva   libincell                4
## 3             0.00                 # 20 kva   liblgchem                4
## 4             0.03         Perkins # 20 kva   libincell                7
## 5             0.02         Perkins # 20 kva   libincell                7
## 6             0.00 Lister Petter # 13.5 kva   liblgchem                2
##   dg2ignitioncount   availtimesolar atskwhtotal savings siteload
## 1                1 10.7061111111111       24.32   21.83 1.013333
## 2                4                0       66.74   13.66 2.780833
## 3                4                0       97.42   14.45 4.059167
## 4                7                0      101.81   15.84 4.242083
## 5                7                0      113.79   12.64 4.741250
## 6                2           10.665       33.50   20.51 1.395833
##   siteloadAct solaryesno
## 1   11.207373          1
## 2    6.454545          0
## 3   10.201047          0
## 4   12.476716          0
## 5   10.016725          0
## 6    9.598854          1
```

Some predictions using Decision Trees "rpart"

To be deleted.

```
head(allanHy)
inTrain <- createDataPartition(y = allanHy$usagetimedg1, p = 0.7, list = FALSE)
training <- allanHy[inTrain,]
testing <- allanHy[-inTrain,]
modFit <- train(usagetimedg1 ~ ., data = training, method = "rpart")
print(modFit$finalModel)
plot(modFit$finalModel, uniform = TRUE, main = "Classification Tree")
text(modFit$finalModel, use.n = TRUE, all = TRUE, cex = 0.8)
## Plotting another type of decision tree
fancyRpartPlot(modFit$finalModel)
```

COMMENTS:
16/09/2019 Bugamba: Fix automation issue, Nyakajumo: Resolve rectifier module issue, Nteko, Makanga,

Kabaraga: Burnt subrack issues.

Kambugu: Replace faulty rectifier module (FT 348816), optimise to 8.19500W/8.16 Kitampene: Restore rectifier module

Bwambara: optimum at 9500W Bugongi: optimize to 9500W (167A, 57V) Butogota: optimise to 9500W/10.2 Mirama Hills: Optimise to 9500W/8.16 Kambugu: Optimise to 9500W/8.16 Savana: Optimise to 8600W/7.65 Rwentuha: optimise to 9500W