#define LIGHT\_MOSFET\_PIN 8
#define SUPERCAP\_VOLTAGE\_PIN  A3

#define HIGH\_THRESHOLD 900
#define LOW\_THRESHOLD 300

#define CAPACITANCE 1.5

// Energy (joules) stored in a capacitor = 0.5 x C x V^2
#define HIGH\_THRESHOLD\_ENERGY   (0.5 \* CAPACITANCE \* (5.0\*HIGH\_THRESHOLD/1024.0)\*(5.0\*HIGH\_THRESHOLD/1024.0))
#define LOW\_THRESHOLD\_ENERGY    (0.5 \* CAPACITANCE \* (5.0\*LOW\_THRESHOLD/1024.0)\*(5.0\*LOW\_THRESHOLD/1024.0))

void setup()
{
  Serial.begin(9600);
  pinMode(LIGHT\_MOSFET\_PIN,OUTPUT);
}

void loop()
{
    static boolean lightIsOn = false;
    static unsigned long nextReport=0;
    static float energyGathered = 0.0;

    int a = analogRead(SUPERCAP\_VOLTAGE\_PIN);
    if (lightIsOn)
    {
        if (a < LOW\_THRESHOLD)
        {
            Serial.print("a=");
            Serial.print(a);
            Serial.print("; switching off light. ");
            energyGathered += (HIGH\_THRESHOLD\_ENERGY - LOW\_THRESHOLD\_ENERGY);
            Serial.print(energyGathered);
            Serial.println(" joules");
            lightIsOn = false;
            digitalWrite(LIGHT\_MOSFET\_PIN,LOW);
        }
    }
    else
    {
        if (a > HIGH\_THRESHOLD)
        {
            Serial.print("a=");
            Serial.print(a);
            Serial.println("; switching on light");
            lightIsOn = true;
            digitalWrite(LIGHT\_MOSFET\_PIN,HIGH);
        }
    }
    if (millis() > nextReport)
    {
        nextReport = millis()+1000;
        Serial.println(a);
    }
}